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), 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 through the design/technical review process. Some items within this specification are shown in** **bold text** ***are for emphasis only*. Bold & Italics means *edit* as required. Read this section carefully before proceeding with editing of this specification and do not include these instructions in the Contract 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.cityofseattle.gov/parks/projects/standards, the SPR Design Standard 32 80 00 - Irrigation 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 Irrigation Systems in Seattle Parks. This Specification includes electronic equipment that is intended to be used with the "Maxicom" computerized central control system as manufactured by Rainbird Sprinkler Manufacturing Corporation. This system is the Seattle Parks & Recreation (SPR) approved standard method of centralized computer control for all automatic irrigation systems, except as otherwise approved by the Parks Engineer, during the project's technical review process.

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.

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 review 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).

All SPR Standard Details related to these irrigation system design and these specifications shall be used as shown on the SPR Design Standards website (without alterations) and shall be included in the Contract Documents on the Plans.

INSPECTION CRITICAL PATH:

(for Irrigation System Construction Testing, Inspections and Close Out)

1. **Pressure Test and Visual Inspection** of trenches, main lines, control wires and valves (at 150 psi, for 30 minutes).
2. **Pressure Test and Visual Inspection** of trenches, lateral lines and swing joints (at the design pressure).
3. **Coverage Test** of the entire system (using the hard powered controller, no generator use is allowed) after trench backfill and head installation (at the design pressure).
4. **Functionality Test** (30 day period after punch list inspection). This testing shall include the complete functionality of all of the valves, the heads, the control/communications equipment, including appropriate grounding. **It is the responsibility of the Consultant to contact the appropriate SPR personnel (Parks' Project Manager, Irrigation Coordinator, Landscape Architect, District Maintenance, Plumbing and Electrical Shop Personnel) and arrange for the contractor to demonstrate the complete functionality of all the equipment.**
5. **Preliminary Punch List Inspection** of the entire system, control/communications equipment, and trench backfilling. Punch list is developed.
6. **Substantial Completion Inspection** (10 working days after punch list inspection) punch list items are substantially complete.

SUBSTANTIAL COMPLETION

7. **Inspection of backflow prevention device** by a **Backflow Assembly Tester (BAT),** hired by the Contractor, who will present the certification report to SPR's Plumbing Shop & Seattle Public Utilities.
8. **Training Session** (M & O manuals, timing of controller stations set, "red lined as-builts" submitted).

PHYSICAL COMPLETION

9. **Physical Completion (Final) Inspection** of the entire project (all punch list items have been completed).
10. **Transfer to Operations** – The Project Manager fills out the appropriate form and Parks takes over all maintenance responsibilities.
10. **Winterization** - October 31st after substantial completion. **(Applies only for construction projects that carry over into the winter months or where extended maintenance / establishment periods are in place**).
11. **De-winterization** - March 1st after substantial completion. **(Applies only for construction projects that carry over into the winter months or where extended maintenance/ establishment periods are in place**).
12. **Warranty period** - (for a period of one year after documented Physical 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 as determined by the Engineer.

<u>RECORD DOCUMENTS</u>: It is the 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 prior to substantial completion of project.

Step 5: 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.

PART 1 - GENERAL

1.01 Description: Furnish and install Automatic Irrigation 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, wire sleeves, fittings, back-flow prevention device assemblies, valves, valve boxes, swing joints, sprinkler heads, control and communications equipment and enclosures, 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 Park 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 01 56 39 - Tree & Plant Protection
Section 02 41 13.23 - Site Utility Removal
Section 31 00 00 - Earthwork
Section 32 82 00 - Irrigation Booster Pumps
Section 33 10 00 - Potable Water Systems for Drinking Fountains

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 or controllers. Locate new items as closely as possible to related curbs, walls, fences or edges of paving. 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. Sprinkler heads are shown accurately and shall be installed as indicated by center of symbol.

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 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 irrigation 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. **(<u>Note</u>: No telescoping repair couplings will be allowed).**

1.07 Irrigation System Warranty:

A. Contractor shall provide a **One Year** warranty as per the requirements of Division 00.

B. The Warranty shall include restoration of planted or paved areas due to settlement of trenches.

C. 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:

<u>Optional as directed</u>, for All Water Systems - mainlines only, use:

A. Ductile-Iron Pipe (DIP) and Fittings: All Ductile iron pipe and fittings shall conform to the City of Seattle Standard Plans and Specifications for water mains and service connections, unless otherwise indicated herein.

1. 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.
2. Ductile Iron fittings shall conform to the Standard Specifications Section 7-09.2 for water mains and Section 7-15 for service connections, unless otherwise indicated herein:
   a. DIP Fittings shall be short-bodied ductile cast 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 as shown.
   b. 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.

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

OR, Optional as directed, for All Water Systems - mainlines only, use:

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

1. **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 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.
2. **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 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.
3. **Polypropylene Compression Fittings for HDPE (PE) pipe**: Fittings **(2" O.D. and smaller laterals 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 bevelling 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., or approved equal, and represented by The Harrington Corporation (Harco) of Lynchburg, VA (434) 845-7094. Local Washington and Oregon area representative: Mike Scheel (434) 382-7930.

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**.**

<u>OR, Optional as directed</u>, for Potable Water Systems <u>only</u> - generally 2" and smaller use:

2.02 Copper Pipe and Fittings:

A. All Copper Piping shall be Type 'K' Copper and shall conform to industry standards and be in conformance with applicable ASTM or ANSI standards.

B. Copper Tubing: ASTM B 88, Type 'K' water tube. For tubing up to 2" diameter, use 'soft' copper (annealed temper). For tubing with diameters larger than 2", use 'hard' copper.

1. For **2"O.D. and smaller**: Cast-copper alloy solder-joint pressure fittings and soldered joints with Alloy Sn95 solder.
2. 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.

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 Brass Pipe and Fittings:

A. Brass pipe shall be seamless red brass per ASTM B 43 rated for 250-psi working pressure.

B. All Brass Pipe and fittings shall conform to industry standards and be in conformance with applicable ASTM or ANSI standards.

C. 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.

For Irrigation <u>Laterals</u> - generally 2-1/2" O.D. and smaller (as directed) use:

2.04 PVC (Polyvinyl Chloride) Pipe, Fittings, Primer and Glue:

A. All PVC Pipe shall be **Schedule 40 PVC** (or better) and shall conform to all requirements of ASTM D1785-86.

B. All PVC Pipe shall be marked with the manufacturer's name, class of pipe and NSF seal. Pipe shall bear no evidence of interior or exterior extrusion marks. Pipe walls shall be uniform, smooth and glossy. Pipe may be pre-belled or with individual solvent-weld couplings.

C. All PVC Pipe shall be solvent welded pipe. All PVC pipe must be delivered in at least twenty foot (20') lengths.

D. All PVC fittings shall be of the solvent welded type except where risers, valves, etc., require threaded transition fittings. All threaded PVC tees, fittings, adaptors and nipples shall be **Schedule 80 PVC** (or better) and shall conform to the requirements of ASTM D2466-78.

Optional (as directed).

E. Fittings used on Lateral Pipes (4" O.D. and larger) shall be manufactured of 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. Fittings shall be DEEP BELL as manufactured by HARCO (Harrington Corporation) of Lynchburg, VA, or approved equal. Transition gaskets shall not be allowed.

F. 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 Fitting to Pipe Joint Restraints 6" O.D. through 12" O.D. 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 to ASTM A563 or low alloy steel per AWWA/ANSI C111/A21.11. Fitting to Pipe Restraint shall be supplied by HARCO (Harrington Corporation), Lynchburg, VA, or approved equal.

3. 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.

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

H. All PVC pipes and fittings for swing joints shall conform to all requirements of ASTM D3139. No additional threaded PVC nipples of any kind are allowed in swing joint fabrications. All swing joints shall be threaded into Schedule 80 PVC tees or Schedule 80 PVC 90-degree ells that are glued into the Schedule 40 mainline and lateral pipes.

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

J. Primer color shall be **Purple** and glue color shall be **Gray**.

2.05 Sleeves:

A. Sleeves required for main and lateral lines located under paving (pathways and service roads within the park site) where vehicles are anticipated, shall be, **Schedule 40 PVC** (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. All wiring shall be in its own separate **Schedule 40 PVC** sleeve, independent from the piping sleeves.

B. Sleeves under roadways (street rights-of-way, boulevards or parkways) where heavy vehicular traffic is anticipated, shall be ductile iron 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). All wiring shall be in separate **Schedule 80 PVC** (or better) electrical conduit (min. 2" O.D.) within the ductile iron pipe.

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.

2.06 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.

2.07 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.

2.08 Irrigation Booster Pump(s) (if required): Pump(s) shall be as manufactured by Precision Pumping Systems, Boise, ID, Flowtronex, Dallas, TX, Watertronics, Hartland, WI, or approved equal. Size of pump(s) varies and shall be determined by the designer based on the pressure and flow demands of the irrigation system as designed. Refer to Section 32 84 00 – Irrigation Booster Pumps for information and specific requirements.

2.09 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.
3. Drain Valves: Shall be Mueller Mark II Oriseal H-10284, stop and waste, or approved equal.

2.10 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 on the Details.

D. 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.

C. For Quick Coupler Valve installations on ballfield infields (generally located behind the pitcher's rubber/mound) a 1-1/2" brass, single piece body QCV shall be used. In addition to the swing joint described below, an additional three (3) feet of 1-1/2" O.D. Sch. 40 galvanized steel pipe shall be installed at the end of the pipe to the QCV and shall be installed as shown on the Details. Note: When adding a quick coupling valve to an existing system, a "Romac" Model #511 (long version) repair coupling is required. No telescoping repair couplings will be allowed.

D. (Optional as directed) Quick coupler valve assemblies shall be anchored with quick coupler anchors as manufactured by HARCO, or approved equal.

2.11 Swing Joints:

A. Swing joints for quick couplers shall be triple swing joints using schedule 40 galvanized steel with threaded fittings. Swing joints shall consist of street ells, ells, and nipples for full adjustability. Galvanized swing joint, quick coupler assemblies shall be installed in valve boxes, per the Details.

B. Pre-fabricated swing joints, for irrigation heads, shall be triple swing joints, using Schedule 80 or Class 315 PVC threaded fittings. Swing joints shall consist of street ells, ells, and nipples for full adjustability. Fittings shall have "O" ring seals.

C. (Optional, as directed) Ductile Iron Swing Joint with 1-1/2" DI Swivel Tee (#8xx5403), 1-1/2" DI Swivel x 1" MNPT (#871-15-10) Schedule 80 Pipe nipple (cut to length needed) and an Optional DI- QC Anchor (#82201), per SPR Standard Detail # 02810.82. DI-QC Swing Joint, as manufactured by HARCO, or approved equal

2.12 Pop-up Sprinkler Heads:

A. All heads shall have a built-in pressure-regulating device. The device shall regulate nozzle pressure to the design pressure. The pressure-regulating device shall be an internal part of the pop-up stem.

B. The heads shall have matched precipitation rate nozzles with adjusting screws.

C. All heads shall have screens under the nozzles.

D. The heads shall be equipped with check valves to prevent low head drainage. The check valves shall hold back pressures equivalent to 10 feet of head.

E. The heads shall be of types, manufacture and sizes shown on the Plans and Details and shall be from the following list:

1. For Athletic Fields and Large Lawn Areas use: ***Toro 640 Series, or Hunter I-20 or I-40 Series Heads,*** or approved equal. All large throw rotor heads shall have stainless steel risers, if available.
2. For Medium-sized Lawn Areas and/or Large Shrub Bed Areas use: ***Toro T5, 800 Series, 300 Series or Hunter I-10 or 1-20 Series Heads***, or approved equal. All heads shall have stainless steel risers, if available.
3. For Small/Narrow Lawn Areas & Strips and Shrub Bed Areas use: ***Rainbird 1800-SAM-PRS-MPR Series or Toro 570 Series, (including strip or bubbler heads)***, or approved equal**.** No 'Vans' are permitted unless approved in advance by the Engineer.

2.13 Automatic Control Valve Assemblies:

A. Valves shall be of types, manufacture and sizes as shown on the drawings and/or the following: For **(¾" to 2" O.D.)** use Buckner/Superior VB/HD Series - 2-way solenoid brass valve with 24 VAC -50/60 Hz coil, or approved equal. For **(2-1/2" O.D. and larger)** use Superior 950 Series valves, or approved equal. If contaminated or dirty water conditions exist, "Buckner" VBDW valves shall be used, or, approved equal. ***Note: For occasional situations where reducing pressure at each valve assembly is required to match existing conditions, use Buckner/Superior Model 950PRS brass valves, as approved by the Engineer.***

B. Valves shall be of all brass construction or iron body, bronze-mounted, globe pattern. The valve pressure rating shall be 150 psi min. All connections shall be brass pipe, threaded.

C. Valves shall be electrically operated, actuated by a solenoid utilizing AC current, 24 volts, and rated at not more than 8.5 VA with an in-rush maximum of 1.0 amp. The solenoid coil is to be sealed in an "Epoxy" material so it is completely waterproof.

D. Operation of all valves shall be normally closed solenoid control capable of operating within minimum flow requirements.

E. Diaphragm operated of one-piece construction. The diaphragm shall be fully pressure balanced in both the open and closed positions.

F. Solenoid shall be mounted directly on the valve or bonnet. All parts and tubing downstream of the entrance shall be of larger size to permit passage of foreign particles.

G. A flow adjustment stem with cross handle shall be provided that limits the travel of the valve plug from full closed to full open, allowing manual closure or flow regulation. A manual control shall be provided for operation with or without the control wiring installed.

H. Construction shall be so that all operating parts are accessible and removable from the top by removing the bonnet without having to disconnect the valve body from the pipeline. The valve shall be capable of being operated in any position.

I. All automatic control valve assemblies shall include a manual shut-off valve upstream of the solenoid valve. The shut-off valve shall be a Mueller Oriseal Mark II, or approved equal.

2.14 Wiring for Automatic Control Valves, Master Valves and Flow Sensors:

A. Automatic Control Valve Wires shall be insulated single strand copper designed for twenty (20) to fifty (50) volts and UL approved as Type U.F. (Underground Feeder). The UL and U.F. designations shall be clearly marked or indented on the insulation jacket of the wire.

B. Expansion curls shall be provided within three (3) feet of each wire connection to solenoid and at least every three hundred (300) feet in length of control wire length. Expansion curls are formed by wrapping at least 5 turns of control wire around a rod or pipe 1” or more in diameter. Withdraw the rod or pipe once curls are formed.

C. Color coded wires shall be used for all control wires and the following colors are the only colors that will be accepted:

Power (or lead-in) - Black or Red
Common (or neutral) - White
Spares (see below) - Orange

D. One (1) unconnected Spare Wire (color Orange) for each four (4) zones) shall be run from the controller through each intermediate control valve box. Provide at least a twenty-four inch (24") long, tight loop for each wire in each box. For clarification; zones 1 thru 4 require one spare wire, zones 5 thru 8 require an additional spare wire, and zones 9 thru 12 require an additional spare wire, and so on. Where control valves run in multiple directions from the controller, at least one (1) separate spare wire shall be run in each direction. The spare wire(s) shall always be installed to the farthest valve(s) location(s) from the controller.

E. The Master Valve shall be installed with separate power and common wires which shall be different colors than the other control wires. A spare wire shall also be installed to the Master Valve. The following wire colors are the only colors that will be accepted:

Power - Blue
Common – Yellow
Spare – Orange

F. The Flow Sensor shall be installed with a **PE-89 Shielded Communication Cable** as manufactured by Regence, or approved equal. This cable shall be installed with no splices accepted other than where cable is attached to flow sensor, unless as approved by the Engineer. Approved splice kit shall be **Super Serviceseal Closure with Poly-bee**, or approved equal, to make that splice.

G. Copper conductors must meet or exceed ASTM B-3 requirements

2.15 Master Valves/Flow Sensors/Flow Monitors:

A. Master Valves: ***Normally Open*** ***when MV is located on the same mainline as the Quick Coupler Valves (QCV) and*** ***Normally Closed*** ***when the quick coupler valves are on a separate mainline. (Locating QCV on a separate mainline is the preferred method).***

1. The Master Valve shall be of the type, manufacture and size shown on the Drawings and/or the following: ***Superior Series #3100 (for normally Open up to 3" O.D. size) or Superior Series #3200 (for normally Closed up to 3" O.D. size) or Bermad Ram 400 Series Hydraulic Control Valve (for 4" O.D. pipe size and larger), or approved equals.***

2. The Master Valve shall be a normally ***Open/Closed*** electric solenoid actuated valve. The valve shall have an NPT inlet and outlet. The valve shall be capable of working at pressures of up to 150 psi.
3. The Master Valve shall meet all of the requirements for Automatic Control Valves as noted above.
4. The Master Valve shall be installed with separate power and common wires which shall be different colors than the other control wires. The wire colors shall be blue (power) and yellow (common).

B. <u>Hard Wired</u> Flow Sensor and Flow Monitor: (Use as required)

1. The Flow Sensor shall be a Rainbird, Model #FS-X00P (X=pipe size).
2. The Flow Monitor shall be a Rainbird, Model #PT-1502.
3. The thermoplastic Flow Sensor shall have a six bladed impeller with a proprietary, non-magnetic sensing mechanism. The transmitted signal shall be a low impedance 8 VDC square wave signal. The maximum transmitted signal distance shall be 2000 feet.
4. The Flow Sensor shall include a Schedule 80 PVC tee fitted with a removable sensor insert.
5. The Flow Sensor shall be installed in a PVC jumbo valve box, green color.

C. <u>Wireless</u> Flow Sensor and Flow Monitor: (Use as required)

1. The Wireless Flow Sensor System shall be battery operated and shall be a Badger Series, Model #228PVX00U-1231 (X=pipe size), with Low Profile Antenna, Model #A335LP.
2. The Flow Monitor is the same as listed above.
3. The thermoplastic Flow Sensor shall be the same as listed above.
4. The Flow Sensor shall include a Schedule 80 PVC Tee fitted with a removable sensor insert.
5. The Flow Sensor shall be installed in a PVC jumbo valve box, green color.

D. Pulse Decoder: (Use as required)

1. The Pulse Decoder shall be a Rainbird, Model #DECPULLR.

2.16 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 Pentek or NDS Pro Series 10 inch diameter round valve boxes with locking lids for quick coupler valves, green color, or approved equal.
2. Use Pentek 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, or approved equal, 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, or approved equal, with metal lid and extensions and/or bricks as required.
4. Use Pentek or NDS Pro Series 6-7 inch diameter round box, or approved equal, for grounding rods, green color.

B. Automatic control valves shall be enclosed in valve boxes of HDPE or polyolefin and fibrous material (preferably recycled material) with locking lids. The bottom

shall be slotted so as to extend below the pipe. Extensions shall be added as required to meet grades per the Details. Automatic control valves shall read ACV, master valve boxes shall read MV, cast iron gate valve boxes shall read WATER, etc.

C. Manual drain valves and individual gate valves shall be enclosed in a Cast Iron Roadway Box, as manufactured by Olympic Foundry, Tyler Pipe, or Pentek "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.

E. Occasionally, valves may need to be installed in athletic field areas of play. In those cases valve boxes shall be installed underground with the box cover 6" below finished grade and shall have covers with a 4 inch by 4 inch by 1/8 inch thick steel locator plate attached to the top of the cover.

2.17 Automatic Irrigation Controller and Communications Equipment:

A. Hybrid type controller that combines electromechanical and microprocessor based circuitry capable of fully automatic and manual operation. Station timing: 1-120 minutes in 1-minute increments, and 2-12 hours in 10-minute increments. Input: 117 volt AC, 60HZ. Output: 26.5 Volt AC, 1.5 amps. Controller shall have an integral circuit breaker or fuse. Controller shall have two master valve/pump start circuits. Controller shall have remote operation capability and shall also include the following additional equipment:

NOTE: The Consultant needs to select the controller type from the following list of choices depending on whether the system is 'Maxicom' controlled or not. If the system is not a "Maxicom' controlled system then select item #1 below and fill in the correct controller model number. If the system is to be a "Maxicom' controlled system then select item #2 below and fill in the correct controller assembly model numbers. (Delete the item not used and this note).

1. The Controller shall be a Rainbird -(***LXME, SAT, or SiteSAT) Controller (XX station, wall mount). (Note: The model number and exact type of controller varies based on the number of zones and other site conditions, or approved equal.***

2. The Controller Assembly shall be Model # ESP-(***LXME, SAT, or SiteSAT) 1EXXTERP15C-RP Controller (XX station, wall mount). (Note: The model number varies based on the number of zones and other equipment required, or approved equal.***

3. All Controllers shall be equipped with an **ESP Receiver Card** with antenna and **(2) TRC Commander Transmitters**, as manufactured by TRC Systems, or approved equal.
4. All Controller panels shall have a Duplex Receptacle, **LEV5280-W**, or approved equal.
5. All Controller panels shall include a **Terminal Strip** for 24-volt wires.

6. All Controller panels shall include a **Cellular Communication Device, DataRemote Modem #9060**, or approved equal.
7. All Controller assemblies shall be mounted on an aluminum panel that is pre-assembled at the supplier's facility and later installed in the controller enclosure at the site by the Contractor's electrician.
8. Pulse Decoder/Output Decoder and accessory control equipment (if required) shall be Rainbird, Model #DECPULLR.

B. Controller:

1. The Controller shall be hard wired in conduit. All conduits shall be UL approved electrical conduit minimum size 1 1/2-inch diameter, 18-inch deep minimum.
2. The Conduit size for irrigation control wires shall be minimum 1-1/2-inch diameter or greater to allow for all wires to be installed in a single conduit.
3. The Communication Cable, or approved equal shall be the type recommended by the irrigation controller manufacturer. No splices in the communication cable will be allowed unless approved in writing by Engineer.

C. All controllers, communications and other required electrical equipment shall be grounded (to a resistance of less than 10 ohms) using an array of three ground rods per the Details.

2.18 Controller Enclosure:

A. The Controller Enclosure for a ***Single or Multiple Controller(s) or a*** **Metered Power Drop** with control equipment combination shall be either a ***Skyline Electric NEMA-3R steel enclosure with concrete pedestal, a Strong Box stainless steel enclosure and concrete pedestal,*** or approved equal, per manufacturer's specifications and SPR Standard Details and shall be sized according to the control equipment required by the design and as shown on the Plans and Details.

B. Controller Enclosures shall be constructed of 12 gauge pre-galvanized steel with aluminum interior mounting panels, double doors with three point compression latches, and special vandal proof slide bar and lock as shown on Plans and Details. The exterior of the enclosure shall be dark green baked enamel.

2.19 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.

D. Encapsulate all control valve wire splices with approved splice kit with sealant. The Wire Splice Kit is the 3M-DBY splice kit, or approved equal.

E. Grounding array shall consist of at least three (3) eight feet (8') long by 5/8" diameter copper rods.

F. When tying a irrigation system piping into an existing system, a "Romac" Model #511 (long version) repair coupling is required. No telescoping repair couplings will be allowed. An isolation valve is also required at that point of connection to allow for pressure testing of the new system.

G. <u>Optional</u> Sprinkler Head Protection Collars: Pre-cast concrete protection collars for heads installed immediately adjacent to walking or driving surfaces, as shown on the drawings, or as directed by the Engineer. Pre-cast concrete protection collars shall be type 'B', 8.625" diameter by 2" depth.

2.20 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".

B. Valve zone identification tags are required and shall be Christy's ID Tags, as manufactured by Christy Concrete Products, Inc., Portland, OR, or approved equal. Tags shall be made of polyurethane, incorporating an integral attachment neck and reinforced attachment hole and will be capable of withstanding 180 pounds pull force. Tag shall be 2 1/4" x 2 3/4" in size. All lettering shall be hot stamped in black and capable of withstanding outdoor use. Tag color shall be yellow shall be double sided and stamped with zone valve number.

2.21 Backfill Materials:

A. For backfill around all irrigation heads use common builder's sand.

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 Irrigation System:

A. Stake the irrigation 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 Installation:

A. 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.

B. 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.

C. Solvent Welded PVC Pipe and Fittings:

1. The Contractor shall exercise care in handling, loading, unloading and storing to avoid damage. The pipe and fittings shall be stored under cover, and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat, so as not to be subject to undue bending or concentrated external load at any point. Any pipe that has been dented or damaged shall be discarded until such damage has been cut out and the pipe is rejoined with a coupling.
2. PVC pipe ends shall be cut to ninety (90) degrees to the pipe length and cleaned of all cutting burrs prior to cementing. Use approved reaming tool. Pipe ends shall be wiped clean with a rag and lightly wetted with PVC primer. Cement shall be applied with a light coat on the inside of the fitting and heavier coat on the outside of the pipe. Pipe shall be inserted into the fitting and given a quarter turn to seat the cement. Excess cement shall be wiped from the outside of the pipe. Pipe will be tested as indicated elsewhere in these specifications. No back filling will be permitted other than at the centers of pipe lengths until the pressure test is completed.
3. Appropriate primer shall be used with solvent glue. Solvent welded joints shall be given at least fifteen (15) minutes set-up time before moving or handling. Pipe shall be partially center loaded to prevent arching and slipping. No water shall be permitted in pipe until a period of at least ten (10) hours has elapsed for solvent weld setting and curing.
4. Before pressure testing, soluble weld joints shall be given at least twenty-four (24) hours curing time.
5. No PVC pipe may be threaded or connected to a threaded fitting without an adapter. Use Teflon tape on all male threads.
6. Great care must be taken to insure that the inside of the pipe is absolutely clean. Any pipe ends not being worked on must be protected and not left open.
7. Repairs or connections to existing PVC pipe shall be done using 'Romac', or approved equal fittings, as shown on SPR Standard Details. 'Romac' Model #511 (long version) repair coupling is required. No telescoping repair couplings will be allowed. An isolation valve is also required at that point of connection to allow for pressure testing of the new system.

D. <u>By Exception Only</u> - Gasketed PVC Pipe and Fittings:

1. Cut the pipe squarely and bevel the plain end of the pipe. Bevel should be approximately 15 degrees and ¾" long. Remove any burrs and ridges on the pipe. Measure the bell depth and mark the pipe for reference. In cold weather allow ½" clearance between end of pipe and bell stop, to allow for

later pipe expansion.

2. Clean all debris from the bell areas of the fitting or pipe. Check the position of the gasket so it's completely seated in the groove with no raised areas.

3 Lubricate the gasket and the plain end of the pipe with lubricant supplied by the pipe manufacturer.

4 Align the pipe with the bell end of the fitting or pipe and push together by hand or with pry bars on the end of the fitting or with pry bars using the lugs on the fitting. Insert until the reference line mark is even with the edge of the fitting bell.

E. 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**.

F. Thrust Blocking: Thrust blocking shall be installed on mainlines **4" O.D. and larger** according to City of Seattle Standard Specifications (most recent edition), or as otherwise indicated on the Plans.

G. 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**.

H. Irrigation Pump (if required):

1. Install per manufacturer's recommendations and as shown on the Details.
2. Coordinate pump installation with electrical work.

I. 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, as shown on the Details.

J. Quick Coupling Valves:

1. ***On 'Maxicom' controlled irrigation systems the Quick Coupler Valves shall be installed on a separate mainline pipe designed for use independently of the rest of the system***. Quick coupler valves shall be located as shown on the plans or at approximately 100' intervals, unless otherwise directed by the Engineer through the design review process. One additional 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 on the Details.

K. Risers and Swing Joints:

1. All pop-up sprinkler heads and quick coupler swing joints must be constructed as shown on the Details.
2. Minimum riser size shall be the pipe size of the sprinkler head.
3. All threaded joints shall have Teflon tape (approved for PVC pipe) applied to male threads only. No pipe dope is allowed.
4. Risers are to be capped after installation in preparation for pressure testing.
5. All pop-up sprinkler heads and quick couplers shall have swing joints that allow the head or quick coupler to be set perpendicular and flush with finish grades.
6. In no case shall the heads be set with swing joints at maximum extension, thus preventing future adjustment.

L. Pop-up Sprinkler Heads:

1. Install all sprinkler heads as shown on the Plans and Details.
2. Spacing of heads shall not exceed spacing shown on the Plans for any reason.
3. Heads along curbs, walks, paving, etc. shall be placed 1/2 inch above finish grade and no closer than 4 inches from paving edge.
4. All impact sprinkler heads located in athletic turf areas shall be equipped with rubber covers.
5. All heads shall be set perpendicular to finish grade unless otherwise designated on the Plans.
6. Backfill around heads with sand, as shown on the Details.

M. Automatic Control Valves:

1. Install as shown on the Plans and Details.
2. Before installation of any automatic valves, the supply line must be thoroughly flushed.
3. All Automatic Control Valve Assemblies shall be enclosed in jumbo valve boxes with valve box extensions as required, as shown on the Details.
4. Install only one (1) valve assembly per valve box.

N. Master Valve/Flow Sensors:

1. Install Master Valve/Flow Sensors per manufacturer's specifications.
2. Coordinate wiring with control equipment (blue and yellow wires required).
3. ***If Master Valve is the <u>Normally Closed</u> type, its wires shall be connected to the Master Valve terminals on the terminal strip. If Master Valve is the <u>Normally Open</u> type, its wires shall be connected to Station # 24 on the terminal strip. Use terminal #12 if the controller is smaller than a 24 station controller.***
4. All Master Valves and Flow Sensors shall be enclosed in valve boxes with valve box extensions as required, as shown on the Details.

O. Wiring:

1. Control wires shall be taped together at five (5) foot intervals with black electrical tape; then this bundle shall be taped to the bottom of the supply lines at ten foot (10') intervals with at least three (3) wraps of electrical tape. A bare copper wire (#14 or greater), shall be installed on top of the PVC supply line for future detection with the wire ends clearly exposed in the valve boxes.
2. Tie a loose 24 inches long loop in all wiring at changes of direction greater than 30 degrees. Untie all loops after all connections have been made.
3. Splices shall be permitted only at junction boxes, valve boxes, or at control equipment and never between valves or valve and controller. A minimum of 24 inches of excess conductor shall be left at all splices, terminal and control valves to facilitate inspection and future splicing. All splices must be encapsulated with sealant in approved splice kit. The splice kit shall be a 3M-DBY type water-proof wire splice, or approved equal. If a splice between the controller and valve is required due to damage to existing valve wires, the splice shall include minimum 24 inches excess length of control wire added at the splice location. At the break location, two splices are required to complete the repair. The splices (two per break) shall leave splice kits unburied, and shall be housed in a separate valve box and brought to finish grade.
4. One (1) unconnected Spare Wire (color Orange) for each four (4) zones) shall be run from the controller through each intermediate control valve box. Provide at least a twenty-four inch (24") long, tight loop for each wire in each box. Where control valves run in multiple directions from the controller, at least one (1) separate spare wire shall be run in each direction. The spare wire(s) shall always be installed to the farthest valve(s) location(s) from the controller.
5. A schedule diagram (zone chart) shall be posted in the controller to facilitate the selection of the valves to be operated.
6. Minimum size of wire is to be determined strictly by the following chart:

No. of	Maximum Length of Common Wire			
Valves	500'	1000'	2000'	3000'
1	14	14	14	14
2	14	14	14	10
3	14	14	10	8
4	14	14	10	8
5	14	10	8	6
6	14	10	6	6
7	14	8	6	4
8	14	8	6	4
9	14	8	4	4
10	10	6	4	2
11	10	6	4	-

7. The Flow Sensor Wire - PE-89 Shielded Communication Cable, or approved equal, shall be installed with no splices accepted other than where the cable is attached to the flow sensor, unless as approved by the Engineer. Splice kit used to make that splice shall be a Super Serviceseal Closure with Poly-bee, or approved equal. At least a five foot (5’) loop of excess cable shall be left

at the point of connection in the controller enclosure to ensure that enough slack is available for connection to the controller.

P. Automatic Controllers:

1. Install irrigation Controllers per manufacturer's specifications and shop drawings.
2. Electrical wiring (120 V.A.C.) shall be installed according to local code. A licensed electrician must perform hard wiring of controller, and the work must be permitted per City of Seattle requirements. The cost of all electrical work necessary to make the automatic equipment operate properly shall be included in this contract.
3. Conduit for power supply wires shall be installed as shown on Plans and Details and controller manufacturers shop drawings. The ends of all conduits, whether shop cut or field cut, shall be reamed to remove burrs and rough edges. Cuts shall be made square and true. Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit. A 3/16-inch polyethylene pull rope shall be installed in all conduits with two feet of pull rope extended beyond the conduit openings and then secured. All conduits shall be free of debris. All conduit openings shall be sealed with duct tape to prevent fouling.
4. The controller enclosure shall be properly grounded per the Details.
5. A diagram of schedule (zone chart) shall be posted in the controller to facilitate the selection of the valves to be operated.
6. Install decoders, transmitter and all control equipment in controller housing per manufacturer's specifications.
7. Cellular Communication and other required equipment: The Contractor shall notify the Engineer when the “Maxicom” controller panel is installed so that Parks staff can obtain the modem cell phone number and then program the modem for the Functionality Test. The contractor shall also provide the Engineer with the 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/winterizing can continue after departure of the Contractor.
8. The Contractor shall be liable for all damage or loss resulting from failure to comply with the provisions of this paragraph. All of the above mentioned procedures must be done before the Functional Test can occur, as described below.

Q. 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 PVC main lines 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 PVC 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. If the system requires a pump, the service line pressure is required with the pump in operation. 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. Coverage Test:

1. Before the irrigation system will be accepted, the Contractor, in the presence of the Engineer, shall perform a water coverage test for each zone of the system. This test shall be performed using only the power supplied from the metered power drop supplied by Seattle City Light. Never perform this or any other testing of the irrigation system equipment using power supplied by a portable generator. The Contractor shall be responsible for changing nozzles, etc., at the discretion of Engineer, in order to obtain full coverage with minimum over spray. The Contractor will be required to adjust and/or replace nozzles, etc. as necessary to meet this requirement. Prior to arrival of the Engineer, the Contractor shall accomplish the following: complete all work including balancing, adjusting the system (pressure reducing valves, flow adjustment keys, nozzles, etc.) to provide optimum coverage without fogging.
2. Notify the Engineer at least two (2) working days in advance of coverage test by calling the **SPR Inspection Request Line @ (206) 684-7032 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice**.

D. Functionality Test:

1. A functionality test of the control/communication systems shall be performed and demonstrate that all parts of the system function as specified or intended. The functionality test for each new system shall consist of not less than thirty (30) calendar days of continuous, satisfactory operation.
2. Any materials determined to be faulty as part of the installation shall be replaced or corrected by the Contractor at their expense in a manner respective to the Plans, Details and other sections of this Specification. In the

event of a system failure due to faulty installation or workership, the thirty (30) day period will be repeated until testing is complete.

E. 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.

F. Substantial Completion:

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

G. System Operation Orientation Session:

1. A training and orientation session shall be required. The Contractor, the irrigation Sub-Contractor, the Consultant and the Engineer shall be present. The date and time of the session shall be subject to the approval of the Engineer.

H. 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. Controller Charts:

a. The record documents shall be approved by the Engineer before charts are prepared. The chart shall be a reduction of the actual record documents prepared by the Consultant.

b. Provide one controller chart per controller. Controller chart shall fit in behind controller door.

c. The Chart shall be a bond copy print with a different pastel transparent color to show each separate zone. Verify that the zone number as shown on the Controller Chart matches the number on the actual control valve identification tag. Numbering of zones shall be done as specified above in this section.

d. When completed and approved, hermetically seal (laminate) the chart between two pieces of plastic.

e. The charts shall be completed before the project can be considered Physically Complete.

5. 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/winterizing can continue after departure of the Contractor. The Contractor shall also provide the two (2) TRC Remotes to the Engineer at this stage. The Contractor shall be liable for all damage or loss resulting from failure to comply with the provisions of this paragraph.

I. 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.

J. Irrigation System Warranty for winter work: The Warranty shall include one complete winterization and one complete de-winterization of the irrigation system if the project carries over through the winter months.

K. Term of Warranty: The Contractor shall be responsible for all work showing defects in materials or workmanship, at no cost to the Owner, for a period of **One Year** from date of Physical Completion or one year from date of de-winterization, whichever is latest. The Warranty shall include restoration of planted or paved areas due to settlement of trenches.

1. A final site meeting shall take place eleven months after the date of Substantial Completion or de-winterization, whichever is later. The system shall be examined by the Engineer to determine if the system requires alterations or replacements.

END OF SECTION