

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Work to be performed under this Section shall consist of furnishing all labor and materials necessary to construct a complete working and tested sprinkler irrigation system as per all drawings and specifications.
- B. Irrigation Contractor shall participate in coordination meetings as required with the Landscape & Natural Resources Representative and related parties prior to commencement of construction.

1.02 REFERENCES

- A. ANSI – American National Standards Institute
- B. ASIC – American Society of Irrigation Consultants: ASIC Grounding Guideline.
- C. ASSE – American Society of Sanitary Engineering: ASSE 1013, 1015: Backflow Preventers, Pressure Reducers.
- D. ASTM – American Society of Testing and Materials
- E. IA – The Irrigation Association: Main BMP Document.
- F. NFPA – National Fire Protection Association: NFPA 70 National Electrical Code.
- G. UL – Underwriters Laboratories: UL Wires and Cables.

1.03 DEFINITIONS

- A. Point of Connection: Location where Contractor shall tie into water supply to provide irrigation water to the Project.
- B. Mainline: Pressurized piping downstream of the Point of Connection to provide water to remote control valves and quick couplers. Normally under constant pressure.
- C. Lateral Pipe: The system of pipes that provide water from the valves to the sprinkler heads or emitters.

1.04 QUALITY ASSURANCE

- A. The irrigation system is to be installed by a contractor who specializes in irrigation design and installation and has installed at least 5 projects of equal or comparable size and complexity. Irrigation work shall be performed by a single firm, acceptable to the Landscape & Natural Resources representative and licensed as a contractor in the state where the project is to be installed.
- B. All work to be performed to current standards of local governing municipality.
- C. Referenced Standards: American Society for Testing and Materials, Annual Book of ASTM Standards, latest edition.
- D. Codes and Standards: Irrigation design and installation shall comply with all applicable federal, state and local governing agency requirements and to industry standards. Notify Landscape Architect immediately in writing of any discrepancies, inconsistencies, or contradictory requirements.
- E. Location of Equipment: Design locations shown on plans are approximate. Minor adjustments in the system layout will be permitted to clear fixed obstructions. Any major revisions to the irrigation system shall be submitted in writing to the Landscape Architect for approval. The final system layout must be acceptable to Landscape & Natural Resources.
- F. The number of heads or valves cannot be less than that indicated on plans without

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approval by Landscape & Natural Resources. Under no circumstances shall any turf areas be watered in combination with plant beds. Spacing of all sprinkler equipment selected shall not exceed the manufacturer's recommendations as published. "Head to head" coverage is required in all turf areas.

- G. Substitutions: No substitutions from the irrigation plan will be permitted without review and approval by the Landscape & Natural Resources representative. Requests must be made at least 2 weeks in advance of the project start date. In the event the contractor desires to make substitutions of materials, sufficient descriptive literature, new design, and material samples must be furnished to establish the material as an equal substitute, and the design as functional. The proposed material substitution must meet the original design intent as it pertains to water conservation.
- H. All materials shall come from a regionally authorized irrigation distributor for the product as specified for warranty purposes.
- I. Workmanship: Install materials and equipment in a neat and professional manner following manufacturer's recommendations.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions prior to ordering of any materials. Delivered material shall match approved submittals.
- B. Certifications: All general laborers and workers shall be previously trained and familiar with sprinkler installation, and have a minimum of one-year experience. Contractor to have a Rain Bird Factory Trained Maxicom Technician on site at all times.
- C. As-Built Drawings: Submit layout and details illustrating field installed points of connection, satellites, mainline and lateral line locations, size, and assembly. Include type and coverage of heads, type of valves, satellites, fittings, emitters, and accessories. The drawing shall be scaled no smaller than 1" = 30'-0". Submittal, review, and approval by the Landscape & Natural Resources Representative and Landscape Architect of the As Built Drawing shall precede Application for Final Payment by the Contractor
- D. Operation and Maintenance Data:
 - 1. Submit instructions covering full operation, care, and maintenance of system (and controls) and manufacturer's parts catalog.
 - 2. Include year-to-year schedule showing length of time each valve is to be open to provide determined amount of water, drain procedures, cleanout features, etc.
 - 3. Instruct Landscape & Natural Resources maintenance personnel on how to operate controller, adjust sprinkler heads and other equipment, and use special tools for adjustments.
- E. Completion Kit: Provide 10% of components in the irrigation system to UCF representative. Include, but not limited to the following:
 - 1. Manual Valve Key: Furnish two 3 foot long valve keys to fit each type of valve assembly.
 - 2. Controller: Furnish two keys for each automatic controller.
- F. Tools: Furnish two sets of special tools required for removing, disassembling, and adjusting each type of valve supplied on the Project.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and equipment in such a manner as not to damage the parts or decrease the useful life of equipment.

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- B. Store materials away from detrimental elements. Coordinate with Landscape & Natural Resources Representative, General Contractor, or Landscape Contractor, as appropriate, to secure a safe staging area.
- C. Handle, load, unload, stack, and transport materials carefully to avoid damage. Handle pipe in accordance with manufacturer's recommendations.

1.07 JOB CONDITIONS

- A. Prior to commencing any work required under the Contract, the Contractor shall locate all utilities, subsurface drainage, and underground construction so that proper precautions may be taken not to disturb or damage any subsurface improvements. Damage to any of the above mentioned items or other shall be promptly repaired by the contractor at no additional cost to the owner.
- B. Water service and electric service will be supplied by the General Contractor to a designated area in landscape planting for the purpose of the automatic irrigation system. It is the responsibility of the Irrigation Contractor to coordinate the location of the waterline and electric service.
- C. Irrigation System is to operate under the water pressure and flow rates prevailing at the project site. Irrigation Contractor shall be responsible for determining these parameters, and reporting any deviations to the Landscape Architect between these existing conditions and the required parameters as stated on the irrigation plans.
- D. Insurance on irrigation materials or equipment stored or installed is the responsibility of the Irrigation Contractor. Such insurance shall cover fire, theft, and vandalism. Should the Irrigation Contractor elect not to provide such insurance the Owner shall in no way be responsible for any losses incurred by the aforementioned acts. The Irrigation Contractor is responsible for all costs incurred in replacing damaged or stolen materials or equipment prior to Substantial Completion of the Work.
- E. Obtain all required permits and pay all required fees at no additional cost to the Owner. Any penalties imposed due to failure to obtain permits or pay fees are the responsibility of the Irrigation Contractor.
- F. Provide and maintain all passageways, guard fences, warning lights, and other protection devices required by local authorities or others having jurisdiction.
- G. Irrigation Contractor shall adequately protect adjacent property as provided by law and the Contract Documents.
- H. Existing Site Improvements: Perform Work in a manner that avoids damage to existing site improvements. The Irrigation Contractor is responsible for any damage of mechanical nature as well as damage resulting from leaks in the irrigation system whether due to negligence or otherwise.
- I. Test water conditions: It shall be the responsibility of the Irrigation Contractor to measure or analyze the existing or anticipated water pressure at the point of connection.
 - 1. In the event water pressure is insufficient to operate the system per designed pressure and flow, the Irrigation Contractor shall be responsible for notifying the Landscape Architect for specification of a booster pump capable of increasing the pressure and flow as required. The contractor shall supply and install the booster pump. The booster pump shall be operated by a magnetic starter, flow, or pressure transducer/switch. Coordinate provision of adequate electrical service for the pump with General Contractor. The booster pump shall be provided in a lockable enclosure on a WWF reinforced concrete pad 5" thick, over 6" CA6 base if it is to be installed outdoors. Indoor installation of a booster pump is also acceptable provided the proper approval and space requirements

exist.

2. In the event the water pressure significantly exceeds an appropriate operating pressure, it shall be the Irrigation Contractor's responsibility to provide and install a pressure regulator downstream from the backflow preventer. Pressure regulation may be accomplished via a master valve with a pressure reducing dial, or may be accomplished at the individual zone valve locations with a pressure reducing dial.
 3. Each spray head, rotary sprinkler or emission device must contain a built in, in-stem pressure regulator designed to optimize pressure at the nozzle. Sprays are 30 psi with standard nozzles, 45psi for use with rotary sprays and turf rotors.
- J. Sleeves for irrigation piping and wiring shall be coordinated and installed by the General Construction Contractor.
1. It shall be the Irrigation Contractor's responsibility to submit the Irrigation Design Drawing, showing these sleeves, in a timely manner, such that the General Construction Contractor is able to install sleeves within an appropriate sequence of work, i.e., without undoing, damaging, or otherwise compromising work that has already been installed.
 2. Irrigation sleeves shall be Schedule 40 PVC pipe, minimum 2X pipe size of proposed irrigation pressure pipe. A separate Schedule 40 PVC sleeve shall be installed for irrigation wire. Ends of all irrigation sleeves shall be marked with 2 x 2 wooden stakes or white pvc pipe, indicating in indelible marker "Irrigation Sleeve." General Contractor shall expose any irrigation sleeves that are not marked for the Irrigation Contractor prior to start of irrigation work. Coordination and scheduling for excavation of sleeve ends is the responsibility of the Irrigation Contractor.

1.08 WARRANTY

- A. Warranty all Work for a period of one (1) year, starting on the Date of Substantial Completion, against defects in materials, equipment, workmanship, and any repairs required resulting from leaks or other defects of workmanship, material, or equipment.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Specific requirements concerning the various materials and the arrangements in which they are to be installed are outlined in this Specification.
- B. Quality and Size
1. Material specified by name and / or model number in the Specifications, on the site, or detailed drawings are used for the purpose of identification of materials and to ensure specific use of that material in the construction of the system. No substitutions will be permitted without approval. (See Substitutions).
 2. All materials used in the system must be new and without flaws or defects of any type and be the best quality available. All sprays, rotors and valves shall have a minimum three (3) year warranty against material defects or defective workmanship.

2.02 NON-POTABLE WATER SOURCE

- A. When applicable, major components associated with a non-potable irrigation system must be distinguished from potable by the use of light purple color and, in some cases descriptive signage. All valves, valve boxes, irrigation heads, hose bibs, quick coupling valves, etc. must be painted or manufactured in the appropriate color to avoid improper

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use. Valves need to have purple valve tags to identify them as non-potable. Signage must also be used (CAUTION-NON-POTABLE WATER, DO NOT DRINK) at any distribution point (i.e. hose bib, quick coupling connection, etc.). Signage must be in both English and Spanish and located as to be readily visible to potential users.

2.03 PIPE AND FITTINGS

- A. All PVC pipe from sizes three (3) inches and above shall be Schedule 40, SDR 26, unplasticized rigid polyvinylchloride (PVC) pipe with integral bell and rubber ring gasket unless otherwise specified. Pipe from sizes two and one - half (2 1/2) to one and one - quarter (1 1/4) inch shall be Schedule 40, solvent weld PVC pipe. Pipe sizes one (1) and three - quarters (3/4) inch shall be Schedule 40, solvent weld PVC pipe. One - half (1/2) inch pipe shall be Schedule 40 solvent weld PVC pipe. All pipe shall be supplied in standard twenty (20) foot lengths and shall be from one of the following manufacturers: Certain-Teed Products Corporation, Can-Tex or approved equal. No polyethylene pipe will be accepted unless prior written approval is obtained by the landscape architect.
- B. All pipe that is exposed or not below grade shall be Schedule 80 PVC or HDPE.
- C. All pipe fittings size four (4) inches and greater shall be ductile iron. 3" fittings shall be bell and rubber gasket. Fittings 2-1/2" and under shall be Schedule 40 solvent weld PVC.
- D. Solvent weld PVC pipe, if and when used in construction of this system, shall be rigid PVC pipe and shall be assembled using appropriate PVC pipe cleaner / primer and solvent cement in accordance with the manufacturer's recommendations.
- E. Expansion joints shall be installed every three hundred (300) feet of solvent weld piping.
- F. PVC Pipe Couplings Located Within Sleeves: PVC pipe couplings four (4) inches and smaller shall be solvent weld. PVC pipe couplings six (6) inches and larger shall be mechanical joints. Upon exiting sleeves, pipe solvent weld or integral bell and rubber gasket, as described in Section 2-03-A, must be adhered to.
- G. Pressure test all mainline inside of sleeves prior to connecting. Provide 48-hour notice to Landscape & Natural Resources prior to pressure test.

2.04 RISERS: Provide threaded Schedule 80 PVC risers. All risers above grade shall be either dark gray or black PVC pipe, and shall be supported so as not to cause unnecessary movement while sprinkler is in operation.

2.05 ELECTRIC WIRING

- A. 120 Volt AC Wiring: 120 volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service is to be provided by the General Contractor unless otherwise directed by Landscape & Natural Resources Representative. It is the Irrigation Contractors responsibility to coordinate the location of electrical service to be provided for controller.
- B. Splices in controller wiring shall be waterproof direct bury application. Use Rain Bird-DBY T or R wire connectors. 3M DBY/R-6 are equal. No substitutions will be allowed.
- C. Provide junction box, flush-mounted and gasketed per code as required.
- D. Control Wiring shall be 24 volt solid wire Underwriter's Laboratory (UL) approved for direct burial in ground. Minimum wire size shall be fourteen (14) gauge. All control wiring and wiring connections from the controller to the valves is included in this Contract.

2.06 SPRINKLER HEADS

- A. Short or intermediate range - Spray Type Sprinkler Head:
 - 1. The Pop-Up Spray Sprinklers shall be the Rain Bird RD1800-SAM-PRS Series,

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6" or 12" pop-up (NP for non-potable) designed for in ground installation. The sprinkler shall be capable of covering a maximum of fifteen (15) foot radius at thirty (30) psi and maximum delivery of 3.7 gpm. Pop-up height shall be 6" or 12" as indicated on the plans. Shall be manufactured by Rain Bird Corporation, Azusa, California.

- a. The addition of a pressure regulating device to prevent high pressure fogging to the nozzle stream shall be incorporated into the spray body and used throughout the system. This regulating device shall be an integral part of the pop-up stem and shall regulate the nozzle pressure to 30 PSI or 45 psi (nozzle appropriate) for inlet pressures from 35 to 70 PSI. These units shall be identifiable from the top with "PRS" markings on the cap.
 - b. The addition of a check valve feature (SAM) to minimize water hammer and eliminate low head leaking shall be incorporated into the spray body and used throughout the system. These units shall be identifiable from the top with "SAM" markings on the cap.
 - c. The addition of a "Flow Shield" shall be incorporated into the spray body and used throughout the system to alert maintenance when a spray nozzle is removed. These units shall be identifiable from the top with "F" markings on the cap.
 - d. A purple wiper seal (NP) with the international Do Not Drink symbol and warnings in English and Spanish shall be incorporated for all non-potable systems.
2. Spray Nozzles: Rain Bird spray nozzles designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure. All nozzles shall all have a matched precipitation rate with other nozzles on the same zone. Shall be manufactured by Rain Bird Corporation, Azusa, California.
- a. Utilize lower precipitation rate rotary nozzles (.6 in/p hour) on hilly areas and/or where infiltration is low and therefor runoff is expected. Provide the Rain Bird R Series Rotary or R-VAN Nozzle for shrub or small turf areas (13-24 feet) spacing: Rain Bird Rotary nozzles with 45 PRS pop-ups spray bodies.
 - b. Utilize high-efficiency nozzles for improved wind resistance to allow for shortened run-times on flat areas or where infiltration rates allow. Provide Rain Bird HE-VAN-8', 10', 12' or 15' spray nozzles Spacing of 8 to 15 feet (DU of 73% to 78% respectively). Shall have an arc adjustment from 0 to 360 degrees. Rain Bird He-VAN nozzles with 30 PRS pop-up spray bodies.

B. Tree Bubblers

1. The pop-up full-circle bubbler for in-ground installation shall be Rain Bird RD1800 Series with a 1400 Series bubbler. The nozzle piston shall have a smooth external surface, riser wiper seal in cap, full-length stainless steel retraction spring, and filter screen. Sprinkler body constructed of non-corrosive heavy duty plastic. All parts shall be removable through top of unit by removal of threaded nozzle. Pop-up height shall be 6" (NSI) or 12" as indicated on the plans. Shall be manufactured by Rain Bird Corporation, Azusa, California.

C. Intermediate Range Rotors:

1. The full or part circle Rotor shall be Rain Bird 5000PL-SAM-PRS Series (NP for non-potable) utilizing the MPR Nozzle sets. Sprinkler shall be a single stream, water lubricated, gear drive type capable of covering the areas between 25 and

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35 feet at a minimum base pressure of 45 psi. The part circle sprinkler shall have adjustable arc coverage of 40 to 360 degrees. Pop-up height shall be 6" or 12" as indicated on the plans. Shall be manufactured by Rain Bird Corporation, Azusa, California.

- a. The sprinkler shall include an integral pressure regulator to reduce operating pressure to 45 psi for optimal nozzle performance. The sprinkler shall have a flow shut-off device (5000 Plus PRS only) that is integrated into the flow path of the rotor as well as adjustable arc coverage of 40 to 360 degrees.
- b. The sprinkler shall have a standard rubber cover, tapered stem for positive flushing, and a strong stainless steel retracting spring for positive pop down.

D. Large Turf Rotor:

1. The full or part circle Large Turf Rotors shall be a Rain Bird 8005 Series (NP for non-potable), single stream, water lubricated, gear drive type capable of covering a radius of 39'-81' at a minimum base pressure of 60 psi. The part circle sprinkler shall have adjustable arc coverage of 40 to 360 degrees. Shall be manufactured by Rain Bird Corporation, Azusa, California.
 - a. The sprinkler shall be capable of full circle (360 degree) operation in either the single direction mode (FC) or the bi-directional mode (PC). The sprinkler shall have a pressure activated, multi-function, soft elastomeric wiper seal that will clean debris from the pop-up stem as it retracts. Arc adjustment can be performed with or without the rotor in operation and shall require only a flat blade screwdriver. The sprinkler shall have a rotating nozzle turret independent of the riser stem.
 - b. The sprinkler shall have eight color-coded nozzles and a front-load nozzle assembly which will allow the nozzle to be installed without a stator bushing change. The sprinkler shall have a standard rubber cover and a strong stainless steel retracting spring for positive pop-down. The sprinkler shall have a standard Seal-A-Matic™ (SAM) device capable of holding up to 10 feet of head. Pop-up height shall be 4 inches.

2.07 CONTROL SYSTEM

- A. The irrigation control system shall be a Rain Bird Maxicom system utilizing 2-wire communication between field satellites and a C.C.U. The site shall communicate with the central via an Ethernet line. The University shall utilize an existing central monitoring computer and weather station.
- B. A CCU shall provide middle management capability. The CCU shall be in constant two-way communication with all devices at that site. The middle manager shall be able to manage incoming flow data from multiple water sources demanded by multiple satellite controllers. Each C.C.U. requires its own rain can. The CCU shall be manufactured and furnished by Rain Bird Corporation, Glendora, California.
- C. The satellite controllers shall be Rain Bird ESP24SAT2S, 24 Station, installed in a Stainless Steels Pedestal with 2-Wire Communication. The satellites shall be manufactured and furnished by Rain Bird Corporation, Glendora, California.
- D. All electrical control components including C.C.U.'s and satellite controllers must be grounded according to the grounding specifications and details in the plan documents. Rain Bird warranties Maxicom products only when connected to a grounding system with a ground resistance of ten (10) ohms or less.

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- E. An MSP-1 Surge Arrestor shall be installed on the 2-wire communication path at each solitary satellite controller or the first satellite within a satellite cluster and at the CCU (both ends of the communications path). The MSP-1 shall detect and transfer voltage surges of 60 volts or higher traveling along the 2-wire path to a local grounding system via the dedicated grounding wires provided at each end of the device. The MSP-1 Surge Arrestor shall be mounted in the stainless steel mounting bracket in the pedestal of the satellite unit or other suitable location. An optional MGP-1 mounting plate is available for mounting MSP-1 to a local ground rod. A local grounding system (ground rods, plates, cables, or combination) with a ground resistance of ten (10) ohms or less shall be provided at each MSP-1 location. The surge arrestor shall be as manufactured and furnished by Rain Bird Corporation, Glendora, California
- F. Control Wire - Use UF, 600 Volt, solid copper, irrigation control wire, sized as required, with 3MDBY or DBR connectors at all splices. Install all splices inside a Rain Bird Standard Rectangular Valve Boxes model # VB-STD with beveled bolt down lids. Install one common in each direction from the controller. Install one hot wire for each remote control valve. In addition, install one spare common and four spare hot wires in each direction, from controller, to all ends of the mainline.
- G. Communication cable - Paige Electric PE-39-19-three pair (or more if required). Install inside 1.5" gray PVC electrical conduit. When runs exceed 300' use pull boxes installed at 300' on center. Use multi-color maxi wire in 2-wire star design for ease of troubleshooting. Use Rain Bird Standard Rectangular Valve Boxes model # VB-STD with beveled bolt down lids. Make all splices using the SUPER SER V1-SEAL as required by Rain Bird Maxicom specifications.
- H. A master valve shall be installed in a valve box near the POC, as designated on the plan. This valve will be wired to the satellite controller. The valve shall be a Rain Bird PEBSB-R series valve, normally closed, 24 VAC 50/60 cycle solenoid actuated globe design. The wiring between the valve and controller shall be accomplished with copper wire with an exterior jacket which is U.L. listed for direct burial and sprinkler control. The size shall be a minimum of 14-11. Larger gauges will be used where voltage loss dictates.
- I. Flow sensors shall be an in line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part. The electronics housing shall have two O-Rings and shall be easily removed from the meter body. The sensor electronics will be potted in an epoxy compound designed for prolonged immersion. Electrical connections shall be 2 single conductor 18 AWG leads 48 inches (1, 2 meters) long. Insulation shall be made using special direct burial "UF" type, electrically shielded cable to avoid interference, colored red for the positive lead and black for the negative lead. The sensor shall be capable of operating in line pressures up to 400 psi (27,5 bars) and liquid temperatures up to 220° F, and operating in flows of ½ foot per second to 15 feet per second with linearity of ±1% and repeatability of ±1%. The meter body shall be cast 85-5-5-5 bronze, in 1" and 1½", female iron pipe thread sizes. Surge Suppressor with ground rod located at the Flow Sensor shall be a Rain Bird Surkit. The flow sensor shall be Rain Bird Model FS series (appropriately sized based on flow).
- J. A Transmitter shall be installed with the satellite controller. The Transmitter shall be a Rain Bird PT322, capable of receiving input signals from any Rain Bird, non-magnetic Impeller Flow Sensor.
- K. The Pulse Decoder shall be Rain Bird Model #M51200. The Decoder shall be capable of reading pulses from monitoring devices and sends the information to the control system for analysis and action. Pulse Decoder will be installed in the controller.
- L. The control system must be installed by a company whose on-site foreman is an employee of the installing company and who has successfully completed both Rain Bird Level two hardware and software classes. The contractor must have successfully

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- installed a minimum of three Maxicom systems within the past three years. Contractor must submit, prior to being awarded the installation contract, three references for such projects including job name, contact person, contact phone number, and a brief description of the project.
- 2.08 METER: Submit product data as required.
- 2.09 BACKFLOW PREVENTER:
- A. To be supplied and installed by the Irrigation Contractor. The backflow preventer shall be a PVB or RP type, as required by code and shall meet or exceed specifications and standards set by the State and USC Foundation for Cross-Connection Control and Hydraulic Research. The Contractor shall check with local authorities for code compliance. The backflow shall be sized as shown on drawings. All exposed standpipe and fittings shall be copper or galvanized pipe to 18" below grade. The backflow preventer shall be installed per local code and manufacturers recommendations. Backflow preventer assembly must include (2) gate valves for isolating unit, and two (2) ball valve test cocks for testing unit to ensure proper operation.
- 2.10 VALVE BOXES
- A. Control Valves and Quick Coupling Valves shall be Rain Bird VB-10RND or VB-STD for multiple valves.
- B. Valve box body and black lid shall be composed of 100% recycled HDPE. There shall be no pre-punched hole in the valve box lid. The standard rectangular body shall have 14 knock-outs molded into the sides that can be readily removed. The valve box shall have corrugated sides for lateral strength. Lids shall have beveled edges to minimize potential damage from lawn equipment. Lids shall be clearly marked with the words "Irrigation Control Valve" molded onto the top. Lids shall have a marking area measuring 6.0" by 2.0" suitable for branding or other identification. The locking bolt, washer and clip shall be made of stainless steel. The valve box shall be manufactured by Rain Bird Corporation, Tucson, AZ.
- 2.11 SLEEVES: Schedule 40 PVC Pipe Type II20 or 1220 coordinate with and installed by the General Contractor.
- 2.12 QUICK COUPLING VALVES:
- A. Quick Coupling Valves (QCVs) will be used for manual access to the pressurized main line so that a hose can be attached and used for hand watering. QCVs shall be constructed of brass with a spring loaded seal that will keep the valve in a closed position until the key is inserted into the valve.
- B. Two-piece body design for easy servicing (models 33-DRC, 44-LRC, 44-RC, 33-DNP, and 44-NP).QCVs shall be installed on a triple elbow swing joint.
- C. Irrigation Contractor to contact Landscape & Natural Resources Representative to determine hose type. Key and swivel shall both be constructed of brass.
- D. Shall be manufactured by Rain Bird Corporation, Tucson, AZ.
- 2.13 CONTROL VALVES:
- A. Remote Control Zone or Master Valve model shall be PEBSB-R series control valve with a nylon scrubber to prevent debris build-up and clogging on non-potable water sources. The valve shall be normally closed globe pattern design, normally closed, 24 VAC 50/60 cycle solenoid actuated globe design. The valve shall have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electronically energizing the solenoid. A brass flow control stem shall provide accurate manual regulation and/or shut off of outlet flow. The valve shall be slow closing to

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prevent water hammer and subsequent system damage. Operating flow rate shall be .25 to 200 gpm. Operating pressure range of 20 to 200 psi. Shall be manufactured by Rain Bird Corporation, Azusa, California.

2.14 SURGE PROTECTION EQUIPMENT

- A. Provide General Electric Lightning Arrestor No. GL 15 CC B 007 for controllers not equipped with primary surge protection.
- B. Irrigation Contractor is responsible for determining whether the above mentioned surge protection equipment is provided in the controller as a "built - in" unit or if it must be supplied and installed separately.

2.15 ISOLATION VALVES

- A. Provide all gate valves for isolation purposes, allowing full diameter opening when in full open position. Gate valves are to be 100% American Made.
- B. Manually operated valves shall be the same size as the line.
- C. Valves three (3) inches or smaller shall be brass construction, threaded, and rated for two hundred (200) psi WOG.
- D. Valves four (4) inches or larger shall be cast iron fitted with a rubber ring, slab - type gasket.

PART 3 - EXECUTION

3.01 GENERAL

- A. Supervision: Provide a full - time superintendent and necessary assistants on the job while Work is in progress. Irrigation contracting firm shall have a C.I.C. (certified irrigation contractor) on site at all times and must be an employee of said irrigation contracting company. The Superintendent represents the Irrigation Contractor in all functions, and directives given to him by the Landscape & Natural Resources Representative, Landscape Architect, General Construction Contractor, and / or Landscape Contractor are binding as if given to the Irrigation Contractor in person.
- B. Inspection of Work in progress: During installation the Landscape & Natural Resources Representative or the Landscape Architect may review and observe the Work on a regular or random basis, and may reject any work and / or materials that do not meet the requirements of the Contract Documents. Rejected Work must be promptly corrected. No time extension will be allowed replacement or repair of rejected work.

3.02 REVIEW IN ADVANCE OF CONSTRUCTION: The Irrigation Contractor shall review the Project Site prior to start of Work to determine that all site conditions are acceptable for Irrigation Work to begin. Inform the Landscape & Natural Resources Representative and the Landscape Architect of any and all unsuitable conditions. Do not proceed with installation of irrigation system until unsatisfactory conditions have been corrected in an acceptable manner.

3.03 PREPARATION: Flag all existing underground utilities prior to trenching and / or boring operations. Obtain locations of any new utilities from the Landscape & Natural Resources Representative and / or the General Contractor. Irrigation Contractor is solely responsible for contacting the utility locating service(s) and Landscape & Natural Resources Representative (with 48 hours minimum notification) and locating on - site utilities in advance of installation.

3.04 SLEEVING (by General Contractor)

- A. Location of sleeving shall be coordinated with the General Construction Contractor. Make adjustments necessary to accommodate existing vegetation, utilities, and other

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existing conditions.

- B. Repair of damage to existing utilities, structures or other construction resulting from installation of sleeves is the responsibility of the Contractor installing the sleeving.

3.05 PIPE

A. Pipe joints

- 1. Follow Manufacturer's recommendations and use pipe and bell from the same manufacturer. Pipes two and one - half (2 1/2) inches and smaller use solvent weld system. Pipes three (3) inches and larger use approved compression type push on joints.

- B. Solvent weld PVC Pipe, assemble according to Manufacturer's recommendations, using appropriate PVC pipe cleaner/primer and solvent cement.

C. Pipes and Fittings

- 1. Install according to Manufacturer's recommendations including snaking in of PVC pipe to prevent excessive strain when contracting in cold weather.
- 2. A single strand of 14-1 wire, yellow in color, shall be run with all main line from the point of connection to the end of the main line. This single stand of wire shall be available for main line tracking.
- 3. Solvent weld fittings shall conform to Schedule 40 or Schedule 80 PVC dimensions and specifications for solvent weld fittings.

D. Lateral Lines and Risers

- 1. Install according to Manufacturer's recommendations using standard techniques.
- 2. Install risers such that no excessive movement occurs while sprinkler head is in operation. Height of risers to be in accordance with planned and existing plant material. Height of all risers is subject to approval of Landscape Architect.
- 3. Plug lines immediately upon installation to minimize infiltration of foreign matter.
- 4. Flush lateral lines and risers prior to installation of sprinkler heads.
- 5. Above ground risers shall match existing on site.

- E. Concrete thrust blocks shall be installed at all gasketed tees, elbows, valves, and reducers. Concrete for thrust blocks shall be 2,800 psi at 28 days. Expose for inspection.

3.06 TRENCHING

- A. All mainline to be installed in separate trenching process from lateral lines.

- B. The initial backfill will always be placed by hand and shoveled in evenly along both sides of the pipe and hand tamped into place. Care will be exercised to insure that soil does not bridge and final to go under the pipe. The soil in the trench shall be backfilled to the point of the same condition of the density of the surrounding soil.

- C. In backfilling trenches, the addition of water should be limited to achieving optimum moisture content for tamping procedures. The contractor shall not crown the backfill on the trench area with the thought that it will eventually settle; this will not be accepted as a finished job. All excess materials shall be removed from the site in a satisfactory manner.

- D. During the entire prosecution of the work, the Contractor will be responsible for all open excavations and as a means of protection, shall keep such protective devices buried at proper intervals along the excavation to protect the public from injury.

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- E. Trenching and excavation in newly sodded areas: Prior to trenching and excavation remove sod, preserve, and replace after backfilling is completed.
- F. Trenching and excavation in established grass or newly seeded areas: After trenching, excavation and backfilling is completed, re-grade trenched area consistent with surrounding area and sod with matching existing grass.
- G. Trenching and excavation through existing asphalt or concrete: Cutting, removal and replacement of asphalt or concrete is the responsibility of the Irrigation Contractor.
- H. Trenching and excavation near existing trees: Irrigation Contractor shall paint the proposed trenching or excavation which occurs within the "drip line" or within fifty (50) feet of the trunks of the existing trees, whichever is greater. Irrigation Contractor must contact the Landscape & Natural Resources Representative for review of the proposed trenching and excavation lines prior to proceeding with the work. Landscape & Natural Resources Representative may adjust proposed trenching and excavation lines in order to avoid damage to tree root systems and other plants. Such adjustments shall be made by the Irrigation Contractor at no additional cost to the Owner.
- I. BACKFILLING
 - 1. Backfill material shall be free from rocks, large stones, and other unsuitable material which could damage pipe or create settling problems. Backfill in six (6) lifts and tamp after each lift to prevent excessive settling.
 - 2. Backfill trenches with plastic pipe when pipe is cool to avoid excessive contraction in cold weather. Backfilling during summer season or on other warm days may be done in the early morning hours, or pipe may be water cooled prior to backfilling.
 - 3. Minimum depth of cover of pipe is as follows: Mainline 18"-36", Lateral lines 12".

3.07 SPRINKLER HEADS

- A. Sprinklers with a 1" and larger bottom inlet shall be installed on Rain Bird swing joints, minimum 4"-6" off inside edge of curbs, drives and sidewalks. Sprinkler with a 3/4" and smaller inlet may be installed using flexible swing joints. Consistency in placement must be maintained throughout the project in all cases.
- B. Low Pop up Sprinkler Heads: Install in such manner that top is flush with finish grade. Where finish grade has not been established extend riser a minimum of twelve (12) inches above existing grade to mark location of head. After finish grade is established install heads at specified height.
- C. High Pop up Shrub Heads: Finish height to be proposed by Irrigation Contractor as a function of plants specified on landscape plans and noted on irrigation design submittal.
- D. Backfill around sprinkler head assembly in such manner as to stabilize the sprinkler head so that no lateral motion occurs during operation.
- E. Sprinkler heads on risers: Utilize a schedule 80 T.O.E. nipple. If greater than 24" height is required, provide fitting in the ground with a solvent weld 90 degree elbow with the appropriate length of pipe glued to it and coming out of the ground to the desired height. Glue male adapter to the riser to allow for the connection of the sprinkler head. Stabilize riser by fastening it to rebar as required. Height of all heads in bed areas to be proposed by Irrigation Contractor as a function of plants specified on landscape plans.

3.08 ELECTRIC CONTROL WIRES

- A. Install control wires in orderly fashion, locate in main line trench. Bundle wires together and tape at ten (10) foot intervals. Position wires to the right of the water supply line in the direction of the water flow.

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- B. Provide looped slack at directional changes in supply line to allow for contraction of wires.
 - C. Keep wire splices to a minimum and provide ten (10) inch round valve box at each splice location.
 - D. Pass wires under existing or future paving, construction, etc., through PVC sleeves provided by General Contractor.
 - E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 - F. Ground electric-powered satellites controllers, valves, and devices.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
 - G. Arrange for electric-power connections to satellites controllers, control valves, and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.
- 3.09 CONTROL EQUIPMENT: All automatic valves and satellites shall be installed following the recommendations of the manufacturer of said equipment and in accordance with any detailed drawings which may accompany these specifications as part of the Contract Documents. Location of satellites and CCU's shall be approved by the Landscape & Natural Resources Representative and the Landscape Architect prior to installation.
- 3.10 VALVE BOXES: All valves are to be housed in valve boxes. Install according to Manufacturer's recommendations and any detailed drawings which may accompany these specifications as part of the Contract Documents. Position boxes at a height where they will not interfere with maintenance machinery (e.g., mowers) and such that soil and mulch do not wash into the box. In essence, valve boxes to be installed flush with grade.
- 3.11 BACKFLOW PREVENTER: Installation in accordance with manufacturer's recommendations and all federal, state and local codes.
- 3.12 BALANCING AND ADJUSTMENT: Balance and adjust the various components of the sprinkler system so that the overall operation of the system is most efficient. This includes synchronization of the satellites, adjustments to pressure regulators, part circle sprinkler heads, and individual station adjustments on the satellites. The Irrigation Contractor may call in the Landscape Architect to aid in the balancing and adjustment of the system.
- 3.13 OPERATION TESTING: Upon completion of the irrigation system, and after head installation, test the entire system for proper operation. Flush all air from the system and check components for proper operation.
- 3.14 AS - BUILT DRAWINGS: As - Built Drawings shall include locations of all valves (automatic and manual), with triangulated measurements to each location, as well as any deviations in location of piping and heads as represented by the irrigation design submittal. All changes shall be shown in RED.
- 3.15 OWNER ORIENTATION
- A. Upon completion of the Work and final acceptance by the Landscape & Natural Resources Representative and the Landscape Architect, the Irrigation Contractor shall be responsible for the orientation of maintenance personnel in the operation, maintenance, and repair of the system. Furnish copies of all available parts lists, trouble

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shooting lists, instruction sheets, and specification sheets to the Landscape & Natural Resources Representative prior to final payment.

- B. Set initial watering schedules and programming of the automatic controller(s). Changes in the schedules and programming and instruction on how to make such changes is the responsibility of the Landscape Contractor.
- C. Provide a program and zoning chart: For each irrigation zone, list the following items in an Excel spreadsheet.
 - 1. Zone number.
 - 2. Remote control valve size.
 - 3. Feed pipe size.
 - 4. Sprinkler complement: quantity, model, nozzle number
 - 5. Design pressure.
 - 6. Design flow.
 - 7. Coverage arc of sprinklers.
 - 8. Precipitation rate, inches per hour.
 - 9. Runtime required for applying appropriate plant water needs for each zone.
- D. Provide a written description and schedule of annual maintenance requirements to the Landscape & Natural Resources Representative at the final inspection.

3.16 FLUSHING SYSTEM

- A. Flush the system completely after any repairs are made and monitor system operation closely under regular system flushing schedule.
- B. Check the pressure at the supply prior to installation and compare with the pressure readings taken after installation.
- C. Subject installed piping to water pressure equal to specified operating pressure for ten (10) minutes. Test with control zone components installed.
- D. Partially backfill buried pipe to prevent movement under pressure. Expose couplings, fittings, and valve components.
- E. Visually inspect valve assemblies and fittings for leakage and replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until test segment is free from leaks. Cement or caulking to seal leaks is prohibited.

3.17 CLEAN UP AND PROTECTION

- A. During irrigation Work keep Project Site clean and orderly.
- B. Upon completion of Work clear grounds of debris, superfluous materials and all equipment. Remove from site to the satisfaction of the Landscape & Natural Resources's Representative and the Landscape Architect.
- C. Protect Irrigation Work and materials from damage due to irrigation operations, operations by other contractors and trades, and trespassers. Maintain protection until Date of Substantial Completion.
- D. Cover all openings in the system as it is being installed to prevent obstructions in the pipe and the breakage, misuse, or disfigurement of the equipment.
- E. Theft: Irrigation Contractor shall be responsible for theft of equipment and material at the job site before, during, and after installation, until Date of Substantial Completion of the

Work in total.

3.18 COMMISSIONING

- A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturers, proceed as follows:
 - 1. Verify that specialty valves and their accessories are installed and operate correctly.
 - 2. Verify that specified tests of piping are complete.
 - 3. Verify that sprinklers and devices are correct type.
 - 4. Verify that damaged sprinklers and devices are replaced with new materials.
 - 5. Verify that potable-water supply connections have backflow preventers.
 - 6. Energize circuits to electrical equipment and devices.
 - 7. Adjust operating controls.
- B. Operational Tests: Measure and record water flow rate and area coverage at each sprinkler. Adjust to achieve indicated values.

3.19 INSPECTION, ACCEPTANCE, RETAINAGE AND PAYMENT

- A. Upon completion of Work, the Contractor shall notify the Landscape & Natural Resources Representative and the Landscape Architect at least ten (10) days prior to requested date of review for Substantial Completion of all portions of the work. Landscape Architect will issue a punch list for work to be corrected. All work on the punch list must be completed within five (5) working days from the date of inspection. Where Irrigation Work does not comply with requirements, replace rejected Work. In unusual circumstances a longer time period may be granted by the Landscape & Natural Resources Representative. If such replacements are not completed within the time specified, the Irrigation Contractor may be considered to be in default of the Contract, and the Landscape & Natural Resources Representative may use the contract retainage to hire other Contractors to finish the Work.
- B. It will be the responsibility of the Irrigation Contractor to provide a reliable communication system (i.e., two way radios or remote radio control activation system) for Substantial Completion and Final Inspections.
- C. If an inspection / acceptance walk-thru has been scheduled and the Landscape Architect arrives at the site and determines that the Irrigation System is not substantially complete (all system components in place, operational, and checked with 100% sprinkler coverage), the Irrigation Contractor shall be responsible for all costs incurred by the Landscape Architect to revisit the site at a future date. Reimbursable expenses include, but are not limited to, automobile mileage, airfare, landscape architect's hourly billing rate, parking fee, meals, rental car, etc. All incurred expenses will be deducted from the final contract amount or the contract retainage.
- D. Certificate of Substantial Completion will be issued for satisfactory completion of repairs and replacements and completion of As-Built Drawings. If punch list items are issued with the Certificate, they must be corrected within five (5) working days.
- E. Final Acceptance: One year after Date of Substantial Completion of the Work, the Landscape & Natural Resources Representative and the Landscape Architect will review the Work for Final Acceptance. Upon satisfactory completion of repairs and/or replacements the Landscape Architect will certify, in writing, Final Acceptance of the Work. The Final Acceptance Certification issued by the Landscape Architect will serve as evidence that Contractor's one (1) year warranty obligations have been met.

END OF SECTION