

SECTION 02486 – IRRIGATION

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SECTION 02486 – IRRIGATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work includes installation of a complete automatic irrigation system, including excavation for points of connection, trenching, piping, equipment, electrical components, maintenance of the system, and incidentals related thereto.

1.02 RELATED REQUIREMENTS

- A. Section 02480, "*Landscape Soil Preparation*"
- B. Section 02499, "*Landscape Maintenance*"

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)

1.04 QUALITY ASSURANCE

- A. Reviews.
 - 1. Contractor shall specifically request the following reviews be made by the Engineer prior to progressing with the work:
 - a. Layout of system; Proposed layout of irrigation system before installation and installed system prior to burial;
 - b. Points of connection excavation;
 - c. Coverage adjustment of all heads, valve boxes
 - d. Operation of system.

1.05 MEASUREMENT AND PAYMENT

- A. The furnishing and metalling of the specified irrigation system, which shall include the installation of a complete automatic sprinkler or subsurface watering system, or both; trenching, piping, electrical components, backflow preventers, irrigation controllers, pressure reducer, connection to water meter, and tie-in shall be measured and paid as a Lump Sum Price, unless otherwise indicated to be paid for as individual items in the Special Provisions and the Bid Schedule.

- B. The specified payment will include full compensation for furnishing all labor, materials, tools, equipment, and other incidentals, complete in place and in operation, for installing the irrigation system as shown on the Plans and specified in these specifications and Special Provisions, and as directed by the Engineer.

PART 2 - PRODUCTS

2.01 PIPES AND FITTINGS

- A. Copper Pipe: Copper pipe shall be standard size and weight, drawn type, type K, complying with the requirements of ASTM B 88, "*Seamless Copper Water Tube.*" Copper pipe shall be jointed with copper sweat fittings.
- B. Steel Pipe: Steel pipe shall be galvanized, standard weight (Schedule 40) complying with the requirements of ASTM A 120, "*Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, For Ordinary Uses.*" Steel pipe shall be jointed with galvanized, threaded, standard weight, malleable iron fittings and couplings.
- C. Plastic Pipe For Use With Solvent Weld Socket or Threaded Fittings: Plastic pipe shall be rigid unplasticized polyvinyl chloride (PVC) 1220, Type 1, Grade 2, conforming to ASTM D 1785, "*Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.*" Plastic pipe marked with Product Standard PS 21-70 conforms to ASTM requirements.
 - 1. Schedule 40 pipe shall be used for installation on the discharge side of control valves, and Schedule 80 shall be used for continuously pressurized pipe on the supply side of control valves.
 - 2. Schedule 80 only shall be supplied when threaded joints are specified or otherwise permitted by the Engineer.
 - 3. Schedule 40 socket fittings shall conform to ASTM D 2466, "Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40". Schedule 80 threaded fittings shall conform to ASTM D 2464, "Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40".
- D. Plastic Pipe for Use With Rubber Gaskets: Plastic pipe for use with rubber ring gaskets shall be rigid unplasticized polyvinyl chloride (PVC) 1120, Type 1, Grade 1, manufactured in accordance with ASTM D 2241, "*Bell-End Poly (Vinyl Chloride) (PVC) Pipe*". Pipe shall be supplied with plain ends or with an integral thickened expanded bell with rubber ring groove. Rubber ring gaskets shall be of a synthetic rubber supplied in accordance with the requirements of ASTM D 1869, "*Rubber Rings For Asbestos Cement Pipe*". Pipe shall be furnished in the following Standard Dimension Ratios (SDR) and Pressure Ratings:

160 psi -- SDR 26
200 psi -- SDR 21

- E. Polyvinyl Chloride Plastic Pressure Class Water Main for Distribution of Reclaimed Water to Irrigation Systems: Pipe shall be provided with gasketed integral bell and spigot joints meeting the requirements of AWWA C900 and ASTM F477. Size and pressure class shall be as specified, and shall meet the following requirements:

<u>Class</u>	<u>DR</u>
100	25
150	18
200	14

Pipe and all fittings shall be integrally colored purple to designate reclaimed water.

- F. Plastic Pipe for Dripline Subsurface Irrigation Systems:

1. Main Line - Pipe shall be Class 200 PVC, SDR21 in conformance with Article 2.01D of this Section with gasketed joints in accordance with ASTM D3139.
2. Lateral Lines - Pipe shall be Schedule 40 PVC with solvent weld, threaded or gasketed joints in conformance with Article 2.01D of this Section and, as applicable, ASTM D2672, D2464 or D3139.
3. Fittings - all connections shall be made with barb or compression type fittings.
4. All pipe and fittings shall meet toxological, chemical, taste, and odor requirements of NSF Standard No. 14.

- G. Dripline Tubing with Emitters (Drippers) for Subsurface Irrigation System:

Dripline tubing and emitters shall be extruded from linear low-density polyethylene. Unless otherwise specified, tubing shall have a minimum nominal diameter of 1/2" (0.52" ID X 0.62" O.D.) with a minimum wall thickness of 0.050". Protection against root intrusion shall be provided by means of replaceable non-toxic pre-emergent chemical incorporated into a disc-type filter installed at each landscape zone station. As specified, emitters shall be spaced at either 12", 18", or 24" intervals.

- H. Subsurface Irrigation System Accessories. All accessories listed below shall be furnished by the manufacturer of the dripline tubing:

1. Line Flushing Valves - the subsurface irrigation system shall utilize automatic line flush valves at the end of each independent zone area. This valve shall be capable of flushing one (1) gallon at the beginning of each irrigation cycle. The valves shall connect directly to the dripline.

2. Air/Vacuum Relief Valve - each independent irrigation zone shall utilize an air/vacuum relief valve at its high point(s). The purpose of this valve is to evacuate air from the zone at start up and to relieve vacuum at system shut down. The air and vacuum relief valve shall seal effectively from 2 to 10 pounds per square inch (psi).
3. Pressure Regulators - the pressure regulator shall be designed to handle steady inlet pressures over 150 pounds per square inch (psi) and maintain a constant outlet pressure of 20 pounds per square inch (psi). Regulating accuracy shall be within $\pm 6\%$. The pressure regulator shall be manufactured from high impact engineering grade thermoplastics. Regulation shall be accomplished by a fixed stainless steel compression spring, which shall be enclosed in a chamber separate from the water passage.
4. Filters - the filter shall be a multiple disc type filter with notation indicating the minimum partial size to travel through or the mesh size of the element being used. The disc shall be constructed of chemical resistant thermoplastic for corrosion resistance. Filter size shall be as specified.
5. Remote Control Valves - each valve shall be a 24 VAC 50/60-cycle solenoid valve with an in-rush of 0.35 amps and holding current of 0.23 amps with stainless steel flow control, threaded or slip parts and manual operator.

2.02 CONTROL WIRE

- A. Type UF, 600 v. insulation, minimum size #14, copper, common ground white, U.L. approved for irrigation control use. Splices shall be "Scotch-Lok" seal pack or equal, with wire nuts enclosed in a socket seal type wire connection with waterproof sealer.

2.03 PULL BOXES

- A. Pull box shall be a Christy N-16, or approved equal, with type "D" lid marked "Sprinkler-Control".

2.04 VALVE BOXES

- A. Each valve shall be equipped with a valve box complete with cover. Concrete boxes shall be the extension type with a slide adjustment. The word "WATER" shall be inscribed on the cover. Christy #G-5 valve box shall be used in streets, and #F-22 curb valve box in other locations.
- B. Sunlight and weather resistant plastic boxes of approved type and size will be allowed in lieu of concrete boxes.

2.05 VALVES

- A. Valves shall be of the size, type, and capacity designated on the Plan. All valves shall be capable of satisfactory performance at a working pressure of 200 psig.
1. Gate Valves: Gate valves in sizes two inches (2") and smaller shall be Mueller, or approved equal, and shall have all bronze double disc wedge type with integral taper seats and non-rising stem. Sizes two and one-half inches (2-½") and larger shall be iron body brass trimmed, with other features the same as for 2".
 2. Manual Control Valves: Manual control valves shall be brass or bronze Stockham, or approved equal, and shall be straight or angle pattern globe valves, full opening, key operated with replaceable compression disc and ground joint union on the discharge end.
 3. Remote Control Valves: Remote control valves shall be Rainbird Model 100-DV/SS, or approved equal, electrically or hydraulically operated. They shall be constructed of bronze or stainless steel and corrosion resistant components, equipped with flow control, adjustment and capability for manual operation. Each valve shall have an attached brass identification tag indicating assigned controller and irrigation station.
 4. Garden Valves: Garden valves shall be brass or bronze except for the handle. They shall have a replaceable compression disc, and shall be three-fourth inch (¾") straight-nosed, key operated and pressure rated for operation at 150 psi.
 5. Quick-Coupling Valves and Assemblies: Quick-coupling valves shall be No. 44, brass or bronze with built-in flow control self closing valve and rubber lid locking cap supplied with one-inch (1") threaded inlet; unless otherwise noted.
 6. Check valves: In-line check valves shall be Toro 570 CV.
 7. Pressure Regulator: Pressure regulators shall be Mueller, or approved equal, bronze body with full seat opening, completely assembled with strainer.
 8. Quick Coupling Valves: quick coupling valves with locking caps shall be Rainbird Model 3RC/44LRC, or approved equal for potable water or Rainbird Model 3RC/44LNP, or approved equal, for non-potable water usage.

2.06 BACKFLOW PREVENTER ASSEMBLY

- A. The backflow preventer assembly shall consist of a backflow preventer unit and related components approved by San Mateo County Department of Environmental Health, as manufactured by FEBCO, P. O. Box 8070, Fresno, California 93747, Telephone No. (209) 252-0791, or approved equal.

2.07 BACKFLOW PREVENTER ENCLOSURE

- A. Enclosure shall be two-piece expanded metal with provision for padlocking, as manufactured by LE MEUR of Fontana, CA 92336, or approved equal.

2.08 SPRINKLER EQUIPMENT

- A. Sprinkler heads, bubbler heads, and spray nozzles shall be Rainbird, or approved equal, of the types and sizes shown on the Plans. Equipment of one type and flow characteristic shall be from the same manufacturer, and all equipment shall bear the manufacturer's name and identification code.
- B. Fixed head sprinklers shall have a one-piece housing with provision for interior parts replacement. Pop-up sprinklers shall be designed to rise at least three inches (3") during operation. Full or part circle sprinklers shall be interchangeable in the same housing.
- C. Shrubbery and bubbler heads shall be adjustable from full flow to shut off.
- D. All sprinkler heads shall be set at finished grade and installed on a double swing joint utilizing a nipple 8" long, minimum as shown on applicable *Standard Drawings*.

2.09 CONTROLLER UNIT

- A. The type of control unit shall be as called for on the Plans. It shall be fully automatic with provisions for manual operation, sized to accommodate the number of stations or control valves included in the system. Outdoor models shall be housed in a vandal-proof and weather-proof enclosure with locking cover.
- B. Contractor shall clearly label and sequence stations for ease of operation and maintenance. Valves shall be stationed to operate, as they are located around the site. Contractor shall complete all forms and labels shipped with or attached to the controller, and shall submit properly executed guarantees of valves and controllers to the City.

2.10 MATERIALS UTILIZING RECLAIMED WATER

- A. All pipe, box lids, and accessories that utilize reclaimed water shall be furnished with an impregnated purple coloring.

PART 3 - EXECUTION

3.01 GRADING

- A. Contractor shall be responsible for installing all irrigation features to their finished grade and at depths indicated. All rough grading and/or finish grading shall be completed and/or accommodated before trenching commences.

3.02 LAYOUT AND TRENCHING

- A. All features of the irrigation system shall be staked and pipe alignments marked prior to trenching, for approval by the Engineer. Unless otherwise shown as specified, trenching for irrigation lines shall be in accordance with Section 20-5.03D, "*Trenching and Backfilling*", of the *State Specifications*.
- B. For layout of subsurface "dripline" irrigation systems, see specific project specifications and drawings and applicable City Standard Drawings.

3.03 BACKFILLING

- A. No joints shall be covered until system installation has been inspected and approved by the Engineer. Unless other shown or specified, backfilling shall be in accordance with Section 20-5.03D, "*Trenching and Backfilling*", of the *State Specifications*.

3.04 FABRICATION

- A. All manifolds shall be neat, orderly, and constructed for ease in maintenance operations. Construct manifolds so that valve boxes shall be parallel to each other and to adjacent walls, walks, curbs and buildings. Cuts and joints shall be minimized, and shall be smooth and free of burrs.

3.05 PIPELINES

- A. All irrigation pipelines shown parallel on the drawing may be installed in a common trench. Where pipelines are shown parallel or adjacent to shrub or ground cover areas, they shall be installed in these areas. Where shown parallel or adjacent to lawn areas versus pavement, they shall be installed in the lawn area. All changes in depth of pipe shall be accomplished using forty-five (45°) fittings.
 - 1. Plastic (PVC) Pipe for Irrigation Systems

- a. Plastic pipe shall be jointed by socket type solvent welded fittings, threaded fittings or rubber ring fittings. When plastic pipe is joined to steel pipe, steel pipe shall be installed first. Solvent welded joints shall be made in accordance with ASTM D 2855, *"Recommended Practice For Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings."* The solvent recommended by manufacturer shall be used. Threaded pipe joints shall be made using teflon tape or other approved jointing material.
 - b. For all pipes utilizing socket fittings, pipe and fittings shall be sanded before solvent welding.
 - c. Snake plastic pipe from side to side when trench length exceeds thirty feet.
2. Pressure Class PVC Water Main for Distribution of Reclaimed Water to Irrigation Systems
 - a. Pipe shall be installed in accordance with applicable requirements of Section 02710 for potable water mains.
3. Brass Pipe
 - a. Brass pipe shall be joined to galvanized iron or cast iron pipe with a dielectric pipe union.
4. Steel Pipe
 - a. Threaded pipe joints shall be made using teflon tape, pipe dope or other approved jointing material.

3.06 INSTALLATION OF VALVES AND VALVE BOXES

- A. Valves, pressure regulators, and boxes shall be installed in normal upright position, unless otherwise recommended by manufacturer, and shall be readily accessible for operation, maintenance, and replacement.
- B. In-line check valves shall be installed on all sprinkler and bubbler heads below the highest head at all sloped grades.

3.07 SPRINKLER HEADS

- A. Sprinkler head spacing shall not exceed the maximum shown on the Plans. Sprinkler heads shall be installed no more than four inches (4") from adjacent vertical elements projecting above grade, such as walls, planter boxes, curbs and fences. Shrub heads, bubbler heads, and oscillating sprinklers shall have operating height of at least six inches (6") above finish grade.

- B. Adjust all heads for arc, radius, riser height, and distribution, for uniform and optimum coverage. Such adjustments shall include nozzle changes without additional cost to the City.

3.08 CONTROL WIRE

- A. Install control wire in pipe trenches wherever practical. All control wires shall be enclosed in PVC conduits. Control wires shall be color-coded using white as the common ground. No splices shall be allowed except at pull boxes. A slack of twenty-four inches (24") shall be provided at pull boxes. All splices shall have approved waterproof connector, prefill dry fill splice connector DS-400 by Spears, or approved equal.

3.09 PULL BOXES

- A. Pull boxes shall be installed every one hundred fifty feet (150') of straight run, and at every change of direction which exceeds forty-five degrees (45°) deflection.

3.10 BACKFLOW PREVENTERS

- A. Backflow preventers shall be provided with pipe supports and the accessories necessary to properly secure the assembly. All backflow preventers shall be assembled with pipe and fittings of galvanized steel as per *Standard Drawing* details.

3.11 CONTROLLER

- A. Contractor shall clearly label and sequence stations for ease in maintenance operations. Station valves to operate, as they are located around the site. Fasten controller and wire conduits securely to walls or other structures with conduit clamps and screws.
- B. Contractor shall complete all forms and labels shipped with and/or attached to the controller; attached his own name, address and phone number to the controller via a permanent label; and shall properly execute and file with the City the controller and valve guarantees.

3.12 RECORD DRAWINGS

- A. As record drawings, the Contractor shall submit as-built plans of the irrigation system. Features below ground shall be indicated with at least three measurements from surface features such as walks, building, or sprinkler heads. All changes shall be recorded on this plan before trenches are backfilled. The record drawings (as-built plans) shall be completed and submitted to the City before final payment will be made for work installed.

3.13 FLUSHING AND TESTING

A. After completion and prior to the installation of terminal fittings, the entire pipeline system shall be thoroughly flushed. After flushing, the following tests shall be conducted:

1. Pipeline Pressure Test for Irrigation System.

- a. A water pressure test shall be performed on all pressure mains and laterals before any couplings, fittings, valves and the like are concealed. All open ends shall be capped after the water is turned into the line in such manner as all air in the system is expelled. Pressure mains shall be tested with all control valves to lateral lines closed. After the pressure main test, all valves shall be opened to test lateral lines. Test pressure and duration shall be as follows:

Mains - 4 hours at 125 psi

Laterals - 2 hours at 100 psi

2. Pressure Test for Pressure Class PVC Water Mains for Distribution of Reclaimed Water to Irrigation Systems.

- a. Pipe shall be hydrostatically tested in accordance with applicable requirements of Section 02710 for potable water mains.

3. Operational Test.

- a. The performance of all components of the automatic control system shall be evaluated for manual and automatic operation. During the maintenance period, and at least fifteen (15) working days prior to final inspection, the Contractor shall set the controller on automatic operation and the system shall operate satisfactorily during such period. All necessary repairs, replacements, and adjustments shall be made until all equipment, electrical work, controls and instrumentation are functioning in accordance with the contract documents, at no additional cost to the City.

4. Backflow unit shall be tested after installation by a person authorized or certified by the San Mateo Department of Environmental Health. Testing or retesting required due to construction problems shall be required at no additional expense to the City.

End of Section