



**CITY OF SAN RAMON**  
**IRRIGATION SYSTEM SPECIFICATIONS**

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IRRIGATION SYSTEM SPECIFICATION  
SECTION 328000**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

The General Conditions of the Contract, including General and Special Provisions, and General Requirements apply to the work in this Section.

**1.02 DESCRIPTION:**

A. Work Included:

Order and furnish all labor, materials, supplies, tools and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the automatic sprinkler irrigation systems as shown on the Drawings. The work includes, but is not limited to:

1. Verification of locations and operability of existing service points of connection, sleeving, and irrigation systems along southern interface;
2. Automatic irrigation system including piping, fittings, sprinkler heads, bubblers, and accessories;
3. Valves, backflow preventers, flow meters;
4. Coordination with City for communications to controller locations;
5. Controllers, control wiring, ET gauge, and central communications locations;
6. Testing;
7. Excavation and backfilling irrigation system work;
8. Sleeving and conduit;
9. Record Drawings; and
10. One (1) year guarantee.

B. Related Work:

1. Earthwork and Site Grading
2. Planting
3. Electrical (Electrical stub-outs for irrigation controllers)

### **1.03 GENERAL REQUIREMENTS:**

#### **A. OSHA Compliance:**

All articles and services covered by this Specification shall meet or exceed the safety standards established under the Federal Occupational Safety and Health Act of 1970, together with all amendments in effect as of the date of this Specification.

#### **B. Codes and Standards: Comply with all applicable codes and standards.**

1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code, published by the Western Plumbing Officials Association; and other applicable State or local laws or regulations. Nothing in the Drawings or Specifications is to be construed to permit work not conforming to these codes.
2. When the Specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the Specifications shall take precedence over the requirements of the said rules and regulations.
3. Furnish, without any additional cost to the City, any additional material and labor required to comply with these rules and regulations. The Contractor shall do the work even if it is not mentioned in this Section, or shown on the Drawings, in order to comply with all applicable codes.
4. Erect and maintain barricades, guards, warning signs, and lights as required by the owner or required by OSHA regulations for the protection of the public or workmen. All lane closures shall be in accordance with CalTrans traffic control.
5. Repair or replace at no additional cost to the City, any damage to existing utilities, buildings, equipment, irrigation, piping, pipe covering, sewers, sidewalks, paving surfaces, structures, or landscaping, caused by work of this Section. Repair or replace in a manner satisfactory to the City.

### **1.04 QUALITY ASSURANCE:**

Provide evidence to the City that skilled and experienced foreman and workmen will be employed on the job from beginning to end. The foreman shall be English-speaking and shall have full authority to act on behalf of the Contractor.

### **1.05 LAYOUT OF WORK:**

- #### **A.**
- Stake out the irrigation system as shown on the approved Drawings. Obtain approval from the City before starting work. Such approval does not relieve the Contractor of the responsibility to comply with the Drawings and Specifications.

1. For purposes of clarity and legibility, Drawings are diagrammatic to the extent that many offsets, bends, unions, special fittings, and exact locations of items are not indicated, unless specifically dimensioned. Wherever possible, install piping in planting areas. Drawings may show piping under paving for clarity.
2. Exact routing of piping, etc., shall be governed by structural conditions and obstructions.
3. Irrigation Demand: See notes on Drawings at individual points of connection for volume (GPM) and pressure (PSI) requirements for each point of connection.
4. The Contractor shall not willfully install the irrigation system as shown on the Drawings when it is obvious in the field that unknown obstructions, grade difference or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences shall be brought to the attention of the City and Project Manager. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.
5. The Contractor shall coordinate installation of the irrigation system with layout and installation of the plant materials to ensure that there will be complete and uniform irrigation coverage of planting in accordance with these Drawings and Specifications.
6. During construction of the system, do not vary from the irrigation design of pipe, sprinkler heads or valves without obtaining written approval from the City. Contractor shall submit a written request for change including a clear reason for the variance and obtain approval prior to construction of any modifications. Modifications to the irrigation design layout or system, which are completed without prior approval, are at the risk of the Contractor.

#### **1.06 SUBMITTALS:**

##### **A. Submittals:**

Within 15 working days after Contract is signed, submit six copies of catalogue information on materials which are to be used. No substitution will be permitted without prior written approval by the City. Complete material list shall be submitted and approved prior to performing any work.

##### **B. Record Drawings:**

1. The Contractor shall maintain a complete set of blackline Contract Drawings for the irrigation system. If work is not installed as indicated on the Record Drawings such work shall be corrected at no additional cost to the City.

2. Immediately upon the installation of any buried pipe or equipment, the Contractor shall indicate on the progress Record Drawings the locations of said pipe or equipment. The progress Record Drawings shall be made available at any time for review by the City. If the Record Drawings are not current, progress on the job will stop until the Record Drawings are brought up-to-date.
3. Prior to the end of maintenance period, the Contractor shall provide "As-Built" Record Drawings showing the irrigation system work as built. The drawings shall be provided to the City in mylar format and as an AutoCAD file on compact disk or flash drive. The drawings shall include all information shown on the original Contract Drawings and revised to reflect all changes in the work. The drawings shall include the following additional information:
  - a. All valves shall be numbered by station and corresponding numbers shall be shown on the "As-Built" Record Drawings.
  - b. All main line pipe or irrigation equipment including sleeves, valves, controllers, irrigation wire runs, backflow preventers, remote control valves, grounding rods, shut-off valves, rain sensors, wire splice locations, and quick coupling valves shall be located by two (2) measured dimensions, to the nearest one-half foot. Dimensions shall be given from permanent objects such as buildings, sidewalks, curbs, walls, structures, and driveways. All changes in direction and depth of main line pipe shall be noted exactly as installed. Dimensions for pipes shall be shown at no greater than a 50 ft. maximum interval.
  - c. Record Drawings shall indicate precipitation rate for each irrigation zone and a sample 12-month irrigation schedule based on reference evapotranspiration (ET<sub>o</sub>).
  - d. "As-Built" Record Drawings shall be signed and dated by the Contractor attesting to and certifying the accuracy of the drawings. "As-Built" Record Drawings shall have "As-Built" Record Drawings, company name, address, phone number, name of the person who created the drawing, and the contact name if different.
  - e. Submit progress "As-Built" Record Drawings for City approval prior to final submittal.
4. Landscape architect shall make the original Contract Drawing files available to the Contractor.

C. Controller Charts:

1. Provide three (3) controller charts for each automatic controller installed.
  - a. On the inside of each automatic controller, prepare and mount a color-coded chart showing the valves, main line, and systems

serviced by that particular controller. All valves shall be numbered to match the operation schedule and the drawings. Only those areas controlled by that controller shall be shown. This chart shall be a plot plan, entire or partial, showing building, walks, roads, and walls. The plan, reduced as necessary and legible in all details, shall be made to a size that will fit into the controller cover. This print shall be approved by the City and shall be protected in a laminated, 20-mil plastic cover and be secured to the inside of the controller cabinet.

- b. The controller chart shall be completed and approved prior to acceptance of the work.

D. Operation and Maintenance Manuals:

1. Prior to the end of maintenance period, furnish two (2) individually bound Operation and Maintenance Manuals to the City. The manuals shall contain the following:
  - a. Index sheet indicating the Contractor's name, address, and phone number.
  - b. A copy of the completed guarantee following the form in Section 328000-3.17 "Guarantee".
  - c. Certificate of insurance verifying coverage for completed operations.
  - d. List of all the equipment installed on the project with name(s), address(es) and telephone number(s) of the local manufacturer's representative(s).
  - e. Copies of equipment operation manuals, warranties and certificates.
  - f. Complete operating and maintenance instructions of all equipment including exploded drawings and spare parts list.
  - g. Performance charts for all sprinkler equipment.
  - h. Backflow testing report completed by Contractor's certified tester.
2. Provide instruction in operation of system to City, if necessary.
3. All Calsense equipment to be inspected and certified in writing by authorized Calsense representative, including controller communication with City's central system.

E. Hardware Items:

1. Prior to the end of maintenance period furnish the following hardware items to the City:
  - a. Two (2) sets of matching quick coupling valve keys (brass) and hose swivels.

- b. Two (2) keys to each controller box enclosure.
  - c. Two (2) sets of any special tool(s) required for the maintenance of each type of component installed in the project and provided by the manufacturer when purchased.
  - d. Radio Remote Controlled Transmitter/Receiver for Automatic Controllers:
    - For projects with Calsense ET2000E one (1) radio remote controlled transmitter/receiver pair as specified by the City.
    - For projects with Calsense CS3000 one (1) Apple iPad Air 2 (or most current version 128GB or as specified) with Wi-Fi and cellular connection as specified by the City.
- F. Turn Over Documents:
- 1. In addition to the “Record Drawings”, “Controller Charts”, “Operation and Maintenance Manuals”, and “Hardware Items” listed in this Section, prior to the end of maintenance period furnish the City with the following:
    - a. Current PG&E invoices for irrigation controllers and pumps.
    - b. Current invoices for water meters.
    - c. Current telephone company invoices for irrigation controllers, if applicable.
    - d. Copies of all required building permits.
    - e. Listing of landscape areas including square footage or acreage by type, i.e., groundcover, parkway strips, open space, etc.
    - f. Landscape architect’s construction cost opinion.
    - g. Certificate of Completion in accordance with California Code of Regulations Title 23, Division 2, Department of Water Resources, Chapter 2.7, Model Water Efficient Landscape Ordinance.

## **PART 2 - PRODUCTS**

### **2.01 PIPE AND FITTINGS:**

- A. PVC pipe and fittings:
  - 1. Irrigation main lines (constant pressure) 4-inches and larger shall be polyvinylchloride (PVC-1120) class 200 pipe with gasketed connections; 1/2- to 3-inches shall be PVC-1120 Schedule 40 pipe with solvent-weld connections.
    - a. Join lengths of solvent weld pipe by means of Schedule 40 as approved by Uniform Plumbing Code.

- b. Gasketed Main Line: At changes in direction or branch mains, use appropriate Harco or Leemco ductile iron, deep bell, rubber ring seal fittings as approved by the Uniform Plumbing Code.
    - c. Solvent Weld Main Line: At changes in direction or branch mains, use appropriate Schedule 40 PVC solvent-weld fittings as approved by the Uniform Plumbing Code.
  - 2. Lateral lines (non-pressure) shall be 1120-200 psi PVC plastic pipe with Schedule 40, Type I, Grade I, PVC solvent weld fittings.
  - 3. Connections between main lines and remote controlled valves shall be made with Schedule 80 PVC (threaded both ends) nipples and fittings.
  - 4. Sprinkler risers shall be as follows: Schedule 80 PVC threaded nipples and elbows as shown in Details.
  - 5. Potable water main lines (constant pressure) 1/2-inch to 2-inches shall be PVC-1120 schedule 40 pipe with solvent weld connections.
  - 6. All PVC pipe on recycled water systems shall be purple.
- B. Copper pipe and fittings:
- 1. Copper pipe shall be Type 'K', hard tempered ASTM B88 and fittings shall be wrought solder joint type in accordance with ANSI B16.22.
  - 2. Joints shall be soldered with silver solder, conforming to ASTM B 206.
- C. Brass pipe and fittings:
- 1. Brass pipe shall be 85% red brass, ANSI, Schedule 40 screwed pipe.
  - 2. Fittings shall be medium brass, screwed 125-pound class.
- D. Cast iron flanged pipe and fittings:
- 1. Cast Iron Flanged Piping: Flanged piping shall be made with minimum Class 53 thickness pipe in accordance with AWWA C151: flange shall be screwed on, faced and drilled according to ANSI Specification B16.1. Flanges may be cast on with metal thickness of the body conforming to AWWA Specification C110, at option of the manufacturer.
  - 2. Cast Iron Flanged Fittings: Cast iron fittings shall conform to American Society for Testing and Materials Specification A126 Class B, cast gray iron. Fittings to be Class 125 and manufactured according to ANSI Standard B16.1, finish to be black. Fittings shall comply with Federal Specification WW-F-406.
  - 3. Gaskets: Gaskets for flanges shall be full face, 1/8-inch neoprene or composition rubber.
  - 4. Flange Bolts: Bolts shall be stainless steel hex head machine bolts per ASTM A 193, Grade B8, (type 304). Nuts shall be heavy hex, stainless steel per ASTM A 194, Grade B8, (type 304), coated to prevent galling.

5. Polyethylene Encasement: Cast iron and ductile iron pipe, fittings shall have a bituminous coating and shall be encased in loose polyethylene tubing for external corrosion protection. Installation of polyethylene encasement shall be in accordance with the requirements of ANSI A 21.5 (AWWA C105). The interior and exterior surfaces of all fittings and valves shall be coated with 6-8 mil nominal thickness of protective fusion-bonded epoxy. The fusion-bonded epoxy coating shall be applied in accordance with and shall meet all applicable terms and provisions of ANSI/AWWA C116/A21.16-09.

## **2.02 BACKFLOW PREVENTION UNITS: (Potable Water Irrigation Only)**

- A. 'Reduced pressure' type backflow presenter shall be as manufactured by Wilkins, Febco, or approved equal. Units shall be equipped with ball valves and shall be approved by water purveyor for use.
- B. Reduced pressure units must be tested after installation by a certified person in accordance with the water purveyor's standards. Send copies of the test report to water purveyor and the City.

## **2.03 QUICK COUPLER VALVES:**

- A. Quick coupler valves shall be Signature 7645-B, or equal.

## **2.04 AUTOMATIC CONTROLLER:**

- A. Automatic Controllers for City maintained irrigation systems shall be Calsense centralized system as specified on the Drawings.
  1. Confirm model, features, and components with City prior to ordering.
  2. Provide flow meters and normally open/closed master control valves as specified by the City.
- B. All controller components shall be fused and have a chassis ground.
- C. All controllers shall be equipped with an integral radio remote controlled receiver. Circuitry shall be done in such a manner to include remote activation of remote controlled valves.
- D. Provide and install additional conduit and wiring with Calsense controller for centralized control system, per manufacturer's and telephone company specifications. Installation includes connection to telephone system resulting in a turn-key operation of the centralized system.
- E. Installation of Calsense controllers shall include all communication equipment; modem, phone jacks, ET gauge interface, and line amplifiers as specified by the City.
- F. All controllers shall be equipped with a 4 x 4 inch electrical junction box, with an on/off switch, and a ground fault protected duplex receptacle mounted with controller's electrical sub-assembly.

- G. Controllers shall have conduit between them when there are multiple controllers to link them together.
- H. Irrigation controllers are to be mounted in a Calsense vandal-and weather-resistant stainless steel pedestal enclosure with integral locking mechanism.
- I. The cabinet shall fully enclose all controller components, accessories and terminal connections. See Drawings for more specific information.

#### **2.05 MASTER CONTROL VALVES:**

Master control valves shall be normally open (Parks) or closed (Streetscapes), as specified by the City, globe pattern with cast iron, brass or bronze body and bonnet, brass or bronze flow stem and manual bleed petcock. Sizes of master control valves shall be listed on the Drawings. Normally open master valves shall be epoxy coated. Unions shall be placed at both the inlet and outlet ends of the master control valves.

#### **2.06 REMOTE CONTROL VALVES:**

Remote control valves shall be globe pattern with brass or bronze body and bonnet, brass, bronze or stainless steel flow stem and manual bleed petcock. Sizes of remote controlled valves shall be listed on the Drawings. Unions shall be placed at both the inlet and outlet ends of the remote control valves. One ball valve shall be placed at the inlet of each valve group or single valve.

#### **2.07 LOW VOLTAGE CONTROL WIRE:**

- A. Low voltage control wire shall be copper with UL approval for direct burial in ground. Common ground wire shall be #12-1 AWG with white insulating jacket; control wire shall be #14-1 AWG with insulating jacket of color other than white. Wire for flow meter/master control valve shall be #12-1 AWG with a unique color insulating jacket for each controller. Splices shall be made with 3M DBY/R-6 direct bury splice kits or equal. Provide a separate ground wire for each controller. Provide a minimum of a one spare black wire for every 12 valves per each controller. Spare wire is to be routed through each valve box connected to the respective controller.
- B. The wire for the flow meter/master control valve shall be in conduit, continuous from the flow meter device to the controller. Conduit size and pull box locations shall be as shown on the Drawings.
- C. Only red and black color wires should be used for flow meter.

#### **2.08 BOXES:**

- A. For, master control valves, remote control valves, and flow meters: Use Carson plastic valve box or equal with bolt-down, non-hinged 'T' plastic lid. Lid shall be marked 'Irrigation Control Valve'. Provide valve boxes of sufficient size to provide complete access to valve components and fittings specified in assembly.
- B. For gate valves, ball valves and quick coupling valves: Use Carson 10-inch diameter round plastic round box with bolt-down, non-hinged 'T' plastic lid. Add extensions for gate valves as required.

- C. For splice and pull boxes: Use Carson 14-inch by 19-inch green plastic valve box with bolt-down, non-hinged 'T' plastic lid. Lid shall be marked 'Irrigation Control Valve'.
- D. All irrigation valve boxes on recycled water systems shall be purple.

**2.09 SPRINKLER HEADS AND BUBBLERS:**

- A. Turf and shrub sprinkler heads shall be as specified and detailed on the Drawings.
- B. Bubblers at trees shall be as specified and detailed on the Drawings.

**2.10 EQUIPMENT ENCLOSURES:**

- A. All equipment enclosures are to be as specified on the Drawings.

**2.11 MISCELLANEOUS INSTALLATION MATERIALS:**

- A. Solvent cement and primer for solvent weld joints shall be of make and type approved by manufacturer(s) of pipe and fittings. Cement shall be maintained at proper consistency throughout use.
- B. Lubricant for assembling rubber ring seal joints shall be of make and type approved by manufacturer of pipe.
- C. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Use Rectorseal No. 5, IPS Weld-On All Seal pipe joint compound, or equivalent, except at remote control valves and sprinkler heads where 3-4 wraps of Teflon tape are to be used.

**2.12 MISCELLANEOUS EQUIPMENT:**

- A. Provide all equipment called for by the Drawings.
- B. Provide backflow preventer freeze protection cover for all backflow preventers. Polar Parka model or approved equivalent.

**2.13 GATE VALVES:**

- A. Gate valves, 3-inches or smaller, shall have bronze bodies, non-rising stems, and brass cross handles. Gate valve shall be Nibco Class 125, T-113, threaded or approved equal.
- B. Gate valves 4-inches and larger shall be AWWA approved and have gasketed or flanged connections as specified and detailed on the Drawings, a 2-inch square operating nut, cast iron bodies, and have an arrow cast in metal indicating the direction of water flow. Gasketed gate valves shall be Nibco P-619-RW, or

approved equal. Flanged gate valves shall be F-619-RW, or approved equivalent.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL:**

- A. Prior to all work in this Section, inspect the site and verify that preceding work of other Sections is complete and has been approved by the City.
- B. Irrigation system shall be installed in accordance with all applicable local and state codes and ordinances by a licensed landscape contractor.
- C. Recycled water systems shall be installed in accordance with the water purveyor's standards.
- D. Follow manufacturer's direction except as shown or specified.

#### **3.02 INSPECTION OF SITE CONDITIONS:**

- A. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work.
- B. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, and/or groundcover.
- C. Avoid trenching within drip line of trees where possible. When not possible, all damaged roots over 1-1/2-inches in diameter shall be cut leaving clean face, then immediately install pipe, wire, etc. Refill trench and soak root zone with water.
- D. The Contractor shall carefully check all grades to determine that he may safely proceed before starting work on the irrigation installation.
- E. Coordinate work with work of others for the location of pipe sleeves or conduit through walls, paving, existing planting, etc.
- F. The Contractor shall verify water pressure and available gallonage prior to construction. If deficiencies are noted that will hinder the system's performance, notify the City for directions to correct deficiencies.
- G. The design is diagrammatic. All piping, valves, etc., shown within paved areas is design-clarification only. Install piping, valves, etc., in planting areas.
- H. The Contractor shall coordinate with the City prior to construction for location of existing system components and utilities beyond the contract area for each phase, which are to remain operational. The Contractor is responsible for providing additional pipe, wire, and other equipment and labor necessary to keep existing systems beyond the contract area for each phase operational as directed by the City.

#### **3.03 PROJECT COORDINATION**

- A. Sequencing and Scheduling:

Coordinate irrigation installation work with the installation of other site improvements, including utility installation work, paving work, and landscape installation.

B. Environmental Conditions:

Site work such as trenching and backfilling shall not be performed during wet, muddy, or frozen conditions.

C. Rules and Regulations:

All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code, the Uniform Plumbing Code, and other applicable state or local laws or regulations. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes.

1. The Contractor shall furnish any additional material and labor required to comply with these rules and regulations, though the work is not mentioned in these particular Specifications or shown on the Drawings.
2. When the Specifications call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, the provision of the Specifications shall take precedence over the requirements of the said rules and regulations.

D. Safety:

1. The Contractor shall erect and maintain barricades, guards, warning signs, and lights as required for the protection of the public and workmen. All lane closures shall conform to CalTrans "Work Area Traffic Control Handbook".
2. All work shall be performed in a safe manner. All regulations, all OSHA requirements, and other authoritative agencies shall be followed.

**3.04 PROTECTION OF WORK AND MATERIALS:**

- A. Contractor shall protect all work within and beyond the contract area, and the work of others for the duration of the Contract. Protect plastic pipes and fittings from direct sunlight, and avoid undue bending and any concentrated external loading. Beds on which pipe is stored shall be full length of pipe. Pipe or fittings that have been damaged shall not be used.
- B. Contractor shall exercise extreme care in excavating and working near existing utilities. Damage to utilities, which are caused by Contractor's operation, shall be the Contractor's responsibility. Call USA (Underground Services Alert) at 811 or (800) 227-2600 for underground marking prior to construction.
- C. Contractor shall take necessary precautions to protect site conditions and plant material that is to remain. Should damage be incurred, Contractor shall repair damage to its original condition or furnish and install equivalent replacements.

- D. All existing irrigation systems shall be kept in operation at all times. If the existing system is damaged by Contractor, the Contractor shall be responsible for immediate repair of such damage. After each repair, all heads of the repaired system shall be removed so that the lines can be cleared of all dirt and foreign matter.

### **3.05 CORRECTION OF WORK:**

Any and all discrepancies or unsatisfactory work shall be corrected by Contractor at no additional expense to City. The correction of work shall be finished within a reasonable period as agreed upon between the City and Contractor.

### **3.06 PREPARATION - LAYOUT OF WORK:**

Prior to installation, stake out all pressure supply lines and wire routing, and locations of backflow preventers, sprinkler heads, control valves, flow meters, controllers, and ET gauge and notify City to review layout.

### **3.07 INSTALLATION:**

#### **A. Trenching:**

1. Dig trench straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout shown on Drawings.
2. Provide for a minimum of 24-inches cover for all pressure supply lines unless indicated to be deeper on the Drawings.
3. Provide for a minimum cover of 12-inches for all non-pressure lines to spray heads, bubblers, and pop-up rotary heads.
4. Provide for a minimum cover of 12-inches for all control wiring.
5. Provide for a minimum cover of 36-inches from finished grade or 12-inches below subgrade, whichever is deeper, over sleeving and conduit installed under asphalt pavement.
6. No irrigation piping shall be placed beneath or in close proximity to tree rootballs. The Drawings are diagrammatic, and piping may diagrammatically be shown running through tree rootballs.

#### **B. Backfilling:**

1. Do not backfill trenches until all required tests are performed. Carefully backfill trenches with approved excavated materials for backfilling, consisting of earth, loam, sandy clay, sand, or other acceptable materials, free from large clods of earth or stones. Backfill shall be mechanically

compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

2. Install 3-inch wide, non-detectable marking tape, as manufactured by T. Christy Enterprises, Inc., (800) 258-4583, 12- to 18-inches below the surface and a minimum of 12-inches above pipe and irrigation wires to be protected.
  - a. Potable lines: tape shall be blue non-detectable marking tape model #TA-ND-3-BW.
  - b. Non-potable lines: tape shall be blue non-detectable marking tape model #TA-ND-3-BI.
  - c. Recycled water lines: tape shall be purple non-detectable marking tape model #TA-ND-3-PBI.
3. Backfill in asphalt paved areas shall have sand covering pipe with a 6-inch minimum depth.

C. Pipe and Fitting Installation and Connections:

1. Install all assemblies specified herein in accordance with Details.
2. Thoroughly clean PVC pipe and fittings of dirt, dust, and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

D. Sleeving and Conduits:

1. Control wiring passing under concrete and paving shall pass through Schedule 40 PVC conduit and sleeve-size as shown on the Drawings.
2. Piping passing under hardscape surfaces or through structural elements shall pass through Class 200 PVC sleeving. Size as required.
3. Sleeving and conduit shall extend 6-inches beyond farthest edge of pavement, curb, or sidewalk.
4. Pull boxes shall be provided at 200-foot maximum intervals and no more than the equivalent of four (4) quarter bends (360 degrees total) between pull boxes, e.g., conduit bodies and boxes, per current California Electrical Code.
5. Provide removable, non-decaying plug at ends of sleeves and conduits to prevent entrance of earth.
6. Provide pull wire in empty conduits.

E. Rubber Ring Seal Joint:

1. Use factory-made male end or prepare field-cut male end to exact specifications of factory-made end.
2. Carefully clean bell or coupling and insert rubber ring without lubricant. Position ring carefully according to manufacturer's instruction.
3. Lubricate male end according to manufacturer's instructions and insert male end to specified depth. Use hands only when inserting PVC pipe.
4. Thrust blocks shall be provided where necessary to resist system pressure on gasketed pipe and fittings. Blocks shall be concrete and the size shall be based on an average soil safe bearing load of 700 pounds per square foot.
5. Form thrust blocks in such a manner that concrete comes in contact only with the fittings. Thrust blocks shall be between solid soil and the fitting.

F. Solvent Weld Joint:

1. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fitting of dirt, dust and moisture.
2. Dry-insert pipe into fitting. Pipe should enter fitting 1/3 to 2/3 depth of socket.
3. Coat the inside socket surface of the fitting and the external surface of the male end of the pipe with P-70 primer (manufactured by Weld-On or approved equal). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.
5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
6. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.

G. Threaded Joint:

1. Field threading of plastic pipe or fittings is not permitted. Factory-formed threads only will be permitted.
2. Factory-made nipples shall be used wherever possible. Field-cut threads in metallic pipe will be permitted only where approved by the City. When field threading, cut threads accurately on axis with sharp dies. Field threading shall be accomplished in a controlled area only. All

improvements and unimproved areas will be protected from drippings and shavings.

3. All threaded joints except those directly contacting sprinkler or bubbler inlets shall be made up with pipe joint compound. Apply compound to male threads only.
  4. Where assembling metallic pipe to metallic fitting or valve, no more than one full turn beyond hand-tight.
  5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand-tight.
  6. Where assembling soft metal (brass or copper) or plastic pipe, use strap-type friction wrench only; do not use metal-jawed wrench.
- H. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstruction. Remove caps or plugs only when necessary to continue assembly.
- I. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

### **3.08 REMOTE CONTROL VALVES AND MASTER CONTROL VALVES**

- A. Install where shown on approved Drawings and group together where practical. Provide only one (1) remote control valve per box without exceptions.
- B. Locate valve boxes 12-inches from and perpendicular to walk edges, buildings and walls. Provide 12-inches between valve boxes where valves are grouped together.
- C. Locate all valve boxes a minimum of 15-feet outside of playing areas at baseball and soccer fields.
- D. Thoroughly flush main line before installing valves.
- E. Install in shrub or ground cover areas where possible.
- F. Label control line wire at each valve with a 2-1/4-inches by 2-3/4-inches polyurethane I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.
- G. Install master control valve wire in conduit with pull boxes in conformance with Section 328000-3.07.B "Installation".
- H. The Contractor shall permanently hot stamp all valve box lids with 2-inch minimum letter height as follows:
  1. 'X1' for Remote Control Valves ('X' = controller and '1' = station number)
  2. 'FM' for Flow Meter
  3. 'MV' for Master Control Valve
  4. 'GV' for Gate Valve
  5. 'QC' for Quick Coupling Valve
  6. 'SP' for Splice Box or Pull Box

- I. Set the discharge pressure at each pressure regulating type remote controlled valve as required to provide the design pressure at the highest outlet elevation associated with remote controlled valve zone. Refer to Irrigation Legend for design pressures associated with each type of equipment.

### **3.09 AUTOMATIC CONTROL WIRING:**

- A. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible. When not possible, house wiring in PVC conduit in conformance with Section 328000-3.07.B "Installation".
- B. Where more than one wire is placed in a trench, the wiring shall be taped together or tied with cable ties at intervals of 10-feet. Do not tape or tie wire together where contained within conduit or sleeves.
- C. Provide 3-foot expansion coil at each wire connection and at least every 100-feet of wire length on runs more than 100-feet in length. Form expansion coils by wrapping at least five turns of wire around a 2-inch diameter pipe, then withdrawing the pipe.
- D. Splicing will be permitted only on runs exceeding 2,500-feet and shall be placed in junction boxes. Indicate all splices on the 'Revised' Drawings.
- E. Connections shall be made with 3M DBY/R-6 connectors and per manufacturer's instructions.
- F. Install separate common wire for each controller. Install a minimum of one (1) spare control wire with black insulating jacket for every 12 valves to serve each individual controller and stub-outs.
- G. Pull boxes locations shall be as shown on the Drawings. If not shown, they shall be approximately equally spaced but not over 200-feet apart. It shall be the option of the Contractor, at no additional expense and subject to approval of the City, to install additional pull boxes as needed to facilitate the work.

### **3.10 AUTOMATIC CONTROLLER:**

- A. Provide and install automatic irrigation controller in locations shown on Drawings. The exact location will be determined on the site by the City. Provide conduit, wire and connect to 120 volt switch to be accessible from controller for ease of maintenance.
- B. Provide 120 volt electrical and telephone service to location(s) as shown on the Drawings under electrical contract work. Irrigation contractor to provide electrical and telephone service from stub-out to controller(s). Provide proper grounding per controller manufacturer's instructions.
- C. Connect control wires to controller in sequential arrangement according to assigned identification number of valve. Each control wire shall be labeled at controller terminal strip with 3M ScotchCode wire marker tape indicating the station number.

- D. Master Control Valve, Flow Sensor and Telephone Service: Provide and install conduit with pull wire and pull boxes from service connection point to controller location under the direction of City in conformance with Sections 328000-3.07.B "Installation".
- E. Each controller shall have its own ground rod. Separate the ground rods by a minimum of 8-feet. The ground rod shall be an 8-foot long by 5/8-inch diameter U.L. approved copper clad rod. No more than 6 inches of the ground rod to be above grade. Connect #8 gauge wire with a U.L. approved ground rod clamp to rod and back to ground screw at base of controller with appropriate connector. Make this wire as short as possible, avoiding any kinks or bends.
- F. Program the irrigation controllers during the maintenance period to provide the minimum amount of water needed to sustain good plant health. Adjust the program for seasonal weather changes, plant material, water requirements, mounds and slopes, sun, shade, and wind exposures.

### **3.11 FLOW METERS:**

- A. Install as detailed and in accordance with manufacturer's representative's directions.
- B. Install flow sensor wire in conduit with pull boxes in conformance with Section 328000-3.07.B "Installation".

### **3.12 TESTING:**

Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.

### **3.13 SPRINKLER HEADS, BUBBLERS, AND QUICK COUPLER VALVES (QCVs):**

- A. Thoroughly flush lines before installing heads, bubblers, or QCVs.
- B. Locate heads, bubblers, and QCVs as shown in the Drawings and Details.
- C. Adjust sprinkler heads for proper distribution and trim.
- D. Set sprinkler heads perpendicular to finish grade of the area to be irrigated unless otherwise noted on the Drawings.
- E. At locations where low sprinkler head drainage will cause erosion and/or excess water use a pop-up body with integral check valve or KBI CV-Series spring loaded check valve on bubbler risers where required.
- F. Install quick coupling valves at locations shown on Drawings.
  - 1. Space quick coupling valves 200-feet maximum on centers and 100-feet maximum from end of landscape.
  - 2. Locate quick coupling valves at ends of main lines and valve manifolds.

3. Maintain a 10-foot minimum clearance between quick coupling valves and potable water lines.
- G. Recycled Water Warning Tags and Signs: Install identifications tags and signs for recycled water systems in accordance with the water purveyor's standards.

### **3.14 FIELD QUALITY CONTROL:**

Adjustment of the System:

1. Flush and adjust all sprinkler heads for optimum performance and to eliminate overspray onto walks, roadways and buildings.
2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
3. Adjust flow control and pressure regulators at each valve to obtain the optimum operating pressure for each system.
4. Input precipitation rates for each station into controller prior to City acceptance.

### **3.15 TESTS:**

Contractor shall:

- A. Notify the City at least two (2) days in advance of testing.
- B. Testing shall be performed at the Contractor's expense.
- C. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.
- D. Apply the following tests after solvent weld plastic pipe joints have cured at least 24 hours.
  1. Solvent weld: Test supply lines per ASTM-F690 as follows: (a) add water slowly to pipe to avoid water hammer damage, (b) bleed system to insure all air is out of pipes, (c) pressurize system to 125 PSI for two (2) hours. Visually inspect for leaks while system is holding pressure constant. Note - use hydraulic pump or other safe method - do not use air compressor.
  2. Gasketed: Test live (constant pressure) and quick coupling valve lines hydrostatically at 125 PSI minimum pressure. Lines will be tested for six (6) hours. There shall be no more than five (5) pounds of pressure loss during the six (6) hour test. The lines shall be restored to the original test pressure and the amount of water required to do so shall be measured. Approved tables of allowable loss shall be consulted, and the line will be

approved or not approved as such results may indicate. The Contractor shall make tests and repairs as necessary until test conditions are met.

3. Test non-pressure lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.
- E. When the irrigation system is completed, perform a coverage test to determine if the water coverage for planting areas is complete and adequate without overspray onto adjacent paved or decomposed granite areas. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviation from Drawings.

This test shall be accomplished before any groundcover is planted, mulch is placed, hydro-seeding is conducted, or installation of sod.

### **3.16 CLEAN-UP:**

- A. Clean-up shall be made weekly at a minimum. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.
- B. When work of this Section has been completed and at such other times as may be directed, remove all trash, debris, surplus materials and equipment from site. At no time shall debris, surplus materials and equipment be placed on adjacent property unless said location is approved by the City and with written permission from the property owner.

### **3.17 GUARANTEE:**

- A. Fill and repair all depressions and replace all necessary surfaces, lawn, and planting due to the settlement of irrigation trenches for one (1) year following completion and acceptance of the work of this Section.
- B. Guarantee all materials, equipment, and workmanship to be free of all defects. Agree to replace, at Contractor's expense, at any time within one (1) year after installation is accepted, any and all defective parts.

### **Guarantee for Sprinkler Irrigation System**

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the Drawings and Specifications. We agree to repair or replace any defects in material or workmanship, any settling of backfilled trenches, which may develop during the period of one (1) year from date of acceptance, and also to repair or replace any damage caused by any

defects in the irrigation system or resulting from the repairing or replacing of such defects at no additional cost to the City. Ordinary wear and tear or unusual abuse are accepted. We shall make such repairs or replacements, including complete restoration of all damaged planting, paving, or other improvements of any kind, within a reasonable time, as determined by the City, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the City, we authorize the City to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project: \_\_\_\_\_

Location: \_\_\_\_\_

Contractor: \_\_\_\_\_

License No.: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

Guarantee To: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Date of Acceptance: \_\_\_\_\_

Authorized Representative: \_\_\_\_\_

**END OF SECTION**