

SECTION 32 84 00
LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all materials, labor, equipment and services necessary to furnish and install Landscape Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. The extent of the underground landscape irrigation system is shown on the drawings. The Contractor shall carefully review the plans and specifications and if they feel that more equipment is needed, they shall include that in the bid. All extra work to achieve full coverage shall be at the Contractors expense. Sprinkler systems shall be complete, operative and automatic and provide full coverage of the planted areas.
- B. Irrigation systems shall be constructed to the sizes, grades and locations shown on the plans. Irrigation pipelines shown on the plans are essentially diagrammatic. Locations of all irrigation improvements shall be established by the Contractor at the time of construction. Typical spacing of the sprinklers are shown on the plans and shall not be exceeded, except by written permission of the Owner's authorized representative.
- C. The system has been designed to a pressure as indicated in these specifications. The Contractor shall test the mainline prior to starting any work and verify that such pressure does exist. If it does not, the Contractor shall notify the Owner at once for a ruling before starting work. If the Contractor does not test prior to starting work, all corrective work shall be at the Contractors expense.

1.2 RELATED SPECIFICATION SECTIONS

Division 31	EARTHWORK
32 9000	LANDSCAPE CONSTRUCTION
Division 03	CONCRETE
Division 26	ELECTRICAL

1.3 STANDARDS

- A. Materials and installation shall conform to all State and Local codes and regulations governing the trades included in this work. Requirements of these plans and specifications not conforming therewith, but exceeding code requirements, then the plans and specifications shall govern.

1.4 EXPLANATION AND EXAMINATION OF SPECIFICATIONS AND PLANS

- A. Due to the scale of the Drawings, it is not possible to indicate offsets, fittings, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of their work and plan their work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner so that conflicts between irrigation systems, planting, utilities, and architectural features will be avoided.
- B. Notes on Drawings: Work called for on the Drawings by notes shall be furnished and installed whether or not specifically mentioned in the Specifications.
- C. It shall be the responsibility of the Contractor to carefully examine the site, plans and specifications relating to this work for completeness, accuracy and clarity. Any conflict, error, or clarification shall be immediately brought to the attention of the Owner's authorized representative in writing to obtain a ruling. Failure to do so prior to bidding shall result in any corrective work necessary shall be completed at the Contractor's expense.
- D. It is the intent of these specifications and plans to form a guide to accomplish the work of installing a complete sprinkler system which will operate in an efficient and satisfactory manner according to the workmanlike standards established for the irrigation industry. Therefore, any items not specifically noted, but necessary for a complete installation, shall be furnished and installed under this contract.
- E. Manufacturer printed instructions shall also be a part of these specifications and shall prevail over these specifications. The Contractor shall be responsible to provide such details and instructions to the inspecting person for approval or rulings.
- F. All general and specific notes shown on the drawings and details herein shall take precedence over these specifications. All work designated on the drawings by notes shall be furnished and installed.

1.5 PERMITS AND INSPECTIONS

- A. The Contractor shall obtain and pay required fees to any governmental or public agency. Permits for the installation or construction of the work included under this Contract, which are required by legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. The Contractor shall also arrange for and pay costs in connection with inspections and examination required by these authorities.

1.6 GUARANTEE

- A. Irrigation system shall be guaranteed for a period of one year from the date of final acceptance. Any repairs required are to be completed by the Contractor in a timely manner at no additional cost to the Owner.

1.7 OPERATIONS AND MAINTENANCE INSTRUCTIONS / RECORD DOCUMENTS

- A. Two copies of equipment operations, maintenance instructions, and wire diagrams shall be furnished to the Owner prior to final acceptance. Two copies of control valve station charts (color coded reduced Irrigation Plan with plastic waterproof lamination) showing watering zones and stationing shall be provided and mounted in the controller pedestal.
- B. The Contractor shall furnish one set of reproducible Record Documents (As-Built drawings) in form of 24 lb bright white bond paper.
 - 1. Label first page of each document, or set of documents, "RECORD DRAWINGS" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Do not conceal any work until required information is recorded on a daily basis.
 - 2. Drawings: Legibly mark to record actual construction:
 - a. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and invert of each concealed line or item. Accurately locate each capped, plugged, or stubbed line.
 - b. Field changes of dimension and detail.
 - c. Changes made by Field Order, by Addenda, or by Change Order.
 - d. Details not on original Contract Drawings.
 - 3. Deliver all Record Documents (As-Built) to Landscape Architect. Accompany submittal with transmittal letter in duplicate, containing:
 - a. Date.
 - b. Project title.
 - c. Contractor's name and address.
 - d. Title and number of each Record Document (As-Built).
 - e. Signature of Contractor or his authorized representative.

1.8 SUBMITTALS

- A. Within the required time period stated in the General Provisions, the Contractor shall submit six (6) copies of complete lists of proposed materials to Landscape Architect including manufacturer's name and catalog numbers.
- B. Shop drawings shall follow (six copies) for equipment including dimensions, capacities, and other characteristics listed in product specifications. Materials and equipment shall not be ordered until given written approval by Landscape Architect.
- C. The specified irrigation booster pump has a long lead time (approximately eight weeks) and the irrigation booster pump submittal is to be submitted in a timely manner after the contract award and ordered to avoid project delays.

1.9 DEFINITIONS

- A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.
- B. PVC: Polyvinyl Chloride.
- C. Agencies and Organizations:
 - 1. ASTM American Society for Testing and Materials
 - 2. AWWA American Water Works Association
 - 3. IAPMO International Association of Plumbing and Mechanical Officials
 - 4. CEC California Electrical Code
 - 5. UL Underwriter's Laboratories

1.10 UNDERGROUND OBSTRUCTION

- A. The Contractor shall verify all underground obstructions, and / or utilities, existing or proposed, prior to trenching. Contractor shall avail themselves of any "as built" drawings of the site, Underground Service Alert (USA) 1-800-227-2600 and records of existing and proposed site work. This shall also include verifying between proposed irrigation work and existing / proposed underground utilities. Contractor shall call for a ruling by the Owner's Authorized Representative prior to work to obtain a ruling in the event of a conflict.
- B. The Contractor, after availing themselves to the existing record drawings, Underground Service Alert and coordination with other trades installing underground utilities and excavation operations incurs and damages any existing utility not identified, the Contractor shall stop work and notify the inspector on site, obtain a ruling and repair the damage.

1.11 WORKMANSHIP

- A. The Contractor shall have experience and demonstrated ability in the installation of irrigation systems of this type. No work shall be completed without supervision. All work shall be installed by skilled persons proficient in the trades required, in a neat, orderly and organized manner, with the recognized standards of craftsmanship developed for the industry and as described in the plans, specifications and manufacturers installation instructions.

1.12 PROTECTION TO THE PUBLIC HEALTH AND WELFARE

- A. The Contractor in the course of their work shall make every effort to guard the public health, safety and welfare during construction. This shall include erection of barricades, night warning lights and all necessary devices required to protect the public health and welfare or as required by existing governmental codes. The Contractor shall accept any and all liabilities arising from accident or injury on the job and after construction. All equipment which protrudes above grade shall be installed against a structure or an appropriate barricade shall be erected to protect public safety.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials and equipment to be used shall be as outlined on the irrigation legend, or as described in the irrigation notes and irrigation specifications. All materials shall be new and unused.
- B. All specified materials, products and manufacturers are relevant to describe the required quality and features of a particular component of the irrigation system, however, the specific product or manufacturer noted is to be construed to be followed by the words, "or approved equal".

2.2 PIPELINES / SLEEVES

- A. Irrigation Piping:
1. 2" thru 3": Pressure pipe / upstream of control valve (mainline pipe): PVC Schedule 40 solvent weld pipe, PVC Material ASTM D1784, Cell Class 12454B, Pipe Design ASTM D1785 & compliance with all NSF & IAPMO (UPC) requirements.
 2. 4": Pressure pipe / upstream of control valve (mainline pipe): PVC Class 315 solvent weld pipe, pressure rating 315 psi, SDR 13.5, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design – SDR Pipe ASTM D2241.
 3. 3/4" thru 2 1/2": Circuit pipe / downstream of control valve (lateral pipe): PVC Class 200 solvent weld pipe, pressure rating 200 psi, SDR 21, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design – SDR Pipe ASTM D2241.
 4. 2" and larger: Sleeving under hardscape / paving: PVC Schedule 40 solvent weld pipe, pressure rating varies, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design ASTM D1785.
 5. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name or trademark, nominal pipe size, schedule and type of pipe, pressure rating in PSI and (NSF, IAPMO & AWWA) seals of approval.
- B. Plastic pipe shall be as called for on the plan and extruded from PVC 1120/1220 and shall meet commercial standards CS 256-63. Class and schedule of pipe shall be as called for in the plans. Strict conformance with the manufacturers recommended installation instructions is required. Painted galvanized steel (schedule 40), threaded bronze nipples, copper or painted ductile iron pipe is to be used for any pipe installed above grade. Fittings for above grade piping are to be consistent with pipeline material. Sun burned pipe or pipe that has been abused in shipping and handling is not to be used.
- C. The Contractor is to install concrete thrust blocks as outlined in the thrust block detail and as recommended by the pipe & fitting manufacturers to secure all changes in direction or dead ends of all mainline pipe. The Contractor is to use rebar as needed if necessary to insure the stability of the pipe. Where concrete thrust blocks cannot be installed against continuous native subgrade, the Contractor is to install ductile iron

mechanical joint restraints. No bending, or curving of pipe will be allowed, except as permitted by the pipe manufacturer. Pipe manufacturer must be approved prior to ordering materials.

- D. Where piping on the plans is shown under paved areas, but is running parallel and adjacent to planted areas, the intent of the plans is to install the piping in the planted area. PVC Class 200 sleeves are to be used with all pipe and wire installed under hardscaped surfaces over six feet (6'-0") wide or wider.
- E. Where pipeline routing changes occur in the field, the Contractor is to size the pipe so that a flow velocity of 5.0 feet per second is NOT exceeded. The minimum pipe size is 3/4" and 1 1/4" pipe is not used due to its limited flow range. The following is a basic guide for sizing lateral pipes in the field:
 - 1. 3/4" Pipe - 0 gpm thru 8.0 gpm
 - 2. 1" Pipe - 8.1 gpm thru 16.0 gpm
 - 3. 1 1/2" Pipe - 16.1 gpm thru 36.0 gpm
 - 4. 2" Pipe - 36.1 gpm thru 55.0 gpm
 - 5. 2 1/2" Pipe - 55.1 gpm thru 85 gpm

2.3 PIPELINE FITTINGS

A. Fittings:

- 1. For PVC solvent weld plastic pipe, 2" thru 3" mainline fittings: PVC Schedule 80 socket fittings (ASTM A2564, D2466, D2464 & D2467), Type 1, Grade 1. All mainline fittings are to be PVC Schedule 80 type with solvent weld or threaded connections.
- 2. For PVC class 315 mainline pipe, 4" mainline fittings: Ductile iron mechanical joint fittings with joint restraints as manufactured by MegaLug, LEEMCO, or approved equal. See manufacturer's instructions and recommendations. No angular deflection of mainline pipe at the fitting bell end is allowed. For automatic valve connections to large mainline (4" thru 6") pipe, Romac 202N ductile iron service saddle with double stainless steel straps may be used.
- 3. For PVC solvent weld plastic pipe, 3/4" thru 2 1/2" lateral fittings: PVC Schedule 40 socket fittings (ASTM A2564, D2466, D2464 & D2467), Type 1, Grade 1. All lateral fittings (downstream remote control valve) not specifically noted as PVC Schedule 80 type in the specifications or irrigation details are to be PVC schedule 40 type with solvent weld or threaded connections.
- 4. For connections between main lines and remote control valves: Schedule 80 PVC fittings and nipples (threaded both ends), see Irrigation Details.
- 5. When connection is plastic to metal, Schedule 80 TOE nipple shall be used.
- 6. Teflon tape shall be used on all small diameter (1/2" to 3") threaded connections. No liquid or paste pipe thread sealants are allowed.

B. Risers to irrigation heads: Shall be as noted on Irrigation Details.

C. Solvent Weld Adhesive: Weld-On cement & primer appropriate for size & type of pipe and fittings. See manufacturer's instructions and recommendations. Note weather

and temperature limitations for use. Use primer for all joints, mainline and lateral pipe connections.

2.4 VALVES / CONTROL WIRE

- A. Automatic Control Valves: Globe / Angle valves operated by low-power solenoid, normally closed, with manual flow adjustment. Sizes and types as shown on drawings. Low voltage electrical connections to valves shall have a minimum 24" coiled loop to each valve in valve box, see details. Valves shall be installed in a heavy duty plastic valve box with bolt down lid. Install one valve per valve box, no exceptions. Valves are to have potted DC latching solenoids compatible with the Toro Sentinel 2-wire system.
- B. Control Wire: Comm.
- C. Control Wire Connectors: Valve to decoder wire connectors to be 3M DBY / DBR Direct Bury splice kits and all decoder to communication cable splices and communication cable splices are to be 3M DBR-6 splice kits. Use wire as noted on the plans and as recommended by the Toro manufacturer for Sentinel 2-wire systems.
- D. Control Wire Marking: T. Christy Enterprise, Inc. Waterproof Irrigation I.D. Tag or approved equal (714) 771-4172.
- E. Control Valve Boxes: Christy heavy duty plastic valve boxes with heavy duty bolt down lids, or approved equal. See Irrigation Details for model numbers and sizes.
- F. Control Valve Box Marking: Heat imprinted or engraved with appropriate controller and station number.

2.5 IRRIGATION HEADS

- A. Spray Head: Molded plastic body with plastic nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.
- B. Rotor Head: Molded plastic and stainless steel construction. Gear driven with lockable arc adjustment and matched precipitation rate nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.
- C. Irrigation heads adjacent to concrete walks, mow strips or other paved areas shall be offset 3" to permit edging without damage to irrigation equipment. Irrigation heads are to be set at grade. Irrigation heads are to be adjusted so that no spray hits buildings, fences, walls, or hardscaped surfaces. Install anti-drain check valves under all irrigation heads that weep or show drainage after operation.

2.6 GATE VALVES

- A. 1" thru 3" Size, if required: Class 125 bronze gate valve, 200 psi WOG, manufactured domestically made of cast bronze material and cross handle with non rising stem as

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manufactured by NIBCO, or approved equal. Solid wedge with screw in bonnet gate valve with threaded connections resistant to dezincification.

- B. 4" thru 6" Size, if required: Resilient seat ductile iron gasketed joint gate valve rated for a minimum of 200 psi, manufactured domestically by NIBCO, Waterous or approved equal.

2.7 QUICK COUPLER VALVES

- A. Two piece valve with heavy duty brass construction with vinyl cover and single lug operation. Contractor is to supply Owner with two (2) quick coupler keys and two (2) hose swivels. See Irrigation Legend and Details for detailed descriptions.

2.8 CENTRAL CONTROL SYSTEM

- A. Central control is existing and the Contractor is responsible for all data input and programming of the existing central control system to update the system for the changes resulting from this project.

2.9 HAND HELD RADIO SYSTEM

- A. The irrigation control system is existing and a hand held remote radio is not required for this project.

2.10 FIELD SATELLITE CONTROLLER

- A. Toro Sentinel 2-wire controller is existing and is to remain and protect.

2.11 IRRIGATION BOOSTER PUMP STATION

- A. The irrigation pump is existing and is to remain and protect.

2.12 VALVE BOXES

- A. All valves, manual or automatic shall have a valve box, set flush with grade. All valve boxes shall be of heavy duty plastic construction with heavy duty bolt down lids. Valve boxes are to be manufactured by Applied Engineering, or approved equal. Maximum of one (1) valve per valve box, no exceptions. Placement of the valves within the valve boxes shall allow for proper servicing and maintenance space, or the installation will be rejected.

2.13 AIR RELIEF VALVES

- A. Air relief valves are not required for this project.

2.14 BACKFLOW PREVENTION DEVICE

- A. The backflow prevention device are existing and are to remain and protect.

2.15 OTHER MATERIALS

- A. Materials not specifically indicated but necessary for proper execution of this work shall be of the first quality as selected by the Contractor subject to the acceptance of Architect.
- B. All materials appearing in the legend and details of the irrigation drawings are part of this job. Contractor is responsible for installation according to drawings and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

PART 3 - EXECUTION

3.1 IRRIGATION SYSTEM DESIGN

- A. Irrigation system is designed for a water pressure of 50 psi at the irrigation point of connection.
- B. Verify the design pressure provided at the irrigation point of connection prior to system modifications and report any discrepancies in writing to the Architect. Failure to inform the Architect of any discrepancy in design pressure seven working days prior to installation of the irrigation system shall institute the responsibility of corrective action to the Contractor, at no expense to the Owner.

3.2 IRRIGATION STAKING

- A. The location of all sprinklers, valves, piping and other irrigation improvements shall be staked out by the Contractor. All staking and measurements shall be taken from permanent objects, buildings, or other permanent hardscape features including survey bench markers, and are NOT to be taken from non-permanent boundaries such as turf boundaries which are subject to modification. All measurements shall be made in feet and inches, rounding to the nearest inch. All variations from the plans are to be continuously updated on a daily basis on the record (as built) drawings. The Contractor is to present the areas staked to the Landscape Architect for review and approval prior to starting work. The Contractor is to make the adjustments in staking requested by the Landscape Architect at no additional cost to the Owner.
- B. In planter areas, the Contractor is to stake the tree and shrub locations prior to layout of the irrigation system to get approval from the Landscape Architect in the field prior to trenching. Contractor is to use color coded flags to stake plant materials by variety. Landscape Architect may move plants, delete or add plants during the staking review process. Contractor is to make changes in the field and on the as built plans at no additional cost to the Owner. After the plant layout has been staked, reviewed,

adjusted and approved, the Contractor is to stake the bubbler locations for each plant or tree. Bubblers are to be located within the plant water basin on the uphill side of the plant or tree. Bubblers that are too far from the plant or tree will need to be relocated within an acceptable difference. The plant or tree rootball is to have direct access to irrigation water from the intended bubbler. Sloppy or non-compliant work will be rejected.

3.3 EXCAVATION, BACKFILL

- A. Trenches for irrigation pipelines and sleeves shall be excavated either by hand or machine and shall be of sufficient width to permit proper handling and installation of the pipe and fittings. The backfill shall be compacted and evened off with the adjacent soil level. Select fill material or sand shall be used if soil conditions are rocky, or have debris. No material over 3/8" shall be allowed near the pipe, 6" below it, or 6" above the pipe. Backfill shall be made early in the morning when the soil and pipe temperatures are the same. Pipe to be installed with a minimum cover of 18" for mainline pipe and 12" for lateral pipe with spray heads and 18" for lateral pipe with rotors. Backfill shall be in 6" (lifts) increments. Each (lift) increment shall be compacted as needed to prevent settlement with tamping machine. Backfill material is to be brought to the optimum moisture content prior to starting compaction operations.
- B. Contractor shall compact trench fill material as required to prevent settling of trenches. Contractor is to guarantee trenches against settling for a period of one year from the date of final acceptance by the Owner. Contractor is to fill, compact and seed settled trenches during this time at no additional cost to the Owner.
- C. All pipe in the same trench shall have a minimum clearance of 4" from each other. Pipelines are not to be stacked vertically in the same trench. Pipes and wires or conduit are to have a minimum clearance of 12" from each other. Final fill over trenches shall be compacted to a level grade with no depressions.

3.4 ROAD, DRIVEWAY, PARKING LOT AND SIDEWALK PIPELINE CROSSINGS

- A. Any pipe, wire or communication cable that crosses any hardscaped surface six feet (6'-0") or wider, shall be installed in a PVC class 200 sleeve that is a minimum of two times larger than the pipe or wire bundle being sleeved. Sleeves are to have a minimum trench cover of 18" deep. Pipelines and wires that are to be installed below existing hardscaped improvements are to be installed in a sleeve as noted above, by horizontal directional boring. No cutting and patching of any hardscaped surface will be permitted without written permission of the Owner's authorized representative. Newly paved areas are to be protected and preserved from construction damage. Jacking and hydraulic (water jet) driving are not permitted. The minimum sleeve size is two (2") inch. The Contractor is to verify the inside and outside diameters of pipes and wire bundles being sleeved to insure proper fit and installation. Irrigation pipelines and wires are to be installed in separate sleeves. No more than one (1) irrigation pipeline is allowed per pipe sleeve. Low voltage wires may be bundled with communication cable and installed in an appropriate size wire sleeve in conformance with NEC requirements for wires installed in conduit.

- B. If approval to cut and patch a hardscaped surface has been obtained, the Contractor shall make cuts by a pavement / concrete saw or other approved means. Where any cutting or breaking of hardscaped surface work is necessary, it shall be removed and replaced by the Contractor conforming to all prevailing project specifications and requirements. Cuts are to be made along existing scoring lines or other markings to minimize negative visual aesthetics. Barriers and night lighting shall be erected to protect the public health welfare and safety. If approval to cut and patch a hardscaped surface is denied, the Contractor shall make the crossing by using horizontal directional boring. All materials and labor for all sleeves and crossings, whatever method, are to be supplied by the Contractor at no additional cost to the Owner.
- C. Backfill shall be compacted to 95%. The Owner reserves the right to test such backfill. If the backfill does not meet the required 95% compaction, the Contractor shall recompact the trench. The Contractor shall pay for all additional testing until the work meets the specifications.

3.5 PIPING INSTALLATION

- A. General: Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance with manufacturer's recommendations to allow for expansion. Lay on solid sub-base, uniformly sloped.
- B. The Contractor shall examine all other portions of working drawing and plan trenching and pipe routing and depth so that no conflicts will arise between irrigation and any other work. Any corrective action will be the Contractor's responsibility at no further expense to the Owner. Contractor is to endeavor to route mainline pipes a minimum of fifteen feet (15'-0") from trees and is to get permission to install mainline pipe closer in tight locations from the Owners Authorized Representative.
- C. Joints:
 - 1. PVC Solvent Weld: Pipe shall be cut square and reamed to full size. Check for assembly prior to solvent weld. Remove excess solvent. All assembly shall be in accordance with manufacturer's recommendations, including use of primer on 3/4" pipe or larger.
 - 2. Steel or PVC Schedule 40 Threaded: Pipe shall be cut square and reamed to full size. Threads shall be full cut, true and tapered. Teflon tape suitable for conveyed fluid shall be applied to male thread only.
 - 3. Open Ends: Open ends of piping shall be capped during progress to preclude foreign matter. All pipe shall be assembled free from dirt and pipe scale.
- D. The Contractor shall thoroughly flush all mainline and lateral piping prior to the installation of irrigation heads. Flush entire piping system of all debris.

3.6 IRRIGATION HEAD INSTALLATION

- A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage without overspray on non-planted areas. Flush all lines prior to installation of the sprinkler heads.

3.7 CONTROL WIRE

- A. Protect wire by running along side mainline piping, maintain 4" separation to mainline. Bundle wires together and tape at intervals of ten (10') feet. Do not tape wire together when encased in sleeve. Minimum cover shall be 18 inches. Connect wires together at valve manifold with 3M DBY / DBR and DBR-6 splice kits as required. Tag all control wire splices with approved control wire marker at splices in valve box and in controller.

3.8 CONTROL VALVE BOX MARKING

- A. Imprint valve box lid by heat imprinting or engraving with appropriate controller and station number.

3.9 TESTING

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Owner. Mainlines are to be center loaded with the joints exposed. Should any joints be covered before such tests, the Contractor shall, at their expense, uncover, test, and repair the work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.
- B. Piping Upstream of control valves (Mainline): Maintain 100 PSI water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Perform test with control valves installed.

3.10 CONSTRUCTION OBSERVATION

- A. Observation of Work:
 - 1. Installation and operations must be approved by the Landscape Architect.
 - 2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Landscape Architect. Any work covered prior to inspection shall be opened to view by the Contractor at their expense.
- B. Construction Observation: Periodic site visits shall be required for basic operations and installations during progression of the project. Such site visits will include, but not necessarily be limited to, the following items:
 - 1. Preconstruction meeting.
 - 2. Staking of plant and tree locations prior to irrigation installation.

3. Staking of sprinklers and mainline routing.
4. Mainline, wiring, lateral pipes & valve manifolds prior to backfill.
5. Irrigation coverage test and rough grading.
6. Trees & plants prior to installation, still in containers.
7. Fine grading of turf areas prior to installing sod.
8. Substantial completion to start maintenance.
9. Final acceptance after successful maintenance period.

The Owner will pay for initial construction observation visits, however, any additional visits required due to non-compliance, incomplete work, or substandard performance will be paid by the contractor at a cost of \$300.00 per extra visit.

- C. Coverage Test: When the irrigation system is completed, the Contractor in the presence of the Landscape Architect shall perform a coverage test of water afforded in the planting areas. The Contractor shall furnish all materials and labor required to correct any inadequacies of coverage disclosed. The Contractor shall inform the Landscape Architect of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such corrections or additions are required in the irrigation system, the Contractor shall make all adjustments and corrections without any extra cost to the Owner.
- D. Completion of Work: Prior to substantial completion and the start of the maintenance period, the Contractor shall deliver to the Owner a complete set of as built drawings on 24 lbs bright white bond paper, two (2) sets of manuals covering all materials in the irrigation system with a list of local vendors, two (2) sets of all tools required to maintain system in tool boxes, two (2) quick coupler keys with hose swivels and two (2) quick coupler cover keys, two (2) gate valve operating handles, waterproof color coded controller diagrams and extra equipment listed below not installed as part of the project. Irrigation system shall be fully automatic, operable and provide full coverage of the planting areas. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary, due to developed conditions, to occupy any portion of the work before the Contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's work forces.

3.11 EXTRA IRRIGATION EQUIPMENT

- A. The Contractor shall supply the following extra equipment to be installed at the direction of the Landscape Architect during the project. Each item is to include all piping, wiring, fittings, appurtenances, labor and equipment costs for a complete installation at no additional cost to the Owner. Should any items not be installed as part of the project, the remaining items are to be delivered to Owner as part of project completion documentation.
1. Fifteen (15): Four inch pop up bubblers.
 2. Fifteen (15): Six inch pop up spray sprinklers.
 3. Five (5): Tree bubbler tube assemblies.
 4. One (1): 1" electric valve with line size filter.
 5. One (1): 1 1/2" electric valve with line size filter.
 6. Two (2): 2" electric valves.

7. One (1): 1 station decoder.
8. One (1): 2 station decoder.
9. One (1): 4 station decoder.

All work is to be in compliance with all project specifications and construction details at no additional cost to the Owner. Items not installed as part of the project are to be delivered to the Owner as part of project close out procedures (turn over items).

3.12 MAINTENANCE

- A. Adjustments: Irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the 90 day maintenance period. Irrigation system maintenance shall commence upon approval of substantial completion following irrigation installation, planting operations, and general site clean up. Maintenance shall be continued until final acceptance.
- B. Irrigation controller shall be set (data input and programming) during this time with Owner. Training for persons appointed by the Owner is to be completed during this time. Final acceptance of the project will NOT occur until all training of Owner's personnel is completed.

END OF SECTION