



LAKEMONT IRRIGATION RENOVATION  
SCOPE OF WORK

IRRIGATION SYSTEMS

**PART 1 - GENERAL**

**1.01 Description:**

Furnish and install sprinkler systems in conformance with the drawings and specifications, complete and ready for use. The work consists of furnishing all materials necessary for a complete installation, including, wire sleeves, pipe, valves, fittings, sprinklers, controller, valves, back-flow prevention device, and all appurtenances related thereto. Included shall be all labor of installation, including trenching, plumbing, back-filling, electrical work, adjustments, landscape restoration and all other items of labor necessary for a satisfactory operating system. Contractor shall also provide existing irrigation valves and heads to be removed to the owner.

**1.02 Quality Assurance:**

Qualifications: Contractor must be a Washington State licensed landscape contractor. The irrigation system must be installed under the direct supervision of a journey irrigation mechanic or journey plumber. All potable water system components shall be installed by a licensed plumber and all testing of the backflow prevention equipment shall also be done by a licensed plumber.

**1.03 References:**

None to note.

**1.04 Submittals:**

- A. Submit complete materials list prior to performing any work. Submit four (4) copies of manufacturer catalog data and full descriptive literature, including current manufacturer's price list.
- B. Equipment or materials installed or furnished without prior approval of the Owner's Representative will be rejected and such materials will be required to be removed and replaced with approved materials at the complete expense of the Contractor.
- C. Submit shop drawings for review and approval prior to beginning work.

**1.05 Project Conditions:**

- A. Underground utilities and elements: Locate all underground utilities and elements prior to digging and/or driving stakes. Take care, to neither disturb nor damage any existing above ground or underground utilities or elements. Keep streets, sidewalks and site clean, free from debris and affected drains open and free flowing at all times. Engage the services of a private utilities locating service for location of utilities within the site.
- B. Site inspection and layout: Before proceeding with any work, the Contractor shall inspect the site, carefully check all grades and verify all dimensions and conditions



affecting the work to satisfy him/her that he/she may safely proceed. Changes or alterations to the system to meet actual conditions shall be made at the Contractor's expense. Irrigation plan is diagrammatic and is not intended to show exact locations of existing or proposed piping, valves or controllers. Locate new items as closely as possible to related curbs, walls, fences or edges of paving. Pipelines shown parallel on drawing may be placed in a common trench but separated by at least 3 inches. Sprinkler heads are shown accurately and shall be installed as indicated by center of symbol.

- C. When renovating existing Park irrigation systems, the Contractor and the Owner's Representative shall test the existing system prior to the contractor beginning the work.
- D. All materials shall be inspected by the Owner's Representative prior to installation of any and all materials required to complete the work. Contractor shall call the Owner's Representative at (425) 452-6031 to make arrangements for inspections.

1.06 Guarantee:

- A. Contractor shall provide one year written guarantee as per Paragraph 3.07 of this section.
- B. Guarantee shall include restoration of planted, path or paved areas due to settlement of trenches.
- C. Guarantee shall include one complete winterization and one complete de-winterization of the irrigation system.

**PART 2 - PRODUCTS**

2.01 Copper Pipe:

All copper piping shall be Type K copper and shall conform to industry standards and be in conformance with applicable ASTM or ANSI standards.

2.02 Brass Pipe:

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

2.03 Plastic Pipe:

- A. PVC pipe (mainline) upstream of the control valves (mainlines) shall be Schedule 40 or better and shall conform to all requirements of ASTM D1785-86.
- B. PVC pipe (zone lines) downstream of the control valves (laterals) shall be Schedule 40 or better and shall conform to all requirements of ASTM D1785-86.
- C. All PVC pipe shall be marked with the manufacturer's name, class of pipe and NSF seal. Pipe shall bear no evidence of interior or exterior extrusion marks. Pipe walls



shall be uniform, smooth and glossy. Pipe may be pre-belled or with individual solvent-weld couplings.

- D. All PVC fittings shall be of the solvent weld type except where risers, valves, etc., require threaded transition fittings. All fittings shall conform to the requirements of ASTM D2466-78. All threaded PVC tees, fittings, adaptors and nipples shall be Schedule 80 or better.
- E. All PVC pipe must be delivered in at least twenty foot (20') lengths.
- F. All PVC pipes and fittings for swing joints shall conform to all requirements of ASTM D3139.
- G. Sleeves required for main and lateral lines located under paving shall be Schedule 40 PVC, with the inside diameter (I.D.) of sleeve to be twice the outside diameter (O.D.) of the insert pipe, maximum 1 insert pipe per sleeve. All wiring to be in separate sleeves from piping sleeves.
- H. Sleeves under roadways (street rights-of-way, boulevards or parkways) where heavy vehicular traffic is anticipated shall be ductile iron pipe, with the inside diameter (I.D.) of the sleeve shall be at least 1 inch greater than the outside diameter (O.D.) of the total inserted pipes. All wiring shall be in separate conduit sleeve within the iron pipe.
- I. Use Teflon tape on all threaded fittings (3 wraps minimum).
- J. Primer shall be Weld-On P70 (purple in color) and glue shall be Weld-On 711 (gray in color) or Owner approved equals.

#### 2.04 Automatic Irrigation Controller Assembly:

- A. Hybrid type controller that combines electromechanical and microprocessor based circuitry capable of fully automatic and manual operation. Station timing: 1-120 minutes in 1-minute increments, and 2-12 hours in 10-minute increments. Input: 117 volt AC, 60HZ. Output: 26.5 Volt AC, 1.5 amps. Controller shall have an integral circuit breaker or fuse. Controller shall have four master valve/pump start circuits. Controller shall have remote operation capability.
  - 1. Controller shall be equipped with an ESP Receiver Card with antenna and a TRC
  - 2. Duplex receptacle, LEV5280-W.
  - 3. Controller shall include terminal strip for 24-volt wires.
  - 4. Controller shall be Rainbird ESP24SATL Controller (24 station). Controller to be assembled as shown and specified in drawings.
- B. Controller - General Conditions:
  - 1. Controller shall be hard wired in conduit. All conduits are to be UL approved electrical conduit minimum size 1 1/2-inch diameter, 18-inch deep minimum.
  - 2. Communication cable shall be the type recommended by the irrigation controller manufacturer. No splices in the communication cable will be allowed unless approved in writing by Owner's Representative.
  - 3. All controllers and sensor decoders shall be grounded. The Contractor shall be responsible for the installation of the cellular telephone units in



conjunction with the controller, except as directed by the Owner's Representative at locations where a hard wire connection is possible.

- C. Pulse Decoder, Output Decoder and accessory control equipment shall be manufactured by Rainbird.

2.05 Pop-up Sprinkler Heads:

- A. All heads shall have a built-in pressure-regulating device. The device shall regulate nozzle pressure to the design pressure. The pressure-regulating device shall be an internal part of the pop-up stem.
- B. The heads shall have matched precipitation rate nozzles with adjusting screws.
- C. All heads shall have screens under the nozzles.
- D. The heads shall be equipped with check valves to prevent low head drainage. The check valves shall hold back pressures equivalent to 10 feet of head.
- E. The heads shall be of types, manufacture and sizes shown on the Plans and Details.

2.06 Automatic Control Valves:

- A. Valves shall be of all brass construction or iron body, bronze-mounted, globe pattern. The valve pressure rating shall be 150 psi min. All connections shall be SCH 80 pipe, threaded.
- B. Valves shall be electrically operated, actuated by a solenoid utilizing AC current, 24 volts, and rated at not more than 8.5 VA with an in-rush maximum of 1.0 amp. The solenoid coil is to be sealed in an "Epoxy" material so it is completely waterproof.
- C. Operation of all valves shall be normally closed solenoid control capable of operating within minimum flow requirements.
- D. Diaphragm operated of one-piece construction. The diaphragm shall be fully pressure balanced in both the open and closed positions.
- E. Solenoid shall be mounted directly on the valve or bonnet. All parts and tubing downstream of the entrance shall be of larger size to permit passage of foreign particles.
- F. A flow adjustment stem with cross handle shall be provided that limits the travel of the valve plug from full closed to full open, allowing manual closure or flow regulation. A manual control shall be provided for operation with or without the control wiring installed.
- G. Construction shall be so that all operating parts are accessible and removable from the top by removing the bonnet without having to disconnect the valve body from the pipeline. The valve shall be capable of being operated in any position.
- H. Valves shall be of types, manufacture and sizes as shown on the drawings.

2.07 Control Wire for Automatic Control Valves:

- A. Control wire shall be insulated single strand copper designed for twenty (20) to fifty (50) volts and UL approved as Type U.F. (Underground Feeder). The UL and U.F. designations shall be clearly marked or indented on the insulation jacket of the wire.
- B. Looped wires shall be provided within four (4) feet of each wire connection to



solenoid. Control wires shall also be snaked underneath mainlines to allow "slack" in the lines.

- C. White (common), black (lead) and orange (spare) colored wires shall be used.
- D. The master valve shall be installed with separate power and common wires which shall be different colors than the other control wires. The wire colors shall be blue (power) and yellow (common).
- E. Copper conductors must meet or exceed ASTM B-3 requirements.
- F. One spare wire (orange) for each 4 zones is required unless otherwise shown on the Drawings. For clarification; Zones 1 to 4 require one spare wire, Zones 5 to 8 require an additional spare wire, Zones 9 to 12 require an additional spare wire, etc. The spare wire(s) shall be installed to the farthest valve(s) location(s) from the controller. Loop the spare wires in each valve box.

2.08 Quick Coupling Valves:

- A. Shall be one inch (1"), all brass, and one or two piece bodies, with locking brass tops and have brass swing joints as shown in the Details.
- B. Quick coupler valve for use of compressed air for winterizing shall be 1" all brass, two piece bodies with locking brass tops.
- C. Shall be of the type, manufacture and size shown on the drawings. All quick coupling valves shall be installed in a 10" diameter valve box as shown in the Details.

2.09 Manual Valves:

- A. Gate valves 2" and larger shall be flanged, iron body, brass trimmed, resilient double disc wedge, and integral taper seats with non-rising stem and square actuator. All gate valves shall be Class 150 with a minimum 150 psi - 300 WOG. Red and White or approved equal.
- B. Curb Valves one and one half inches (1-1/2") and smaller shall be all bronze construction with 'tee' handle, 175 psi water working pressure, Mueller Oriseal Mark II, Red and White or approved equal.
- C. Stop and Waste Valves shall be all bronze construction, 175 psi water working pressure, Mueller Oriseal Mark II, or equal.
- D. Drain valves and Gate valves shall be of types, manufacture and sizes as shown on the Plans and Details.

2.10 Master Valves/Flow Sensors:

- A. Master Control Valve:
  - 1. The master control valve shall be a normally closed electric solenoid actuated valve. The valve shall have an NPT inlet and outlet. The valve shall be capable of working at pressures of up to 150 psi.
  - 2. The master control valve shall meet all of the requirements for Automatic Control Valves with the exception of that noted above.
  - 3. The master control valve shall also be of the type, manufacture and size shown on the Drawings.
  - 4. The master control valve shall be installed with separate power and



common wires as described in 2.07 (D) above.

B. Flow Sensor:

1. The thermoplastic flow sensor shall have a six bladed impeller with a proprietary, non-magnetic sensing mechanism. The transmitted signal shall be a low impedance 8 VDC square wave signal. The maximum transmitted signal distance shall be 2000 feet.
2. The flow sensor shall include a PVC schedule 80 tee fitted with a removable sensor alert.
3. The flow sensor shall be of the type, manufacture and size as shown on the Drawings and shall be Data Industries.
  - a. The Flow Sensor (Maxi) Wire shall only be PE-89 Communication Cable, as manufactured by Regency. The cable shall have 6 wire pairs. The conductors shall be 22 awg solid copper, insulated, filled and metal shielded. The outside diameter of the cable shall be 0.40 inch. No splices in the cable are acceptable. Each flow sensor shall have its own PE-89 cable.
  - b. The Output Transmitter shall be that as shown in the drawings (included in controller assembly).

2.11 Valve Boxes:

- A. Automatic control valves and individual gate valves shall be enclosed in valve boxes of HDPE or polyolefin and fibrous material (preferably recycled material) with locking lids. Extensions shall be added as required to meet grades per the Details. Automatic control valves shall read ACV, master valve boxes shall read MV, gate valves shall read GV, etc.
- B. Provide two (2) sets of all keys required for valves, valve box covers, and protective sleeve covers unless otherwise noted.
- C. Occasionally, valves may need to be installed in athletic field areas of play. In those cases valve boxes shall be installed underground with the box cover 6" below finished grade and shall have covers with a 4 inch by 4 inch by 1/8 inch thick steel locator plate attached to the top of the cover.
- D. Valve boxes shall be of the type, manufacture and size shown on the Plans and Details and/or the following:
  1. Carson 10 inch diameter round box (for drain valves, quick couplers and gate valves), green color.
  2. Carson 1220-12 with bolt down locking lid and extensions as required (for single valve only) green color.
  3. Carson 1730-18 with bolt down locking lid and extensions as required (use for two valves), green color.
  4. Backflow preventers shall be installed in a Fogtite #25-TA Concrete Vault as shown on the Plans and Details.
  5. Or, approved equals.



2.12 Backflow Prevention Devices:

Proper drainage shall be provided at all backflow prevention devices. Drainage problems shall be brought to the attention of the Owner's Representative at the time of system layout.

- A. Manufacturer must be on the "Approved Cross Connection Control Devices" list of the Washington State Department of Social and Health Services for that size device.
- B. Shall be type and size as shown on the Plans and Details.

2.13 Swing Joints:

- A. No pre-fabricated swings joint to be used unless otherwise approved by Owner's representative.
- B. Shall be of the type and size as shown in the Plans and Details

2.14 Other Supplies:

- A. Electrical tape shall be black plastic, three-quarters inch (3/4") wide and a minimum of 0.007 inches thick and the all-weather type.
- B. Teflon tape shall be used for all threaded connections. Tape shall be set back a minimum of one quarter inch (1/4") into the pipe threading.
- C. Encapsulate all splices with approved splice kit with sealant. The SPR approved Wire Splice Kit is the 3M-DBY splice kit, or approved equal.

2.15 Identification:

- A. Provide insulated 14-gauge locator wire (blue in color) for all lateral pipe as shown in the Plans and Details.
- B. Automatic Control Valves: Provide Christy's identification tags manufactured from polyurethane Behr Desopan, incorporating an integral attachment neck and reinforced attachment hole and will be capable of withstanding 180 pounds pull force. Tag shall be 2 1/4" x 2 3/4" in size. All lettering shall be hot stamped in black and capable of withstanding outdoor use. Tag color shall be yellow. Marking tag shall be double side stamp with zone valve number.

2.16 Site Restoration/Backfill Material

- A. Suitable bedding material for use around all pipes and equipment as shown on the Details, use: native topsoil with no rocks or other debris more than 1 inch diameter or common builder's sand.
- B. Turf Areas: Use 60/40 topsoil to minimum 2" depth. Hydro-seed with NW perennial-rye blend suitable for site conditions. Owner may request no-net farm grown sod to be used if project restoration occurs outside of typical growing season.
- C. Planting Area: Cover all disturbed areas within planting bed areas with organic mulch as specified on the Plans and Details.
- D. Asphalt: Restoration of asphalt surfacing where sleeves have been installed shall be made with Class "B" HMA. All new asphalt shall be compacted to a uniform



consistency that matches the existing conditions of the hard surface. Joints shall be tack sealed with oil.

- E. Concrete: Restoration of concrete hard surfaces where sleeves have been installed shall be made with min. 3000 PSI concrete. New concrete surfacing shall be finished to match existing conditions of the hard surface.

### **PART 3 - EXECUTION**

#### **3.01 Layout of Irrigation System:**

- A. Stake the sprinkler irrigation system following design shown on the Plans before the construction begins. Alterations and changes in the layout may be expected in order to conform to the ground conditions and to obtain full and adequate coverage of water. It is understood that corrective measures in the system may become necessary, but no changes or alterations in the system as planned shall be made without the prior authorization of the Owner's Representative.
- B. Contractor is responsible for taking all reasonable investigative actions and precautions when working around all utility systems.

#### **3.02 Trenching:**

- A. The contractor will save and maintain any sod from the ditches as practical and replace it after sprinkler installation. Sod shall not be displaced for more than 48 hours. Survival of the sod shall be warranted as specified.
- B. Exercise care when excavating trenches near existing mature trees. Where roots are two inches (2") and greater in diameter hand excavate and tunnel. When large roots are exposed, wrap with heavy burlap for protection and prevent excessive drying. Trenches dug by machines adjacent to trees having roots two inches (2") and less in diameter shall have the sides hand trimmed making a clean cut of the roots. Trenches having exposed tree roots shall be back-filled within twenty-four (24) hours unless adequately protected with moist burlap or canvas.
- C. The top six inches (6") of soil shall be kept separate from subsoil and shall be replaced as the top layer when backfill is made.
- D. Trenches shall be excavated for all pipe to provide the minimum depth of cover below finish grade of 24" (maximum 36") for live lines (mains), and 18" (maximum 24") for laterals and all others, no wider at any point than is necessary to lay the pipe or install equipment. Trenches shall be excavated with vertical sides. Locate outside of paved areas wherever possible.
- E. Materials unsuitable for bedding of pipe to be removed to a depth 4" below trench bottom, and replaced with suitable bedding material as directed by the Owner's Representative. Suitable bedding material shall be: excavated trench material, free from rocks, roots, sticks, debris or other sharp objects over one inch in diameter; or sand, as required.
- F. All trenches must be straight, with appropriate pipe-fittings used to allow pipe to be





- laid without undue bending and not have abrupt changes in grade.
- G. The trench bottom must be free of rocks or sharp-edged objects.
- H. The use of an underground vibratory plow or similar device to pull pipe will not be permitted.

3.03 Installation:

A. Control Wiring:

1. Place control wires in trench prior to placing pipe. Cover control wires with minimum 2" of approved backfill.
2. Control wires shall be taped together at five (5) foot intervals with black electrical tape; then this bundle shall be snaked along the bottom of the supply lines to allow for slack in the line for repairs.
3. Tie a loose 36 inches long loop in all wiring at changes of direction greater than 30 degrees. Untie all loops after all connections have been made.
4. Splices shall be permitted only at junction boxes, valve boxes, or at control equipment and never between valves or valve and controller. A minimum of 48 inches of excess conductor shall be left at all splices, terminal and control valves to facilitate inspection and future splicing. All splices must be encapsulated with sealant in approved splice kit. Splice kit shall be 3M-DBY type water-proof wire splice.
5. One unconnected spare orange control wire (one spare wire for each 4 valves) is to be run from the controller through each intermediate control valve box. Provide a forty-eight inch (48") long, loop in each box. Where control valves run in opposite directions from the controller, run a separate spare wire in each direction.
6. A schedule diagram shall be posted in the controller to facilitate the selection of the valves to be operated.
7. Location and type of monitoring of controllers shall be directed by the Owner's Representative or as shown on the Plans.
8. The control wires shall be color coded as follows:
  - Neutral or common wire – White
  - Lead-in wire – Black
  - Spare wire – Orange
9. Control wires shall be installed in 2 inch minimum PVC schedule 40 sleeve under all paved areas.
10. Flow sensor wire shall be computer interface (Maxi) wire between flow sensor and controller. Install computer-interface wire on the underside of the mainline irrigation pipe and attached in the same manner as for controller wires. The computer interface wire shall be continuous with no splices. Use combined pairs when connecting P-89 wire to flow sensor and control panel.

B. PVC Pipe and Fittings:

1. The Contractor shall exercise care in handling, loading, unloading and storing to avoid damage. The pipe and fittings shall be stored under cover,



and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat, so as not to be subject to undue bending or concentrated external load at any point. Any pipe that has been dented or damaged shall be discarded until such damage has been cut out and the pipe is rejoined with a coupling.

2. PVC pipe ends shall be cut to ninety (90) degrees to the pipe length and cleaned of all cutting burrs prior to cementing. Use approved reaming tool. Pipe ends shall be wiped clean with a rag and wetted with PVC primer. Cement shall be applied with a light coat on the inside of the fitting and heavier coat on the outside of the pipe. Pipe shall be inserted into the fitting and given a quarter turn to seat the cement. Excess cement shall be wiped from the outside of the pipe. Joints and fittings will be tested randomly during the installation to verify these protocols are being followed. If protocol is not followed piping will be rejected. Pipe will be tested as indicated elsewhere in these specifications. Unless otherwise indicated by the Owner's Representative, no backfilling will be permitted until the pressure test is completed.
  3. Appropriate primer shall be used with solvent glue. Solvent welded joints shall be given at least fifteen (15) minutes set-up time before moving or handling. Pipe shall be partially center loaded to prevent arching and slipping. No water shall be permitted in pipe until a period of at least ten (10) hours has elapsed for solvent weld setting and curing.
  4. Before pressure testing, soluble weld joints shall be given at least twenty-four (24) hours curing time.
  5. No PVC pipe may be threaded or connected to a threaded fitting without an approved adapter. Use Teflon tape on all male threads.
  6. Great care must be taken to insure that the inside of the pipe is absolutely clean. Any pipe ends not being worked on must be protected and not left open.
- C. Brass Pipe and Fittings:
1. Brass pipe shall be installed in accordance with the local Plumbing Code and as shown on the Plans and Details.
  2. Teflon tape all male threads to prevent leaks and corrosion.
  3. Wrap all brass pipes with black PVC tape where they pass through grouted openings in concrete vaults.
- D. Sleeves: Trenches located under areas of existing or new paving shall have sleeves installed. Sleeves shall extend 12" beyond the pavement on each side. Trenches shall be back-filled with approved backfill material (6 inches above and 4 inches below the pipe) and compacted in layers to 95% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in firm unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place; cap and pressure test all piping under paving prior to paving work.
- E. Risers and Swing Joints:



1. All pop-up sprinkler heads and quick coupler swing joints must be constructed according to the Details.
  2. Minimum riser size shall be the pipe size of the sprinkler head.
  3. All threaded joints are to have Teflon tape (approved for PVC pipe) applied to male threads only.
  4. Risers are to be capped after installation in preparation for pressure testing.
  5. All pop-up sprinkler heads and quick couplers shall have swing joints that allow the head to be set perpendicular and flush with finish grades.
- F. Pop-up Sprinkler Heads:
1. Lateral lines shall be leak down tested and thoroughly flushed prior to head installation. Contractor will be responsible for purging and cleaning any clogged sprinkler head due to unflushed debris during the specified warranty period.
  2. Install heads as designated on the Plans and Details.
  3. Spacing of heads shall not exceed spacing shown on the Plans for any reason.
  4. Heads along curbs, walks, paving, etc. shall be placed flush or 1/2 inch below finish grade per drawings. Heads shall be placed no closer than 4 inches from paving edge.
  5. All sprinkler heads located in athletic turf areas shall be equipped with rubber covers.
  6. All heads shall be set perpendicular to finish grade unless otherwise designated on the Plans.
  7. Heads to be plumbed vertically unless otherwise approved by the Owner's representative.
- G. Automatic controllers:
1. Install irrigation controller per manufacturer's specifications and shop drawings.
  2. Electrical connection for the controller shall be provided in the irrigation controller cabinet as shown on in the Plans and Details.
  3. A laminated diagram of schedule shall be posted in the controller to facilitate the selection of the valves to be operated.
  4. Install decoders, transmitter and all control equipment in controller housing per manufacturer's specifications.
- H. Double Check Valve Back-flow Prevention Device:
1. Install the Double Check Valve Assembly in accordance with local plumbing code, and as shown on the Details.
  2. For proper maintenance, the Double Check Valve Assembly shall be located with sufficient clearance from other site features and away from traffic patterns.
  3. The Double Check Valve Assembly shall be installed in a specified and approved vault.
  4. Drain valves shall be installed in accordance with current local plumbing codes and as shown on the Details.
  5. Once installed, the DCVA must be tested.



- I. Quick Couplers: All quick coupling valves shall be installed in a 10" diameter valve box as shown in the Details.
- J. Automatic Control Valves:
  - 1. Install as shown on the Plans and Details. Provide mock-up assembly for Owner's approval prior to in-ground installation.
  - 2. Before installation of any automatic valves, the supply line must be thoroughly flushed.
  - 3. All automatic valves shall be enclosed in valve boxes with valve box extensions as required.
- K. Master Valve/Flow Sensors:
  - 1. Install per manufacturer's specifications.
  - 2. Coordinate wiring with control equipment.
- L. Backfilling:
  - 1. Backfilling shall be done when pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system for a short time before backfill, or by backfilling in the early part of the morning before the heat of the day.
  - 2. In refilling the trenches, the fill around, 4 inches below, and 6 inches above the pipe and fittings shall be suitable bedding material or sand, as required, and tamped. The remainder of the backfill shall contain no lumps or rocks larger than three inches. A three inch separation is required between all pipes when more than one pipe occupies the trench.
  - 3. All roots, rocks and surplus excavation shall be removed from the site unless otherwise directed. Any turf areas buried under ditch excavation shall be raked clean of any excavated material.
  - 4. Trenches under roads or paved areas shall be backfilled and tamped with a mechanical tamper in successive six inch (6") lifts. Paving shall be replaced to the satisfaction of the Owner's Representative.
  - 5. Before complete backfilling, all underground appurtenances including risers, valves, double check valve assembly, drain valves, and joints must remain exposed so that they can be viewed during testing and located "as-built" by the Owner's Representative. It is suggested that the Contractor partially backfill the pipe as it is laid, leaving all joints exposed; then complete backfilling later after flushing, pressure testing, inspection and "record drawing" location. The location, inspecting and testing provisions of these specifications will be strictly adhered to. If, for any reason, any part of the sprinkler system is backfilled before approved location, testing, or inspection is authorized, it must be completely uncovered and exposed until approved for backfilling by the Owner's Representative.

#### 3.04 Clean-Up:

Upon completion of operations and prior to watering, clean all adjoining areas such as paving, curbs, and lawns of debris caused by the work on this project, or any part of this project. All hard surfaced areas shall be washed clean. Daily clean up shall be required



on all areas used for circulation, parking, or other daily use.

3.05 Testing and Inspections:

A. Pressure Testing:

1. Make hydrostatic tests only in the presence of the Owner's Representative. No pipe shall be backfilled until it has been inspected, tested and approved.
2. Furnish necessary pump, gauges and all other test equipment.
3. All PVC main lines with gate (isolation) valves installed and closed shall be flushed and pressure tested with Owner present with all joints exposed to one hundred fifty (150) psi until watertight. Maximum psi loss in a thirty (30) minute test period shall be zero (0) PSI.
4. PVC lateral lines with risers installed and capped shall be run through a static pressure leak down test with Owner present. The proper procedure for a leak down test involves installing a pressure gauge with ball valve on the last swing arm of the lateral zone. The control valve shall be opened and water released into the lateral zone until fully pressurized. The leak down test will start once the control valve is closed. Maximum PSI loss allowed from the lateral line shall be five (5) within a 15 minute period. The Owner's Representative shall visually inspect all lateral lines, joints, and swing joints for leakage.
5. To be valid, all tests must be witnessed and approved by the Owner's Representative. The contractor must give the Owner's Representative forty-eight (48) hours notice prior to the anticipated date of inspection.
6. All gauges used in the testing of water pressures shall be certified correct by an independent testing laboratory immediately prior to use on the project. Gauges shall be re-tested when directed by the Owner's Representative.
7. All testing shall be approved prior to installation of irrigation heads.

B. Coverage Test:

1. Before the irrigation system will be accepted, the Contractor, in the presence of the Owner's Representative, shall perform a water coverage test for each zone of the system. Contractor to be responsible to change nozzles, etc. at discretion of Owner's Representative in order to obtain full coverage with minimum over spray. Contractor will be required to adjust and/or replace nozzles, etc. to meet this requirement. Prior to arrival of Owner's Representative, the Contractor shall accomplish the following: complete all work including balancing, adjusting the system (pressure reducing valves, flow adjustment keys, nozzles, etc.) to provide optimum coverage without fogging.
2. Notify the Owner's Representative at least forty-eight (48) hours in advance of coverage test.

C. Complete System Inspection (Punch List):

1. Upon approved completion of the Coverage Test, trenching and installation of all equipment, the Contractor shall request a Complete System Inspection of the entire irrigation system including: backfilling, irrigation



- heads, valves, valve boxes, controller and all other equipment.
- 2. From this inspection, a punch list shall be prepared by the Owner's Representative and presented to the Contractor for completion. The Owner's Representative shall give a date for completion of the punch list, not to exceed two weeks.
- 3. Notify the Owner's Representative at least forty-eight (48) hours in advance of Complete System Inspection. The Contractor shall be responsible for having a two-way communication system or sufficient personnel so that directions from the inspection areas to the controller of the system can be readily accomplished.
- D. Substantial Completion:  
Contractor shall write a letter to the Owner's Representative requesting substantial completion of the irrigation system.
- E. System Operations Orientation:
  - 1. System Operation Training Session:
    - a. A training and orientation session shall be required. The Contractor, the irrigation subcontractor and the Owner's Representative shall be present. The date and time of the session shall be subject to approval of the Owner's Representative.
    - b. The "As-Built" plans shall be reviewed and all features explained. The "As-Built" plans shall consist of red-lined corrections, notes, comments, etc. on a clean bond copy print. Any major deviations from the original design as previously approved shall be documented on the As-Built and explained at the session. All critical dimensions shall be shown. The Consultant shall review and approve the "As-Built" plans submitted and prepare "As-Built" Drawings on Mylar for archive storage.
    - c. A complete maintenance and operations manual shall be prepared by the Contractor and three copies of the manual shall be turned over to the Owner's Representative at the final inspection. The manuals shall consist of three ring binders containing: (1) catalogs of all materials used, (2) a complete parts list of all materials, (3) a written summary of all operations data including spring start-up and winterization techniques, controller programming, valve cleaning, irrigation adjustments, backflow preventer operation and any other information required to operate and maintain system, (4) two local distributors.
    - d. The controller station timing shall be set by the Owner's Representative.
  - 2. Controller Charts:
    - a. As-Built drawings shall be approved by the Owner's Representative before charts are prepared. The chart shall be a reduction of the actual As-Built Drawing prepared by the Consultant.
    - b. Chart shall be a bond copy print with a different pastel transparent color to show each separate zone. Verify that the zone number as



shown on the Controller Chart matches the number on the actual control valve identification tag.

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

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

3. The contractor shall provide the Owner's Representative with the necessary keys and/or other tools necessary to operate/drain/activate the system and spend sufficient time with the Owner's Representative to insure that the system operation/maintenance/winterizing can continue after departure of the Contractor.

F. Functional Test:

1. Functional test of the control system shall be performed and demonstrate that all parts of the control system function as specified or intended. The functional test for each new system shall consist of not less than 30 days of continuous, satisfactory operation.
2. Any materials determined to be faulty as part of the installation shall be replaced or corrected by the Contractor at his expense in a manner respective to the Plans, Details and other sections of this Specification. In the event of a system failure due to faulty installation or workmanship, the 30 day period will be repeated until testing is complete.

3.06 Physical Completion:

- A. Upon completion and approval of all tests, inspections, training, manuals, as-built drawings, and other requirements of this Section, the Owner's Representative shall write a letter to the Contractor transferring the project to the Owner's Maintenance and Operation personnel.
- B. Physical Completion of the system will be contingent upon Contractor providing signed and approved irrigation/plumbing/health/electrical permits as may be applicable.

3.07 Guarantee:

- A. Contractor shall submit a written guarantee, in approved form, stating that all work showing defects in materials or workmanship will be repaired or replaced at no cost to the Owner's Representative for a period of one year from date of Substantial Completion.
- B. A final site meeting shall take place eleven months after the date of Substantial Completion. The system shall be examined by the Owner's Representative to determine if the system requires alterations or replacements covered in the Guarantee.

**END, SECTION 02810**