SECTION 32 8400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a complete working and tested automatic sprinkler irrigation system for planting areas of the site.

B. Existing and preserved landscape and hardscape areas disturbed shall be restored to original or better condition.

C. Related Requirements:

1. Section 31 2000 – Earthwork
2. Section 32 9113 – Soil Preparation
3. Section 32 9200 – Turf and Grasses
4. Section 32 9300 – Plants
5. Division 16 0000 – Electrical

1.2 SYSTEM DESCRIPTION

A. Design of irrigation components: Locations of irrigation components on Construction Drawings may be approximate. Piping, sleeving and/or other components shown on Construction drawings may be shown schematically for graphic clarity and demonstration of component groupings and separations. Irrigation components shall be placed in landscaped areas, with the exception of pipe and wire in sleeving under hardscapes.

B. Construction requirements: Actual placement may vary as required to achieve a minimum of 100% coverage without overspray onto hardscape, buildings or other features.

C. Layout of Irrigation Components: During layout and staking, consult with Consultant to verify proper placement of irrigation components and to provide Contractor recommendations for changes, where revisions may be advisable. Small or minor adjustments to system layout are permissible to avoid existing field obstructions such as utility boxes or street light poles. Place remote control valves in groups as practical to economize on quantity of valve clusters. Quick coupler valves shall be placed with valve groups as shown on plans.

1.3 DEFINTIONS

A. Water Supply: Piping and components furnished and installed

B. to provide irrigation water to the Project. Including but not limited to nipples, spools, shut off valves, corporation stop valves, water meters, pressure regulation valves, and piping upstream of (or prior to) the Point of Connection.

C. Point of Connection: Location where the Work ties into the water supply. May require nipples, spools, isolation valves, meter, back flow device, flow sensor, or stop and waste valve for landscape irrigation needs and use.

D. Main line piping: Pressurized piping downstream of the Point of Connection to provide water to remote control valves and quick couplers. Normally under constant pressure.

E. Lateral line piping: Circuit piping downstream of remote control valves to provide water to sprinkler heads, drip systems or bubblers.

1.4 REFERENCES

A. The following documents or standards will apply to the work of this Section:

1. ASTM – American Society for Testing and Materials
2. IA – The Irrigation Association: Main BMP Document.
3. ASIC – American Society of Irrigation Consultants: ASIC Grounding Guideline.

1.5 CONTRACTOR QUALIFICATIONS

A. Provide document or resume including at least the following items:

1. That Contractor has been installing sprinklers on commercial projects for ten previous consecutive years.
2. Contractor is licensed to perform landscape construction in the State of Utah.
3. Contractor is bondable for the work to be performed.
4. References of five projects of similar size and scope completed within the last ten years. Three of the projects listed shall be local.
5. Project On-site Foreman or Supervisor has at least five consecutive years of commercial irrigation Installation experience.

    a. Project Foreman shall be a current Certified Irrigation Contractor in good standing as set forth by the Irrigation Association.
    b. Project Foreman shall be on Project site 100% of each working day.

6. Provide evidence that Contractor currently employs workers in sufficient quantities to complete Project within time limits that are established by the Contract.
7. Provide list of employees to be assigned to this Project and their irrigation installation experience.

B. Certifications: General laborers or workers on the Project shall be previously trained and familiar with sprinkler installation and have a minimum of one-year experience. Those workers performing tasks related to PVC pipe and electrical components shall have certificates designated below:

1. Certified Irrigation Contractor.
2. Workers engaged in handling, assembling and gluing of PVC pipe shall carry on Project site a Certificate of Training from the IPS factory representative authorizing said worker to prime and glue PVC pipe. (Contact Bill Godwin, G & S Sales, 801-972-0659).

3. Workers engaged in the handling and installation of buried power wire, remote control valve wire, wire connectors, controllers and grounding equipment shall carry on Project site a Certificate of Training from Paige Wire factory representative authorizing said worker to install wire, wire connectors and grounding equipment. (Contact Vince Nolletti, Vice President Irrigation Operations, Paige Electric Co., LP, 559-431-2346).
4. Workers engaged in the installation of irrigation pipe which is assembled using joint restraint fittings, shall carry on project site; a Certificate of Training from authorized representative of Ductile Iron Fitting Manufacturer, (HARCO, Leemco, or approved equal) indicating:

    a. Contractor firm has been adequately trained in installation of joint restraints to replace thrust blocking.
    b. Authorizing said worker to install Ductile Iron fittings, joint restraints, isolation line valves, manifold isolation valves.

5. Documents verifying Certified Irrigation Contractor, PVC Pipe Certification, Electrical Component Certification, and Joint Restraint Systems shall be provided to Consultant at least 30 days in advance of irrigation installation on project site.

1.6 SUBMITTALS

A. Materials: At least thirty (30) days prior to ordering of materials, provide manufacturer catalog cut sheet and current printed specifications for each element or component of the irrigation system.

1. Submittals shall be in electronic format, on DVD or CD, as Adobe PDF documents.
2. Provide three copies of submittals to Consultant. No material shall be ordered, delivered or work preceded in the field until the required submittals have been reviewed in its entirety and stamped approved.
3. Delivered material shall match the approved samples.
4. Substitutions: Use only materials and equipment that matches existing materials and equipment that are being replaced. No substitutions of materials will be approved on the sprinkler irrigation system!

B. Operation and Maintenance Manual: At least thirty (30) days prior to final inspection, provide Operation and Maintenance manual to Consultant, in Adobe PDF format, containing:

1. Manufacturer catalog cut sheet and current printed specifications for each element or component of the irrigation system.
2. Parts list for each operating element of the system.
3. Manufacturer printed literature on operation and maintenance of operating elements of the system.
4. Section listing instructions for overall system operation and maintenance. Include directions for Spring Start-up and Winterization.

C. Owner’s instruction: After system is installed, inspected and approved, instruct Owner in complete operation and maintenance procedures. Coordinate instruction with references to previously submitted Operation and Maintenance Manual.

1. Provide adequate notice to Owner for scheduling.

D. Materials to be furnished: The following items shall be supplied as part of this contract and shall be turned over to Owner at Final Inspection.

1. Two (2) special tools / wrenches for disassembly and adjustment of each type of irrigation equipment/heads installed that require such special tools/wrenches.
2. Two keys for each type of automatic controller.
3. One valve box cover key.
4. Documentation of Water Department's inspection and acceptance of backflow device and flow sensor.

E. Project Record Copy:

1. Maintain at project site one copy of project documents clearly marked "Project Record Copy". Mark deviation in material installation on Construction drawings. Maintain and update drawing at least weekly. Project Record Copy to be available to Consultant on demand.
2. Completed Project As-built Drawings:

    a. Prior to final inspection, prepare and submit to Consultant accurate as-built drawings.
    b. Show detail and dimension changes made during installation. Show significant details and dimensions that were not shown in original Contract Documents.
    c. Field dimension locations of sleeving, points of connection, main line piping, wiring runs not contained in main line pipe trenches, valves and valve boxes, quick coupler valves, color of hot and spare wires – splice boxes, and the size of underground piping, valves, and drains.

        1) Dimensions are to be taken from permanent constructed surfaces, features or finished edges located at or above finished grade.

3. Provide a GPS coordinate location for each of the following items: point of connection, water meter, backflow device, isolation valves, control valves, gate valves, filters, quick coupling valves, controller, flow meters, manual drain valves, and other pertinent component of the irrigation system. Provide coordinates on as built drawings and recorded on a CD in WR format.

F. Controller map: Upon completion of system, place in each controller, a color-coded copy of the area that controller services; indicating zone number, type of plant material and location on project that zone services. Laminate map with heat shrink clear plastic.

1.7 INSPECTIONS

A. Inspections will be required for:

1. Hydrostatic test of irrigation main line.
2. Continuity test of spare wires from controller to last valve with Consultant.
3. Piping system layout before backfilling.
4. Mechanical joints and joint restraints before backfilling.
5. Coverage test.
6. Final inspection / Start of Maintenance.

7. Final inspection.

B. Inspection Requests: Notify the Consultant a minimum of 48 hours (two working days) in advance for inspections.

C. Closing in Uninspected Work: No work of this section shall be covered up or enclosed until it has been inspected and tested as required, and the work approved by Consultant.

1.8 WORKMANSHIP AND MATERIALS

A. It is the intent of this specification that material specified and shown on the construction documents shall be of the highest quality available and meeting the requirements specified.

B. Work shall be performed in accordance with the best standards of practice relating to the trade.

1.9 DELIVERY – STORAGE - HANDLING

A. During delivery, installation and storage of materials for Project, materials shall be protected from contamination, damage, vandalism and prolonged exposure to sunlight. Material stored at Project site shall be neatly organized in a compact arrangement and storage shall not disrupt Owner or other trades on Project site. Material to be installed shall be handled with care to avoid breakage or damage. Damaged materials shall be replaced with new at Contractor's expense.

1.10 GUARANTEE/WARRANTY

A. Obtain in the Owner's name the standard written manufacturer's guarantee of materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. Guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.

B. Provide one-year warranty. Warranty shall cover materials, workmanship and labor. Warranty shall include filling and or repairing depressions or replacing turf or other plantings due to settlement of irrigation trenches or irrigation system elements. Valve boxes, sprinklers or other components settled from original finish grade shall be restored to proper grade. Irrigation system shall have been adjusted to provide proper, adequate coverage of irrigated areas.

1.11 MAINTENANCE

A. Provide the following services:

1. Winterize entire irrigation system installed under this contract.
2. Winterize by 'blow-out' method using compressed air. Compressor shall be capable of minimum of 175 CFM. This operation shall occur at the end of first growing season after need for plant irrigation but prior to freezing. Compressor shall be capable of evacuating system of water from main line pipe and lateral line pipe.

a. Retrofit compressor with adjustable pressure regulation device. Compressor shall be regulated to not more than 60 PSI.

3. Start-up system the following spring after danger of freezing has passed. Train Owner's Representative in proper start-up and winterization procedure.
4. Check coverage and adjust as necessary.

PART 2 - PRODUCTS

2.1 GENERAL

A. Discrepancies between existing site conditions and those indicated on the plans shall be called to the attention of the Consultant prior to continuance of the project.

B. If there is an existing sprinkler irrigation system on the site, remove lines being abandoned, and cap or plug the ends of lines remaining in service with proper fittings and joint restraint systems. Remove or relocate existing heads and/or connect new lines to existing lines, as indicated on the plans. Existing heads or other hardware so removed, which are not to be relocated, will be returned directly to the Owner.

C. Existing head, valve, valve marker, valve box, or other existing equipment located where there will be a grade or surface material change, shall be adjusted up or down to its proper position in relation to the new finished grade, at no additional cost to the owner, unless the plans show it to be relocated.

2.2 PIPE AND FITTINGS

A. General: Polyvinyl Chloride Schedule 40 Pipe and Fittings. This specification covers requirements for Schedule 40 PVC pipe and fittings made from Type 1 Polyvinyl Chloride.

1. Materials: Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1 Polyvinyl Chloride, as outlined in ASTM D-1684. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.

a. PVC Type 1, Grade 1 pipe compound shall have a 2000 P.S.I. design stress at 74 degrees F., which is listed by the Plastic Pipe Institute (PPI). Materials, from which pipe and fittings are manufactured, shall have been tested and approved for conveying potable water by the National Sanitation Foundation Testing Laboratory (NSF).

B. Pipe: Pipe used on the project for the sprinkler irrigation system shall conform to the requirements of ASTM D-1685. DWV PVC pipe shall not be allowed.

1. Pipe, 3 inches diameter and smaller, shall be schedule 40 PVC.
2. Pipe, 4 inches diameter and larger shall be PVC Class 200 0-ring pipe.

3. 3-inch and larger pipe shall have gasketed ductile iron, HARCO, Leemco or approved equal (hereafter referred to only as Ductile Iron) type fittings with transition gaskets if needed, at changes of direction tees, ells, caps, etc.
4. Ductile Iron type fittings may have bolted end flanges and be wrapped in plastic. Bolts and nuts to be greased prior to assembly. Contractor exercising this option shall submit for approval to deviate from shown plan details.
5. No bends other than very gradual in pipe shall be permitted. Use Ductile Iron elbow fittings of 90 and 45 degrees as the situations demand.

C. Fittings:

1. Fittings: Fittings used on the project for the sprinkler irrigation system shall conform to the requirements of ASTM D-2466.

    a. Solvent weld fittings on PVC lateral lines shall be schedule 40.
    b. Solvent weld fittings on PVC main lines shall be schedule 80.
    c. Ductile Iron tees with swivel type connections and integral fitting angle valves shall be used for transition from mainline pipe to manifold construction.
    d. Ductile Iron fittings shall include Joint Restraints at each fitting.
    e. Ductile Iron fittings shall come from a manufacturer offering a 10-year warranty on products and replacement labor costs. Prior to install, provide Consultant documentation from the manufacturer shall provide documentation stating the above warranty information, including the labor reimbursement hourly rate.
    f. Ductile iron fittings and joint restraints shall have a fusion bonded epoxy coating on interior and exterior of the product surface, average of 10-12mm thickness. Epoxy coating shall conform to the requirements of CSA Z245.20-20 and NSF 61 for water services. Tar/bitumen coating will not be approved.
    g. Bolts used in fittings to be stainless steel.

D. Sleeves:

1. Sleeves shall be installed for irrigation pipe and wire under non-soil areas and where noted on the Drawings.
2. Minimum cover over sleeves shall be 18 inches except as noted otherwise.
3. Sleeve sizes shall be at least twice the nominal size of the pipe and wires, and a minimum of 4 inches.
4. Wires shall be sleeved separately within their own sleeve.
5. Sleeves shall be PVC Schedule 40 pipe.

2.3 VALVES AND VALVE BOXES

A. Valves:

1. Provide adequate material for the connection of valves to the system, i.e., adapters, flanges, nuts, bolts, gaskets, etc.
2. Main line or Isolation Gate Valves: Shall be Gate Valves.

    a. Mainline valves shall be resilient wedge and conform to AWWA C153 standards.
    b. Material shall be ductile iron per ASTM A-536, Grade 65-45-12. Epoxy coating on interior and exterior surfaces shall be fusion bonded epoxy, 12-14 mil thickness.

The epoxy coating shall pass 90-Day immersion tests per CSA Z245.20-98. Tar/bitumen coating will not be approved.

c. Gate valves shall be available flange X flange models to mechanically connect to fittings or plastic pipe.
d. Gate valves shall have flange X push-on adapters with joint restraints, to connect to piping.
e. Valve bell end shall be deep bell, gasket and equipped with cast joint restraint clamps to securely fasten to plastic pipe. Restraints shall have blunt cast serrations. Machined threaded restraints will not be allowed.
f. Valves shall have a shroud around the 2" operating nut to accept IPS PVC sleeve which provides dirt-free access to actuate the valve.
g. Mainline valves shall be manufactured by Leemco or approved equal.
h. Mainline isolation gate valves shall be of the same manufacturer and shall provide a 10-year warranty on products and replacement labor costs. Prior to install, provide Consultant documentation from the manufacturer shall provide documentation stating the above warranty information, including the labor reimbursement hourly rate.

3. Manifold or RCV Isolation Valves: Shall be angle type.

a. Shall be epoxy coated cast iron.
b. Shall be same size as the largest lateral pipe they supply.
c. Shall connect to the main line pipe via a Ductile Iron Lateral Tee.
d. Lateral to mainline connection shall be made with ductile iron, resilient seated angle valve.
e. Valve body and restraint clamps shall be constructed of ductile iron per ASTM A-536, Grade 65-45-12.
f. Epoxy coating on interior and exterior surfaces shall be fusion bonded epoxy, 10-12 mil thickness.
g. Valve mechanism and hardware shall be made of 100% 304 stainless steel. The valve stem shall be fine threaded stainless steel, O-Ring sealed for ease of operation.
h. Valve connection to the mainline fitting shall be spigot x bell, mechanically attached and swivel about the base 360 degrees to allow positioning of valve outlet to desired direction.
i. Valve outlet shall be deep bell, gasket and equipped with integrally cast joint restraint clamps to securely fasten pipe to the valve. Restraint shall have blunt cast serrations. Machined threaded restraints will not be allowed.
j. Swivel style extensions shall be stackable.
k. Valve shall have a shroud around the valve stem to accept IPS PVC sleeve.
l. Lateral to mainline transitions shall be as manufactured by Leemco or approved equal.

4. Quick Coupler Valves: Quick coupler valves shall be installed where specified on the plans. Each valve shall be heavy duty brass, two-piece, single lug locking cap. Each valve shall also be teed off the supply line with at least 24 inches of galvanized iron pipe and fittings from that point up shall be galvanized iron. A heavy-duty ball manual valve shall be installed upstream from each quick coupler or group of quick couplers on one supply line for water shut-off and maintenance.

a. Quick coupler valves shall be installed within a 10" round bolt-down box with tee lid unless next to concrete pad, then install to grade.
b. Provide to the Owner at least 1 cap lock key and 1 quick-coupler key with a swivel hose bib attached. These keys shall be delivered prior to final acceptance of the project.

5. Control Valves: Control valves shall be installed as specified by the plans. Each valve shall be plastic globe diaphragm and electrically activated as specified on the plans. No valve shall be installed more than 12 inches below finished grade. Pipe on the control valve manifolds shall be Schedule 80 PVC pipe.
6. Manual Drain Valves: Manual drain valves shall be required at low points in the main lines. See plans, notes, and details.

a. Manual drains shall be heavy-duty brass, ball valves.
b. The location of each manual drain shall be shown on the "as built" drawing with dimensions from the nearest permanent fixture, such as a building corner, etc.

7. Automatic Drain Valves: Automatic drain valves shall not be allowed on this project.

B. Valve Boxes:

1. Main line buried gate valves shall be fitted with a 6" minimum diameter pipe sleeve and 10" round valve box, tee lid with stainless steel bolt. Install a quick coupler just downstream of each gate isolation valve, for blow out purposes.
2. Control Valve Boxes: Control valves shall be housed in a standard or jumbo series heavy-duty plastic valve box, with a tee top, bolt-down lid, using stainless steel bolts.

C. Valve Assembly Marking

1. Valve assembly and valve box must be permanently marked with the appropriate controller station number. Marking must be done in a manner which allows replacement of component parts without loss of marking.

2.4 BACKFLOW PREVENTION DEVICE

A. Assembly:

1. The reduced pressure zone assembly shall consist of two independently operating, spring loaded, “Y” pattern check valves and one hydraulically dependent differential relief valve.
2. The assembly shall automatically reduce the pressure in the “zone” between the check valves to at least 5psi lower than inlet pressure. Should the differential between the upstream and the zone of the unit drop to 2psi, the differential relief valve shall open and maintain the proper differential.

B. Materials:

1. Mainline valve body and caps including relief valve body and cover shall be Lead Free* cast copper silicon alloy.
2. Check valve moving member shall be center stem guided.

3. Hydraulic sensing passages shall be internally located within the mainline and relief valve bodies and relief valve cover.
4. Diaphragm to seat area ratio shall be 10:1 minimum.
5. Relief valve shall have a removable seat ring.
6. Check valve and relief valve components shall be constructed so they may be serviced without removing the valve body from the line.
7. Seat discs shall be reversible.
8. Shutoff valves and test cocks shall be full ported ball valves.

C. Rating:

1. The assembly shall be rated to 175psi (12.1 bar) working pressure and water temperature range from 32°F to 140°F (0ºC - 60ºC).
2. The Lead Free* Reduced Pressure Zone Assemblies shall comply with state codes and standards, where applicable, requiring reduced lead content.
3. The assembly shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C511; CSA Standard B64.4; and approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.

2.5 IRRIGATION HEADS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up Spray Sprinklers:

1. Description:

a. Body Material: ABS.
b. Nozzle: ABS.
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.
e. Pattern: Fixed, with flow adjustment.
f. Flow: As indicated by model.
g. Pop-up Height: As indicated by model.
h. Arc: As indicated by model.
i. Radius: As indicated by model.
j. Inlet: NPS 1/2 or NPS 3/4.

C. Plastic Shrub Sprinklers:

1. Description:

a. Body Material: ABS or other plastic.
b. Pattern: Fixed, with flow adjustment.

2. Capacities and Characteristics:

a. Flow: As indicated by model.
b. Arc: Full circle.

c. Radius: As indicated by model.
d. Inlet: NPS 1/2 or NPS 3/4.

2.6 ELECTRICAL MATERIALS

A. Conduit:

1. Conduits below grade shall be schedule 40 PVC of sufficient size to carry proposed wiring.
2. Conduit above grade shall be galvanized steel.
3. Low voltage (24 V) wiring shall be provided with a separate conduit/sleeve from both high voltage wiring (110/120 volt and higher) and the irrigation mainline sleeve.

B. Control Wires: Conventional irrigation control wire shall bear approval as UF/UL PE type of underground feeder and each conductor shall be of electrical conductivity grade copper in accordance with ASTM-30.

1. Control wire shall be specifically designed for direct burial use.
2. Sizes shall be #14 Paige PE RCV control wire or approved equal for conventional controllers.
3. Sizes shall be #14 gauge Paige Maxi wire or approved equal for decoder wire.
4. A minimum loop of 24 inches shall be left at each valve, at each splice, and at each controller for expansion and/or servicing of the wire.
5. Splices shall be water-tight, as specified above.
6. Wire, crossing water, attached to bridges, going under paving, or where conditions require protection, shall be housed in conduit or sleeves, out of ground conduits shall be metal rigid conduit. Buried conduit can be gray PVC conduit. (See next line item)
7. Decoder wire shall be encased in 1” HDPE poly irrigation pipe, 100 PSI, SDR 15, ASTM D2239/PE 3408, Centennial Cenflo or approved equal.
8. HDPE pipe ends shall terminate within the controller, a valve box, or a pull box. Pull boxes shall be ‘Standard’ size valve boxes, gray in color, and shall not exceed 300’ in distance. ‘SP’ shall be branded on the box lid.
9. Multiple wires in the same trenches shall be banded together at 10-foot intervals for protection. Where wires pass under paved areas, Schedule 40 PVC sleeves shall be installed prior to installation of the paving, if possible, and prior to installation of the wires. Sleeves shall be sized as follows: 1-11 wires in 1-1/4 inch pipe; 12-15 wires in 1-1/2 inch pipe; etc.
10. Common or ground wires shall be white. The pigment or color of the wires shall be integrated into the covering, rather than painted on. No aluminum wire is to be used.
11. Control wire from controller to the master valve shall be Paige Maxi Wire or approved equal. Control wire from the controller to the flow meter shall be Paige PE39 or approved equal.

2.7 CONTROLLERS

A. Automatic Controllers:

1. A valve controller of the type specified on the plans shall be mounted at eye level on the wall of the structure designated on the plans or if no structure, the controllers are to be

mounted inside a stainless steel strong box, in field applications with the necessary equipment needed to provide a complete system and operable control.

2. Interior Control Enclosures: NEMA 250, Type 12, dripproof, with locking cover and two matching keys.

    a. Body Material: Molded plastic.
    b. Mounting: Surface type for wall.

3. Control Transformer: 24-V secondary, with primary fuse.
4. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

    a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
    b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
    c. Surge Protection: Metal-oxide-varistor type on each station and primary power.

PART 3 - EXECUTION

3.1 GENERAL

A. Irrigation System Design and Water Supply

1. The sprinkler irrigation system is designed for the pressure indicated on the Drawings and is schematic only, with the intent to convey full coverage of the lawn and planting areas affected. The system must also provide the manufacturer's recommended minimum operating pressure or greater to every head while maintaining sufficient pressure to overcome the losses due to friction in the piping, fittings, and other equipment.
2. Adequate Water Supply:

    a. Perform static pressure test prior to commencement of work.
    b. Verify that proper connection is available and is of adequate size. Verify that culinary connection components may be installed as necessary. Notify Consultant in writing of problems encountered prior to proceeding.

B. Electrical Service

1. Make power connections indicated on the Drawings at interior installation location indicated.

C. Construction Staking

1. Provide the necessary staking to obtain the layout shown on the plans. The points of reference shall be the existing walks, buildings, curbs, etc. The staking shall be approved by the Consultant prior to commencing installation operations. Changes in the system which appear necessary, due to field conditions, must be called to the attention of the Consultant and approved at the time.

D. Perform site survey, research utility records, contact utility location services. Become familiar with hazards and utilities prior to work commencement. Install sleeving prior to installation of concrete, paving or other permanent site elements. Irrigation system Point of Connection components, backflow prevention, and pressure regulation devices shall be installed and operational prior to downstream components.

1. Main lines shall be thoroughly flushed of debris prior to installation of Remote Control Valves. Lateral lines shall be thoroughly flushed of debris prior to installation of sprinkler heads.
2. Be required to submit detailed Construction Schedule to Owner prior to commencement. Schedule shall be updated weekly.

E. Schedule and organize work to minimize impact on project usage during public hours. Confine work efforts to areas or zones which he can reasonably fence or protect, rather than spreading out trenching or other tasks across large areas of the site.

1. Schedule work to reduce or eliminate open trenches at the end of each work day.

F. Supply water to existing portions of the project during construction.

G. Maintain existing turf and plant material in healthy condition. Loss of turf or plant material due to neglect shall be replaced at no cost to Owner. Water to existing turf or plant material shall not be turned off for more than 48 consecutive hours.

3.2 EXISTING FIELD CONDITIONS

A. Preserve and protect existing trees, plants, structures, hardscape, and architectural elements from damage due to work in this section. In the event that damage does occur to landscaping or structures, the contractor will repair or replace damage.

B. Trenching or other work required in this section under limp spread of existing trees shall be done by hand or by other methods so as to prevent damage or harm to limbs, branches, and roots.

C. Trenching in areas where root diameter exceeds 2 inches shall be done by hand. Exposed roots of this size shall be heavily wrapped with moistened burlap to avoid scarring or excessive drying. Where trenching machine is operated in proximity to roots that are less than 2 inches, the wall of the trench shall be hand trimmed, making clean cuts through roots.

D. Trenches adjacent to or under existing trees shall be closed within 24 hours, and when this is not possible, the side of trench closest to tree or trees affected shall be covered with moistened burlap.

3.3 TRENCHING AND BACKFILLING

A. Excavation and Trenching: Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

1. Excavation work shall be as deep and as wide as will be required to safely perform the work, such as making mainline connections or forming vaults.
2. Trenches shall be deep and wide enough to provide working space for placing 2 inches of mortar sand bedding underneath new mainline pipe and fittings where the soil is rocky or gravelly.

    a. 18 to 30 inches of cover shall be placed over the top of pipe and fittings on main lines (lines which maintain a constant water pressure).
    b. Trench bottoms shall be sloped so that the pipes will gravity drain back to the main connection point or the nearest manual drain.
    c. If the existing main line is deeper than 30 inches, install a riser to a depth of 18 to 30 inches and then install the new line at the required 18-30" depth. At no time will the mainline be installed deeper than 30" unless prior approval by Consultant.

3. Trenches for lines supplying large rotors shall be deep enough to maintain a minimum of 8 to 16 inches of cover over the top of pipe and fittings. Trenches shall also be deep enough to guarantee that swing joints drain back to the lateral and supply lines. Lateral lines may be pulled by a mechanical puller provided minimum uniform depth and other applicable specifications are met.
4. Trenches for lines supplying small heads shall be deep enough to maintain a minimum of 8 to 14 inches of cover over the top of pipe and fittings. Trenches for these lines shall be a minimum of 6 inches away from walks, curbs, and of sufficient width to accommodate tees coming out sideways (horizontally) from the laterals.
5. Rocks or other debris over one inch in diameter uncovered during excavation or trenching shall be removed from the area.
6. If more than one line is required in a single trench, that trench shall be deep and wide enough to allow for at least 6 inches of separation horizontally between pipes.
7. Existing utility lines damaged during excavating or trenching shall be repaired immediately after notification of the utility owner and to his satisfaction. Should utility lines be encountered, which are not indicated on the plans, the Consultant shall be notified. The repair of damage shall be done as soon as possible by the Contractor or the utility owner, and proper compensation will be negotiated by the Owner. Such utility locations shall be noted on the "as built" drawings required before final payment of the sprinkler irrigation system contract.

B. Backfill:

1. No backfilling of trenches shall be done until the system has been inspected for proper trench depths, installation of equipment, Ductile Iron fittings with joint restraints, control wire, and location of heads by the Consultant.
2. Before trenches are backfilled, show the Consultant, the redlined "as built" drawing he has been keeping on the site, showing that changes and corresponding dimensions have been recorded where changes have been made.
3. The system shall be tested under pressure for leaks, and general operation of the equipment. It must maintain a minimum pressure of 60 P.S.I. from the main connection to the farthest head. This may be tested and certified by the Consultant. Defects disclosed by the pressurization and operation test shall be corrected before proceeding with further work.
4. Backfill under and around the lines to the center line of the pipe shall be placed in maximum layers of 6 inches and thoroughly compacted.

5. Special care shall be taken to assure complete compaction under the haunches of the pipe. Backfill compaction under the haunches of the pipe shall be compacted to the original density. Compaction requirements by mechanical compactor, i.e. jumping jack, above the pipe shall be the same as for surrounding areas.
6. No rocks larger than 1 inch in diameter, nor other debris, shall be backfilled into the trenches. Trenches shall be backfilled then saturated with water sufficiently to insure no settling of the surface after lawn is planted or sod is replaced.
7. Where trenching is done in established lawn, care will be taken to keep the trenches only as wide as is necessary to accomplish the work. The trenches shall be backfilled as specified above and then 4 inches of topsoil will be placed to bring the trench up to existing grade so that sod can be laid. The new sod shall be first grade sod per specifications of standard width and shall be laid along the trenches so as to match the existing sod. No small pieces of sod shall be used and only standard lengths shall be accepted. No sod from the construction site shall be used unless otherwise specified.

3.4 PIPE INSTALLATION

A. General:

1. Handling and unloading of pipe and fittings shall be in such a manner as to ensure delivery at the job site in a sound, undamaged condition. Pipe found to be damaged or defective in workmanship or materials shall be rejected or taken out if found installed.

B. Plastic Pipe:

1. Installation: The ends of threaded pipe shall be reamed and free of inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-1/8 times the length of the female thread receiving the pipe. The threaded pipe shall be screwed into a full length of the female thread.

C. Fittings:

1. Tees coming out of main lines or valves and other fixtures, shall be horizontal so that no weight or pressure may be exerted through the fixture on the top or bottom of the main line.
2. Tees coming out of the lateral lines for heads and other fixtures shall be horizontal so that no direct weight or pressure may be exerted through the head to the top or bottom of the lateral line. Tees on lateral lines shall also be SxSxT to the head swing joints. See detailed drawings.
3. Pipe joints shall be properly sealed with pipe dope applied to and well worked over the areas to be joined. The dope for galvanized pipe shall be a white lead and pure linseed oil mixed to be a consistency of thick paint or it may be Teflon tape.
4. Every care shall be taken during installation to prevent dirt and debris (especially rocks) from getting into the pipes.

D. Joint Restraint System

1. Ductile iron pipe fittings and mainline gate valves shall be restrained by the joint restraint system. Fittings shall require a ‘fitting to pipe restraint’ and mainline gate valves shall

require a ‘valve to pipe’ restraint. When required by manufacturer, gasket bell ends of pipe shall require a ‘pipe to pipe’ restraint.

2. Concrete thrust blocks shall not be used.
3. Joint restraints are needed on pipe sized 3” and larger, wherever the main pipe line:

    a. Changes direction at tees, angles, and crosses vertical and horizontal.
    b. Changes size at reducers.
    c. Stops at a dead-end.
    d. Valves at which thrust develops when closed.

E. Sleeves:

1. Verify sleeve locations below future hardscape. Flag existing sleeves and conduits installed by other trades.

3.5 BACKFLOW INSTALLATION

A. Install backflow assemblies at locations shown on drawings, and in compliance with state and local codes and the applicable water district or State (whichever is most restrictive).

B. Install a quick coupler just downstream of backflow device, for blow out purposes.

C. Backflow devices shall have a protective enclosure.

3.6 FLOW SENSOR/MASTER VALVE

A. Install Master Valve and Flow Sensor in high-density polymer concrete box (Old Castle Duo Mold or approved equal) sized as required to provide adequate clearance for service. Master valve and flow sensor shall be installed with unions both sides to allow for ease of maintenance and/or replacement.

3.7 VALVE AND VALVE BOX INSTALLATION

A. Valves:

1. Electric Control and Drip Control Valve Assembly:

    a. Install valve assemblies as detailed on the plans.
    b. Control valves shall be installed on a level crushed stone base. Grade of base shall be consistent throughout. Valves shall be set plumb with adjusting handle and bolts, screws and wiring accessible through the valve box opening.
    c. Adjust zone valve operation after installation using flow control device on valve.
    d. Do not install valves in areas where curbs and side walk come together or at intersection of two or more walkways.
    e. Electronic control valves shall be installed with a Harco Ductile Iron IPS Lateral Isolation valve, which is installed upstream from electronic control valve.
    f. No more than 2 control valves are to be downstream from a single lateral isolation valve.

2. Manual Drain Valves:

    a. Manual drain valves shall be required at low points in the main lines. See plans, notes, and details.
    b. Each manual drain valve will be accessed by a 2-inch PVC Schedule 40 pipe sleeve, capped by a locking valve cap with a key, enclosed within a 10" round down box top of drain sleeve to be 3" - 6" below lids.
    c. Each manual drain shall empty into a gravel sump, a minimum of 18 inches by 18 inches by 12 inches deep. The gravel shall be washed 3/4-inch rock. No pea gravel will be allowed.

3. Shut Off and Isolation Valves

    a. Mainline Isolation Valves: Install mainline isolation valves as detailed in locations shown on the drawings. Main line buried gate valves shall be fitted with a 6" minimum diameter pipe sleeve and 10" round bolt down box. Install a quick coupler just down-stream of each gate isolation valve, for blow out purposes.
    b. Ball Valves at Quick Couplers: shall be installed upstream from each quick coupler or group of quick couplers on one supply line for water shut-off and maintenance. Access ball valve with a 2" PVC sleeve-capped by a cap, within a 10" round box.
    c. Isolation valves at valve manifold: Install Harco Ductile Iron IPS Lateral Isolation Valve on mainline as detailed on the upstream side control valves, no more than 2 control valves per 1 isolation valve.

4. Quick Coupler Valves

    a. Quick coupler valves shall be installed where specified on the plans. Each valve shall also be teed off the supply line with at least 24 inches of galvanized iron pipe and fittings from that point up shall be galvanized iron. A heavy-duty ball manual valve shall be installed upstream from each quick coupler or group of quick couplers on one supply line for water shut-off and maintenance. Access ball valve with a 2" PVC sleeve-capped by a cap, within a 10" round box.
    b. Quick coupler valves shall be installed within a 10" round bolt down box unless next to concrete pad, then install to grade.

B. VALVE BOXES:

1. Control Valve Boxes: No valve box shall rest directly upon the valve or fixture associated with it. Each valve box shall be centered on the valve it covers. Each valve box shall have 6 inches of clean ¾” minus gravel placed in the bottom underneath the valve and lines to reduce the potential of mud and standing water therein.

    a. Connections made inside the box to connect wires to the valve shall be made inside a watertight connector. Each connector shall be completely sealed and water proof with a minimum 24” wire loop in each box for each wire. Wires shall be twisted together first with pliers, soldered with lead free product, wire nut placed on soldered, twisted wire, then placed in waterproof tube. Wire nuts, tubes shall not be re-used or used more than once.
    b. Splices in control wire shall also be housed in a valve box, as specified above.
    c. Valve boxes shall have at least 4 bricks, one per corner, for support.

3.8 IRRIGATION HEAD INSTALLATION:

A. General:

1. Heads shall be installed above grade to minimize washing of the topsoil and seed during the landscaping establishment period, except those which border paving or flat work. These heads shall be installed at the finished grade of the adjacent paving or flat work. Prior to final acceptance of the project, heads shall be raised or lowered to final lawn or planting grade.
2. Heads installed in existing sod shall be set at the grade of the soil.
3. Rotary pop-up heads shall be installed at final grade on double swing joints. See detailed drawings in the section following this one. Swing joints must drain by gravity back to the supply lines.
4. Pop-up, shrub spray, lawn spray, bubbler and strip spray heads shall be installed as shown in the details.

B. Bubblers:

1. Install per schedule indicated on the Drawings.
2. Install Schedule 40 SXT tee on lateral pipe for transition to swing pipe. Each tree shall have one dedicated tee, with swing pipe branching off as shown on details to irrigate root ball. Install one dedicated tee per shrub or combine two shrubs per tee as shown on details. Do not install more than two shrub bubblers per tee.
3. Install bubbler lateral pipe such that swing pipe installation from lateral to plant material shall not exceed ten feet of tubing per run.

3.9 CONTROLLER INSTALLATION

A. Controller:

1. Install and supply a plugged outlet, junction box or separate breaker to furnish power to a new controller.
2. Surge protection shall also be provided at the incoming power and low voltage power side.
3. Grounding shall be per the national electrical code and the Grounding Grid detail shown on the plans.
4. Controller installations shall include commissioning, programming and training of staff.
5. Obtain inspection approval and shall have rejected installation repaired and re-inspected at no cost to the Owner.
6. Provide conduit, wiring, and materials along with the labor necessary to make the controller operational and in compliance with local electrical codes.
7. Confirm exact location and exterior sleeving routing for control wiring with Owner.

3.10 WIRING

A. Wire Placement

1. Each wire shall be tested for continuity prior to final acceptance of the project and guaranteed to be functional. Should the Owner maintenance personnel discover a defect within 1 year afterwards, locate the problem and cause it to be repaired at his cost.
2. Control wires shall be installed in trenches 6 inches to either side of or under the pipes so that the wire is protected from damage during backfilling and maintenance operations. See detailed drawing showing the wire located in those positions.
3. Control wires not placed in the trenches by the sides or under the pipes, shall be buried 18 inches or deeper and marked on the "as built" drawings.
4. Wires shall be installed with Warning Marker tape 6” above wire to indicate locations.

B. Tracer Wire

1. Tracer Wire shall be installed with irrigation mainlines.
2. Tracer Wire shall be (for Open-Trench Installation): direct burial #12 AWG Solid (0.0808” diameter), steel core soft drawn tracer wire, 250# average tensile break load, 30 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30 Conductive Trace Wire for SID Standard Specifications Nonmetallic Pipe Installation volt rating. Color shall be “blue” for domestic water (potable) pipelines and “purple” for raw water (non-potable) pipelines. Manufactured by Copperhead Industries part number 1230-SF or approved equal.
3. Splices along the continuous run of trace wire for repair of a wire break or replacement of failed segment of wire shall use 3M Brand DBR Direct Bury Splice Kit or approved equal. Approved alternatives must securely connect two or more wires, effectively moisture seal by means of a dielectric non-hardening silicone sealant, manufacturer approved for direct burial and rated for a minimum of 50V.
4. Branch connections for laterals, turnouts, services and appurtenances shall use DryConn Direct Bury Lug Aqua or approved equal. Approved alternatives must securely connect one or two wires to the main trace wire without cutting the main trace wire, effectively moisture seal by means of a dielectric non-hardening silicone sealant, manufacturer approved for direct burial and rated for a minimum of 50V.

C. Communication Cable

1. Flow sensor communication cable from flow sensor from hydrometer to controller shall be Paige Electric PE-393 communication cable direct wired.
2. Master valve communication cable from master valve hydrometer to controller shall be 19-gauge 3 pair cable: (1) #14 AWG Red Control Wire with (1) #12 AWG White Common Ground direct wired.
3. Communication cable shall be connected to flow sensor and master valve according to manufacturer’s recommendations. Communication cable shall be run from the flow sensor at the noted points of connection and run to controller.

3.11 FINISHING AND TESTING

A. Ensure work is installed with care and best practices taken, to maximize the efficiency and uniformity of the system.

B. Before pipes are covered, contact the Consultant 24-hours in advance to inspect the system for compliance with specifications and drawings. Required changes will be made at no expense to the owner.

C. After piping, and valves are in place and connected, the pipes shall be flushed under a full head of water.

D. When installation of equipment is complete and back filling, and grading operations are complete, call for an operational test and major inspection of the sprinkler irrigation system. Notice shall be given, in writing, 3 days in advance to the Consultant so that proper scheduling can be done for those who are to attend.

E. At the appointed time, an inspection of valve boxes, controllers, gate valves, and heads shall be made. The entire system will be tested to check for pressure, operation, water coverage, and head adjustment. A list of discrepancies (punch list), shall be written within 3 days and distributed as needed. Each item on the list shall be corrected before the system will be approved by the Inspector who will notify the Consultant before payment will be made. The Contractor will be back charged for time spent by Owner and Consultants who have been brought to the site for a final inspection when the project is not ready for a final inspection.

F. The Owner may hire a third-party IA approved CLIA contractor to perform a uniformity and efficiency audit on representative portions (or the entire area) of the turf zones within the project, at the discretion of the Owner.

G. Provide one or more irrigation technicians onsite prior to the audit to perform fine tuning of zones, and during the audit to tune again zones just prior to being audited.

H. Concerns the Contractor has with installing the system per plan, which will reduce uniformity and efficiency shall be brought to the Consultant’s attention in writing immediately.

I. Following the audit, call for an operational test and major inspection of the sprinkler irrigation system. Notice shall be given, in writing, 3 days in advance to the Project Manager so that proper scheduling can be done for those who are to attend.

J. Prior to acceptance of Project by Owner, engage the controller manufacturer factory authorized service technician to commission, test, inspect, and certify the system is complete, and full operable and ready for use. Make corrections, changes, and repairs to the system at no cost to the Owner to the control system until it is in operable condition ready for acceptance and use.

3.12 CLEANING AND ADJUSTING

A. At the completion of the work, parts of the installation shall be thoroughly cleaned. Equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge that may have accumulated by the operation of the system for testing.

B. Upon completion of installation work, remove leftover materials, equipment and debris resulting from work of this section from the site in a safe and legal manner.

C. Adjust valve boxes to grade as required.

D. After completion of grading, planting, and mulching, carefully adjust irrigation heads for proper watering.

E. Each control zone shall be operated for a minimum of 15 minutes and checked for consistency of delivering water. Valves, timing devices or other mechanical or electrical components, which fail to meet manufacture's standards, shall be rejected, replaced and tested until they meet the manufacturer's standards.

3.13 GUARANTEE AND MAINTENANCE

A. Guarantee the workmanship, materials, fixtures, and equipment to be free from defects for one year after Substantial Completion has been granted.

B. In the fall of the year during the installation and guarantee period, meet with the Owner maintenance personnel on the site. Winterize the system by draining of the water and doing everything necessary to insure protection of the system until spring. Blowing out the lines by compressor shall be permitted during the one year guarantee. The individuals involved from both parties shall exchange information necessary for the eventual take-over of the system by the Owner.

C. Ensure and guarantee complete drainage of the system. In working with or connecting to an existing system, he shall guarantee compatibility in operation and drainage between the two systems.

D. With the Owner maintenance personnel, inspector, or Consultant in attendance, energize the sprinkler irrigation system again the following Spring and shall repair defects found as a result of Winter damage, improper installation, improper maintenance, defective materials or inadequate sprinkler drainage.

E. Coordinate with the landscaping sub-contractor during the entire landscaping and lawn establishment period on the use, scheduling, and maintenance of the sprinkler system.

3.14 FINAL INSPECTION

A. At the end of the guarantee period, when the lawn and landscaping have been approved, call for a final inspection of the sprinkler irrigation system. There shall be 5 days' notice given, in writing, to the Consultant, prior so that the appropriate people may attend.

B. Prior to that time, heads shall have been adjusted to their proper pattern, radii, and height. The system shall have been flushed out, checked for operation, and defects corrected. The entire system will be inspected and checked to determine if everything is in working order to be turned over to the Owner. A final list of items found in need or correction, will be made and will be corrected.

1. The Consultant will notify the Owner when they have verified that every item is acceptable.
2. Upon final acceptance of the project by the Consultant, the Owner shall assume responsibility for the system.

END OF SECTION 32 8400