

ADDENDUM NO. 1

REDBANK FIELD IMPROVEMENTS

January 31, 2020

BID #27-20

The Contract Documents govern all aspects of the project. Informal discussions held during the Pre-Bid Conference, by telephone or email are informational only. All official changes to the Contract Documents are made only by addenda. The following changes and additional information are hereby made a part of the Contract Documents.

CLARIFICATIONS

Addendum #1 provides specifications for the proposed field irrigation system noted on the plans. The contractor is to design, furnish and install an automatic sprinkler system for the graded ball field area.

The specified irrigation equipment manufacturer has been selected for compatibility with other systems operated by the Owner at its other facilities and shall be used as the basis of the bid.

Alternative manufacturers may be considered, provided contractor submits a change request form and side by side comparison of specified item and contractor requested item, to the Engineer. All items from an alternative manufacturer shall, at a minimum, meet the specifications contained within this section. The acceptance of alternatives is at the sole discretion of the Engineer. Additional costs associated with alternative manufacturers items shall be the burden of the contractor.

Prior to installation, the contractor shall submit to the Owner, a detailed plan of the proposed irrigation system showing the location of piping, valves, sprinkler heads and any other appurtenances associated with the system. The submittal shall include a manufacturer's specification sheet detailing type and performance on all equipment and supplies to be used in the construction the automatic irrigation system. The Contractor, at the Owner's request, shall provide written verification of the proposed irrigation system capacity.

AMENDMENTS TO THE CITY OF SOUTH PORTLAND CONTRACT DOCUMENTS

1. ADD Section 328400 Field Irrigation (attached)

ATTACHMENT 1

Specifications Section 328400 FIELD IRRIGATION

SECTION 328400 – FIELD IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Work to be performed under this Section shall consist of designing, furnishing all labor and materials necessary to construct a complete working and tested sprinkler irrigation system for the ball field area per all drawings and specifications.
- B. Prior to installation, the contractor shall submit to the Owner, a detailed plan of the proposed irrigation system showing the location of piping, valves, sprinkler heads and any other appurtenances associated with the system. The submittal shall include a manufacturer's specification sheet detailing type and performance on all equipment and supplies to be used in the construction the automatic irrigation system. The Contractor, at the Owner's request, shall provide written verification of the proposed irrigation system capacity.
- C. Prior to installation the Contractor will be responsible, at no cost to the Owner, to verify water pressure and flow from the proposed service line is adequate for the irrigation system. If water pressure and flows are determined to be inadequate for the operation of the automatic irrigation system or disruptive to the existing water service on the site. The Contractor will provide to the Owner, prior to acceptance, a written statement from the Portland Water District verifying that the proper backflow device has been installed.
- D. Furnish, install and test an automatic irrigation system with all appurtenances necessary to operate an automatic irrigation system within the limits shown on the utility plans.
- E. Provide As-Built drawings after the final testing and performance verification and provide operations manuals.

1.3 REFERENCES

- A. ANSI – American National Standards Institute
- B. ASIC – American Society of Irrigation Consultants: ASIC Grounding Guideline.
- C. ASSE – American Society of Sanitary Engineering: ASSE 1013, 1015: Backflow Preventers, Pressure Reducers.
- D. ASTM – American Society of Testing and Materials
- E. IA – The Irrigation Association: Main BMP Document.

- F. NFPA – National Fire Protection Association: NFPA 70 National Electrical Code.
- G. UL – Underwriters Laboratories: UL Wires and Cables.

1.4 DEFINITIONS

- A. Water Supply: Municipal and private Piping and Components furnished and installed to provide irrigation water to the Project.
- B. Point of Connection: Location where Contractor shall tie into water supply to provide irrigation water to the Project.
- C. Mainline: Pressurized piping downstream of the Point of Connection to provide water to remote control valves and quick couplers. Normally under constant pressure.
- D. Lateral Pipe: The system of pipes that provide water from the valves to the sprinkler heads or emitters.

1.5 SUBMITTALS

- A. The specified manufacturer has been selected for compatibility with other systems operated by the Owner at its other facilities and shall be used as the basis of the bid. Alternative manufacturers may be considered, provided contractor submits a change request form and side by side comparison of specified item and contractor requested item, to the Engineer. All items from an alternative manufacturer shall, at a minimum, meet the specifications contained within this section. The acceptance of alternatives is at the sole discretion of the Engineer. Additional costs associated with alternative manufacturers items shall be the burden of the contractor.
- B. Product Data: Submit manufacturer's technical data and installation instructions prior to ordering of any materials. Delivered material shall match approved submittals.
- C. Certifications: All general laborers and workers shall be previously trained and familiar with sprinkler installation, and have a minimum of one-year experience.
- D. As-Built Drawings: Submit red-lined plan layout and details illustrating field installed points of connection, controllers, mainline and lateral line locations, size, and assembly. Include type and coverage of heads, type of valves, controllers, fittings, emitters, and accessories.
- E. Operation and Maintenance Data:
 - 1. Submit instructions covering full operation, care, and maintenance of system (and controls) and manufacturer's parts catalog.
 - 2. Include year-to-year schedule showing length of time each valve is to be open to provide determined amount of water, drain procedures, cleanout features, etc.
 - 3. Instruct Owner's maintenance personnel on how to operate controller, adjust sprinkler heads and other equipment, and use special tools for adjustments.
- F. Keys:

1. Manual Valve Key: Furnish two 3 foot long valve keys to fit each type of valve assembly.
 2. Controller: Furnish two keys for each automatic controller.
- G. Tools: Furnish two sets of special tools required for removing, disassembling, and adjusting each type of valve supplied on the Project.

1.6 PERFORMANCE REQUIREMENTS

- A. All work to be performed to current standards of local governing municipality.
- B. Location of Equipment: Design locations shown on plans are approximate.
1. Adjust as necessary to avoid obstructions.
 2. Coordinate and receive approval from the owner for all installations including electrical work in the existing utility room, location of control panel and wiring, location of rain sensor and associated work.
- C. Plumbing and Electrical Permits: Plumbing and electrical permits from the City of South Portland Code office are required. The Contractor is responsible for preparing and submitting permit applications and obtaining the required permits. Permit fees will be waived.
- D. PVC Pipe: Must be stamped with certified NFS
- E. HDPE Pipe: Must be DR11 or DR13.5 rated.
- F. Drain the system at the end of each work day if work continues after November 1, or resumes before April 15. Do not permit water to remain in pipe overnight during this window.
- G. Verify and mark locations of all utilities and underground obstructions. Contractor shall contact local utility location services a minimum of 48 hours prior to the commencement of any construction.
- H. Contractor shall be responsible to obtain all necessary permits and to comply with electrical company requirements.
- I. No substitutions of materials are allowed unless approved by Owner.
- J. Record Copy: Maintain at project site one copy of plans marked "Project Record Copy". Mark any deviation in material installation or design on this copy. Maintain and update at least weekly. Use this copy to produce As-Built Drawings upon project completion.
- K. As-Built Drawings: Contractor shall record and submit an "As-Built" drawing which records actual installed conditions.
1. The As-Built Drawings shall be clearly and neatly drawn on a reproducible base of the original site and utility plans. An electronic version is acceptable.
 2. Contractor shall submit As-Built Drawings to the Engineer before work under this contract will be considered for Acceptance.

3. All components of the system shall be shown with dimensions to reference. Drawings shall be scaled no smaller than the design plans. As-Built submittal, review, and approval by the Engineer shall precede Application for Final Payment by the Contractor.

1.7 QUALITY ASSURANCE

- A. Contractor shall have considerable experience and demonstrate ability in the installation of irrigation system(s) of specified type(s) in a neat, orderly, and responsible manner in accordance with recognized standards of workmanship.
 1. Contractor shall have a minimum of five years experience in the commercial irrigation industry constructing jobs of similar size and complexity to this one.
 2. Contractor must be licensed to perform landscape construction in the state of this project.
- B. Contractor shall provide a list of five equivalent commercial irrigation system installations, performed in the last five years, providing the following information:
 1. Name and address of project
 2. Name and address of Owner
 3. Name and address of whom contract was with
- C. All work shall be performed in accordance with the best standards of practice relating to the trade.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, unload, store, and handle materials, packaging, bundling, and products in dry, weatherproof, waterproof condition in a manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism.
- B. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law.
- C. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, temperature extremes, fire, and/or jobsite damage.
- D. Damaged materials attributed to Contractor shall be replaced with new materials at Contractor's expense.

1.9 JOB SITE CONDITIONS

- A. Protection of Property: Preserve and protect all monuments, structures, existing improvements, and paved areas from damage due to work of this section. In the event damage does occur, completely repair or replace all damage to satisfaction of Owner at no additional cost to the Project or Owner.
- B. Protection and Repair of Underground Lines: Request proper utility company to stake exact location (including depth) of all underground utilities. Take whatever precautions are necessary

to protect these underground lines from damage, and, in the event damage does occur, repair all damages at no additional cost to the Project or Owner.

- C. Replacement of Paving and Curbs: Where trenches and lines cross existing roadways, paths, curbing, etc., keep damage to a minimum and restore to original condition.

1.10 WARRANTY

- A. Contractor shall provide a one year warranty that covers all material, workmanship, and labor.
 - 1. Shall include filling and/or repairing depressions or replacing turf or other plantings due to settlement of irrigation trenches or irrigation system elements.
 - 2. Shall include replacing turf or other plantings due to malfunctioning irrigation system.
 - 3. Valve boxes, sprinklers, or other components settled from original finish grade shall be restored to proper grade. Irrigation system shall be adjusted to provide proper, adequate coverage of irrigated areas.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

- A. General Information
 - 1. Provide pipe and fittings as per the specification.
 - 2. Pipe and fittings shall be comprised of components as outlined in this specification in order to meet the demands of the irrigation zones they service.
- B. Pipe and Fittings
 - 1. Material: PVC
 - 2. Pressure Pipe: SDR 21 .
 - 3. Lateral Pipe: SDR 21.
 - 4. Fittings: Sch 40 or to match pipe.
- C. Pipe and Fittings
 - 1. Material: HDPE
 - 2. Pressure Pipe: DR11, DR13.5
 - 3. Lateral Pipe: DR11, DR13.5
 - 4. Fittings: DR11, DR13.5, heat fused or electro fused
 - 5. Risers: Schedule 80, threaded.
 - 6. Sleeves: Schedule 40, minimum 3”.

2.2 AUTOMATIC CONTROLLERS

- A. Rain Bird ESP-ME 4 Station Irrigation Controller
 - 1. ESP-ME Irrigation controller specifications include but are not limited to:

- a. The controller shall be of a hybrid type that is microelectronic circuitry capable of fully automatic or manual operation.
- b. The controller shall be housed in a wall-mountable, weather resistant plastic cabinet with a key-locking cabinet door suitable for indoor or outdoor installation.
- c. The controller shall include a base unit module with 4 stations as well as three expansion slots capable of receiving expansion station modules of either three or six stations to achieve total station capacity of up to 22 stations. The controller shall accept the modules in any configuration and shall not require the installation of a three station module in order to install a 6 station module.
- d. Station run times shall range from 1 minute to 6 hours. The controller shall be set with a factory default start time of 8 AM and default run time of 10 minutes for the first 4 stations for Program A only.
- e. The controller shall have a Seasonal Adjust feature to adjust the run time for all stations from 5% to +200% in 5% increments. Seasonal Adjust can be applied to all programs simultaneously or individually.
- f. The controller shall have 4 independent programs that can have 6 different start times. The controller shall stack multiple start times in sequence to prevent hydraulic overload. All programs run consecutively.
- g. The controller shall be capable of operating two 24VAC solenoid valves per station plus a master valve or remote pump start relay. The controller shall operate on 120VAC \pm 10% at 60Hz (230VAC \pm 10% at 50Hz for international models). A master valve or pump start relay shall operate on 24VAC at 50/60Hz, Max Coil Inrush of 11VA and Max Coil Holding of 5VA.
- h. Watering day cycles shall be: By Day of the week, Odd, Even and Cyclic (Every # day). Odd, Even, and Cyclic shall support permanent days off. A day set to "Permanent Off" shall override the normal repeating schedule and when the dial is turned to the day of the week position, the display shall display the program type (odd, even, or cyclic) and the water drop below the day will show with a line through the droplet.
- i. The controller shall have an electronic diagnostic circuit breaker that shall sense a station with an electrical overload or short circuit and shall bypass that station and continue to operate all other stations. When an electrical condition exists that is preventing normal operation the red LED shall illuminate continuously and scroll a message across the LCD as to what the problem is. When an alert condition is present that is related to programming errors the red LED shall continuously blink and scroll a message.
- j. The controller shall have a 12-hour AM/PM or 24 hour military (for 50Hz models) clock with a midnight day change over. The clock shall default to the time format based upon the power detected. The controller shall have a 365-day calendar backed up against power interruptions by an internal lithium battery that will maintain date and time for approximately 10 years.
- k. The controller shall provide the user the ability to bypass the Rain Sensor for each station independently.
- l. The controller shall be equipped with Special Features (SF) that can be accessed by turning to the appropriate dial position and pressing and holding the two arrow keys simultaneously for 3 seconds. Special Features shall be included on a special features card included with the controller and shall include:
 - 1) Rain Sensor Bypass by Station
 - 2) Permanent Days Off (Odd, Even, Cyclic only)
 - 3) Store/Restore Saved Programs
 - 4) Reset to Factory Defaults

- 5) Set Inter-station Delay timing
- 6) Set Master Valve operation by Station
- 7) Total Run Time Calculator by program
- m. The controller shall offer manual watering of ALL stations or ONE station at a time. When manual watering is triggered, the unit shall ignore the status of the weather sensor (if connected) and re-enable the sensor when manual watering is completed.
- n. The controller shall display on the LCD the message NO AC to indicate to the user when AC Power is not present (only if 9 volt battery is present).
- o. The controller shall be compatible with Rain Bird's LNK WiFi Module, allowing wireless connectivity to the controller.
- p. The controller shall be compatible with Rain Bird's LIMR (Landscape Irrigation Maintenance Remote) and have a mechanism to communicate with future expansion accessories.
- r. The controller shall provide a method for the installer to save the irrigation schedule into non-volatile memory for easy recall later if unwanted schedule changes are made.
- s. The controller shall provide a method for the installer to restore the schedule to the factory fresh condition in order to start programming from a "blank" state.
- t. The controller shall provide a method to wire the controller through a 1/2", 3/4" and 1" wire conduit fitting.
- u. The controller shall have a reset button to reset the controller in the case of micro-controller "lock-up" due to power surges or frequent interruption of power to the power supply.
- v. The controller shall be upgradable to an EPA WaterSense approved smart controller without having to replace the cabinet, nor disconnect station modules.

B. Rainbird 3 Station ESP expansion module

1. Provide Rainbird 3 Station ESP Expansion Module.

2.3 CONTROL VALVES

A. Rain Bird® 150-PESB-PRS-D Electric Remote Control Valve

1. Rain Bird® 150-PESB-PRS-D electric remote control valve specifications include but are not limited to:
 - a. The valve body shall be constructed of heavy-duty glass-filled ultra-violet resistant nylon.
 - b. Diaphragm shall be of nylon reinforced nitrile rubber.
 - c. Shall be compatible with ESP-ME-decoders.
 - d. Shall contain a nylon scrubber which prevents debris build-up and clogging.
 - e. Valve can accommodate a field-installed Rain Bird® PRS-D pressure regulating module.
 - f. Shall include 1.5" (40/49) (NPT female threaded (available with BSP threads) configuration.
 - g. Operating pressure range of 20 to 200 psi (1.4 to 13.8 bar).
 - h. Operating flow rate of 5 to 200 gpm (1.14 to 45.4 m³/h; 19.2 to 757 l/m).
 - i. Shall include a 5-year trade warranty.
 - j. Shall be manufacturer by Rain Bird® Corporation.

2.4 QUICK COUPLING VALVE

A. Rain Bird® Model 7 one piece quick-coupling valve

1. Rain Bird® Model 7 one piece quick-coupling valve specifications include but are not limited to:
 - a. Shall be constructed of red brass. .
 - b. Shall be protective, self closing rubber.
 - c. Operating pressure range of 5 to 125 psi (0.3 to 8.6 bar).
 - d. Operating flow rate of 10 to 125 gpm (2.27 to 28.38 m³/h; 37.8 to 265 l/m).
 - e. Shall include a 3-year trade warranty.
 - f. Shall be manufactured by Rain Bird® Corporation.

2.5 BACKFLOW PREVENTER

A. Backflow Preventer

1. Manufacturer's standard, to suit sprinkler system as follows:
 - a. Reduced Pressure Principle Device (RP) or as approved by local jurisdiction.
 - b. Capability of being tested and serviced without removing from line.
 - c. Comply with local water district and State requirements for such.

2.6 ROTOR HEADS

A. Rain Bird® 5006-PL-PC/FC-SAM-R-SS rotor sprinkler for medium turf areas (25-47 feet (7.6-14.3 m) spacing), maximum 75 psi (5.2 bar).

1. Hunter I 25 ss Stainless Steel Rotor as manufactured by Hunter Industries, Inc.
 - a. The sprinkler shall be constructed from corrosion- and impact-resistant ABS plastic.
 - b. The sprinkler shall be equipped with a durable, stainless steel riser spring.
 - c. The sprinkler shall be available with 12 nozzle choices in flow rates from 3.8 to 31.5 GPM (0.82 to 7.24 m³/hr; 13.6 to 120.2 l/min).
 - d. The sprinkler shall be equipped with a non-strippable gear drive.
 - e. The sprinkler shall be equipped with automatic arc return.
 - f. The arc of the sprinkler shall be adjustable from 50° to 360°
 - g. The sprinkler shall be equipped with through-the-top arc adjustment.
 - h. The sprinkler shall be equipped with a QuickCheck™ arc mechanism.
 - i. The sprinkler shall be equipped with a factory-installed rubber cover.
 - j. The sprinkler shall be equipped with a standard drain check valve to hold back up to 10' (3 m) of elevation.
 - k. The sprinkler shall be available in a high-speed version.
 - l. Operating pressure range: 40 to 100 PSI (2.5 to 7.0 bar; 250 to 700 kPa).
 - m. Radius: 37' to 71' (11.9 to 21.6 m)
 - n. Precipitation rate: 0.4 in/hr (15 mm/hr) approximately
 - o. Nozzle trajectory: 25° approximately

2.7 VALVE BOX

A. Rain Bird® Valve Boxes

1. Rain Bird® valve boxes specifications include but are not limited to:
 - a. Shall be made of structural foam HPDE resin that is resistant to ultra-violet light, weather, moisture and chemical action of soils.
 - b. Lids shall be clearly marked with the words “IRRIGATION CONTROL VALVE” molded onto the top.
 - c. Lid colors are available in black, green and purple designating non-potable water use.
 - d. Shall include a 5-year trade warranty.
 - e. Shall be manufactured by Rain Bird® Corporation.

2.8 RAIN SENSOR

A. Irritrol Wireless Rain Sensor Model RS 1000

1. Furnish and install specified rain sensor. Confirm sensor location and installation details with owner.
2. Operation:
 - a. The rain sensor shall use hygroscopic fiber discs capable of expanding in the presence of moisture. These expanding discs shall have the capability of triggering a switch that interrupts the common field wire return or activates the sensor within an irrigation control product.
 - b. This “open” circuit prevents scheduled irrigation programs from initiating until the fiber discs dry and shrink, closing the switch and allowing programmed irrigation schedules to resume.
 - c. The rain sensor shall have selectable shut-off points based on inches of rainfall with increments from 1/8" to 3/4". These shut-off points may be adjusted at any time based on seasonal weather patterns or specific microclimates.
 - d. The rain sensor shall be capable of operating with any Irritrol or competitive irrigation control product that interrupts programmed irrigation cycles utilizing normally open and normally closed protocol.
 - e. The rain sensor and combination rain/freeze sensor shall have the ability to transmit a wireless signal from the rain or rain/freeze sensor to a receiver module that is wired into the controller.
 - f. The wireless signal utilizes ultra-high frequency radio and does not require FCC licensure or notification, but shall be FCC part 15 approved. The sensor/transmitter shall have the ability to broadcast this signal for a maximum distance equivalent to a line-of-sight transmission of up to 500 feet.
3. Construction:
 - a. The sensor transmitter shall be enclosed in a weather-resistant, PVC plastic case that is molded with UV inhibitors to prevent color fading and embrittlement over extended periods of time.
 - b. The sensor transmitter shall have an internal and replaceable battery that is capable of operating for a period of 3-5 years. The battery shall be of the common, readily available, non-proprietary type.
 - c. The receiver module operates on a nominal 24 V ac in operating temperatures from -40 to 120°F consistently.

- d. The receiver module shall have an 18" length of jacketed 22-gauge color-coded wire for various control product connections.
 - e. The maximum cable run from a receiver module to a controller shall not exceed limits specified by governing electrical codes.
 - f. The sensor receiver shall also be enclosed in a weather-resistant, PVC plastic case with a cover of the same material. It shall have the ability to mount directly outside of a controller, then hard-wire into the controller.
 - g. The sensor receiver shall have a removable cover to expose the signal strength reception from the sensor transmitter, low battery indication of the sensor transmitter, power on (indicating receiver function), and multi-function bypass button primarily used to mechanically override the sensor to resume normal irrigation cycles or manual operation.
 - h. The sensor receiver shall also have the ability to maintain its status following loss of power to the receiver unit. It shall also incorporate a bypass switch that has the ability to reset automatically such that the sensor receiver cannot be permanently bypassed through operator error.
4. Performance:
- a. The sensor transmitter shall be located outdoors on a roof gutter, fence or other location that enables adequate RF communication between the transmitter and receiver (located directly adjacent to an irrigation controller) of a distance not exceeding 300 feet.
 - b. Reception levels can be confirmed by reviewing the signal strength indicator on the receiver module to confirm proper functionality. Once installed the rain sensor and rain/freeze sensor shall operate automatically to interrupt and resume programmed irrigation schedules without any additional controller programming or human intervention.
 - c. The sensor modules shall also have the ability to adjust the nominal shut-off point in pre-defined increments from 1/8" to 3/4".
 - d. The receiver module shall be located directly adjacent to the.
 - e. The rain sensor or rain/freeze sensor shall have the ability to bypass or manually override the remote sensor at the receiver module. This module shall also indicate signal strength reception from the transmitter module as well as indicate when the transmitter battery requires replacement.
 - f. The rain sensor shall also have an illuminated Power LED indicating connectivity to the adjacent control product.

B. OTHER COMPONENTS

- 1. Contractor shall furnish and install all other components required for a complete, functional and tested irrigation systems. Other components include but may not be limited to:
 - a. Pipe and fittings
 - b. Service Tees
 - c. Valves
 - d. Nipples
 - e. Valve boxes
 - f. Electrical work, wire, conduit and splice boxes

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Stake pipe and equipment layout as follows:
 - 1. Mark routing of pressure supply line and flag heads for first few zones for Owner's review and approval. Owner will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement after staking.
- B. Excavate trenches for irrigation system pipe to provide minimum cover. Before excavating, establish the location of all underground utilities and obstructions. Dig trenches straight and support pipe continuously on bottom of trench. Clean trench bottom and smooth by removing all rock and organic debris.
 - 1. Minim cover over pipe shall be:
 - a. Mainline Pipe: 18 inches
 - b. Lateral Pipe: 12 Inches
 - c. Minimum clearance for crossing pipes shall be 6" clear
- C. Barricade trenches that are left open overnight.

3.2 INSTALLATION

- A. General: Plans are diagrammatic. Proceed with installation in accordance with the following:
 - 1. Install stop and waste valves, backflow preventers, and other equipment required by local authorities according to laws and regulations in order to make system complete.
 - 2. Install main line, control valves, lateral lines, fittings, and heads/drip line as specified. Avoid conflict with tree locations. Where trenching is required in proximity to trees which are to remain, do not damage roots.
 - 3. Thoroughly flush main lines before installing automatic control valves, and laterals before installing sprinklers. Flush supply lines thoroughly before installing backflow preventers or other regulating devices.
 - 4. Adjust heads to be plumb and flush with finished grades, even with top of soil level or top of material level after completion of grading, seeding or sodding, and rolling of grass areas.
 - 5. Any discrepancies between existing site conditions and those indicated on the plans shall be called to the attention of Owner prior to continuance of the project.
- B. Piping: Assemble all mainline and lateral lines in accordance with manufacturer's recommendations with no cul-de-sacs. Assure positive drainage.
 - 1. Pack the opening around the pipe with non-shrink grout at wall penetrations. Fill perimeter slot with backer rod and sealant at exterior face. Repair below grade waterproofing and make penetration watertight.
 - 2. Install PVC pipe in dry weather above 40 degrees F as specified by manufacturer's recommendations. Allow joints to cure a minimum of 8 hours before testing.
 - 3. Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.

- C. Sleeves: Install sleeves before concrete/paving work.
1. Sleeves should be a minimum two times the diameter of the pipe passing through them.
 2. Install sleeves at a maximum depth of 24" unless specific site conditions warrant differently.
 3. Use a separate sleeve for irrigation wire.
- D. Control Valves:
1. Install control valves at plan locations based on approved design plans , according to details, and in accordance with manufacturer's recommendations.
 2. Install one valve per valve box and provide 12 inches of expansion loop slack wire at all connections inside valve box.
- E. Manual Drains:
1. Install per manufacturer's recommendations on upstream and downstream side of backflow preventers and at lowest point along main pressure pipe.
 2. Install by teeing down to ¾ inch drain valve. Provide a drainage sump sized to receive volume of drain water.
 3. Make manual drain valves accessible by installing an adjustable pipe sleeve to meet finished grade with locking valve marker lid flush with finish grade.
- F. Quick-Coupling Valves: Install per manufacturers recommendations.
- G. Backflow Preventer:
1. Install assembly complete for irrigation system with 2 drain valves and 2 shut off valves per local laws and regulations, and per manufacturer's specifications.
 2. Install assemblies with drain valves in below grade installations. Provide open box floor with gravel drain sump.
- H. Valve Boxes
1. Install over all remote control valves, manual control valves, zone shutoff valves, gate valves, or globe valves. Size to provide adequate room for maintenance.
 2. Install boxes on level subgrade with proper drainage so that top of boxes are flush with finish grade material (sod, mulch, rock, etc.). Place parallel or perpendicular to adjacent curbs, sidewalks, or driveways.
 3. Imprint a valve control number on each box cover that corresponds to the valve controller in a permanent and legible manner.
 4. Place washed gravel aggregate in sump as shown on details.
- I. Automatic Controller
1. Stake controller location for approval.
 2. Install according to manufacturer's instructions.
 3. Mount the panel enclosure so adjustments can be conveniently made by operator.
 4. Properly ground controller per local laws and regulations. Make all control wire connections to automatic controller. Coordinate controller installation with other electrical work.

5. Connect remote control valves to controller in numerical sequence as shown on the approved shop drawings.
6. Program controller to provide appropriate amount of water for each station.

J. Wire and Electrical Work

1. Use electrical control and ground wire suitable for sprinkler control cable of size meeting electrical code and equipment requirements.
2. Electrical wire to be installed in conduit as shown on the plans. In locations that may not allow for conduit, low voltage wire may be installed as indicated below. .
3. Provide 120-volt power connection to automatic controller to conform to local codes, ordinances and authorities having jurisdiction.
4. Low Voltage Wiring:
 - a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of the pipe, or in separate trenches.
 - b. Bundle all 24-volt wires at 10-foot intervals and lay with pressure supply line pipe to one side of trench.
 - c. Provide an expansion loop at every pressure pipe angle and fitting and at every electric control valve location (in valve box). Form expansion loop by wrapping wire at least 8 times around a ¾-inch pipe and withdrawing pipe.
 - d. Make all splices and E.V.C. connections using connectors or similar dry splice method.
 - e. Install all control wire splices not occurring at control valve in a separate 10” splice valve box. Install a minimum of 24” of spare wire in splice boxes.
 - f. Install control wire for each control valve.
 - g. If running single strand wire, run 2 spare #14-1 wires from controller pedestal or electric control valve on each and every leg of mainline. Label spare wires at controller and wire stub box. If decoder wire used, no spare required.

K. Sprinkler Heads, Emitters, Rotators, and Rotors

1. Install per plans, details, and manufacturer’s recommendations.
2. Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.
3. Adjust nozzles to allow for adequate coverage and to minimize overspray onto walks, roads, driveways, and buildings.
4. Locate part-circle sprinklers a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries, unless otherwise indicated.
5. Stake emitter tubing with 1/4” Rainbird® TS-025 tubing stakes.
6. Adjust heads to be plumb and flush with finish grades, even with top of soil level or top of material level after completion of grading, seeding, sodding, and rolling of grass.

L. Thrust Blocks and/or Joint Restraints

1. Install on pipe sized 2” or larger wherever the main pipe line:
 - a. Changes any direction at tees, angles, and crosses vertical and horizontal.
 - b. Changes at reducers.
 - c. Stops at a dead-end.
 - d. Valves at which thrust develops when closed.

2. Size of thrust block depends on pressure, pipe size, soil type, and fitting type. As a general rule, one cubic foot (minimum) of concrete is required for each thrust block.
3. Thrust blocks shall rest against undisturbed original soil in direction of thrust.
4. Use joint restraints as manufactured by Harco or Leemco on mainline sizes 3" and greater.

3.3 BACKFILLING

- A. Do not begin backfilling operations until system tests and approvals have been completed.
- B. Bed all pipe a minimum of 2 inches. Backfill to 6 inches above pipe with soil free of rocks over 1-inch diameter, debris, or organic matter. Backfill remainder of trench with soil of like quality to adjacent areas. Haul away all material not suitable for backfill.
- C. Compact backfill in 6-inch lifts thoroughly to prevent settling damage to grades or plant material. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Low areas and damage caused by settling will be repaired by Contractor at no additional cost to the Project or Owner.
- D. Prevent soil, rocks, or debris from entering pipes or sleeves.

3.4 FLUSHING AND TESTING

- A. Flushing: After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthest valves. Cap risers after flushing.
- B. Testing: Notify Owner 48 hours in advance of all testing. Conduct tests in presence of Owner's Representative.
 1. After backfilling and installation of control valves, fill pressure supply line with water and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
 2. Leakage, Pressure Loss – Test is acceptable if no leakage or pressure loss is evident during test period.
 3. Leaks – Detect and repair all leaks.
 4. Retest system until test pressure can be maintained for duration of test.
 5. Before final acceptance, test supply line under pressure for a period of 48 hours.

3.5 INSPECTION

- A. Arrange for Owner's presence 48 hours in advance of inspection walk-through.
- B. Examine areas and conditions under which work of this section is to be performed and ensure a complete and operating installation prior to scheduling a walk-through.
- C. Operate each zone in its entirety for Owner at time of walk-through and open all valve boxes as directed.

- D. As necessary Owner will generate a list of items to be corrected prior to Final Acceptance.
- E. Furnish all materials and perform all work required to correct inadequacies of installed system.

3.6 RESTORATION AND CLEANING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.
- B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- C. Restore all damaged areas to original condition unless otherwise shown on plans at no additional cost to the Project or Owner.
- D. Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site, at no additional cost to Project or Owner, all trash or debris generated by installation of irrigation system.