

Exhibit C

IRRIGATION PERFORMANCE SPECIFICATIONS FOR DESIGN/BUILD

SECTION 02810 - IRRIGATION PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide a design build underground irrigation system for the planting areas as shown in the associated bid plans (Highland Horizon Park, Sendero Springs Park, and Pepper Rock Park, sealed 06/09/2017). The work includes:
1. Automatic irrigation system including piping, fittings, sprinkler heads, and accessories.
 2. Pressure Regulation, valves, backflow preventer(s), and fittings.
 3. Meter(s) and/or Pump(s) (if specified on Drawings).
 4. Controller(s), control wire.
 5. Testing.
 6. Excavating and backfilling irrigation system work.
 7. Associated interior and exterior plumbing, and accessories to complete the system.
 8. Pipe sleeves under pavements.

1.02 QUALITY ASSURANCE

- A. Comply with General Contract Requirements.
- B. Installer's qualifications: Installer must be a current licensed irrigator registered with the State of Texas. The irrigation industry in Texas is regulated by the Texas Commission on Environmental Quality.
- C. Materials, equipment, and methods of installation shall comply with the following codes and standards:
- National Fire Protection Association, (NFPA): National Electrical Code.
 - American Society for Testing and Materials, (ASTM).
 - National Sanitation Foundation, (NSF).
 - The Irrigation Association, (IA).
 - Texas Natural Resources Conservation Commission, (TNRCC) and all other applicable government regulations.
- D. Excavating, backfilling, and compacting operations: Comply with Section 02000 requirements and as specified.

- E. Obtain Owner's acceptance of installed and tested main line portion of irrigation system prior to installing backfill materials.

1.03 SUBMITTALS

- A. Furnish the Owner with an Irrigation Design Plan with Pressure loss calculations for all lateral sections, sealed by a License Texas Irrigator for review by the Owner's Representative.
- B. Submit manufacturer's product data and installation instructions for each of the system components.
- C. Furnish the Owner with catalogs, manufacturer's maintenance manuals and applicable warranties for all equipment.
- D. Submit the following material samples:
 - 1. Piping and fittings.
 - 2. Wire connectors and sealer.
- E. Submit the following equipment samples:
 - 1. Sprinkler heads, 1 of each type.
 - 2. Valves, and valve boxes.
 - 3. Swing joints, 1/2" I.P.S.
 - 4. Fittings.
- F. Approved equipment samples will be returned to contractor and may be used in the work.
- G. Upon irrigation system acceptance, submit written operating and maintenance instructions, including equipment manuals, points of emergency shutdown and operating schedules.
- H. Provide irrigation system record "as built" drawings:
 - 1. Legibly mark drawings to record actual construction in red.
 - 2. Indicate horizontal locations of all valves referenced to permanent surface improvements.
 - 3. Indicate routing of valve wires.
 - 4. Identify field changes with dimensions and detail and changes made by Change Order.
 - 5. Contractor shall pay for cost of mylar reproducible drawings on which to draw changes and information specified.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.
- B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.
- C. Store and handle materials to prevent damage and deterioration. Do not store P.V.C. pipe in direct sunlight.

D. The Contractor is responsible for the safe storage and security of all materials and equipment.

1.05 PROJECT CONDITIONS

A. Current irrigation water for the project is provided by a domestic potable water system.

B. Known and proposed underground and surface utility lines are indicated on the Site Utility Drawings and the Utility Surveys. Verify locations of all underground and surface utilities by reviewing the Drawings and by contacting the appropriate utility contractors and utility companies.

C. Protect existing trees, plants, lawns, and other features designated to remain as part of the final landscape work.

D. Promptly repair damage to adjacent facilities caused by irrigation system work operations. Cost of repairs at Contractor's expense.

E. Promptly notify the Owner's Representative of unexpected sub-surface conditions.

F. Exact locations of piping, sprinkler heads, valves, and other components shall be established by contractor in the field at time of installation. All piping to be installed directly behind curbs where possible. Proposed piping layout within tree drip lines will be reviewed by Owner's Representative prior to installation. Obtain Owner Representative's approval prior to installation.

1. Space sprinkler heads as designed to provide head-to-head coverage.

2. Minor adjustments in system layout will be permitted to clear existing fixed obstructions. Final system layout shall be acceptable to the Owner's Representative and/or Owner's Representative.

1.06 WARRANTY AND GUARANTEE

A. Materials and workmanship shall be fully guaranteed for one (1) year after substantial completion.

B. Backfilling of all excavation shall be guaranteed for the one (1) year guarantee period. Repair trenches which have settled.

C. Raise or lower heads to compensate for settling of lawn areas.

D. Provide a one (1) year warranty against material, installation and operation defects. Repairs, adjustments and replacement of defective irrigation system materials, including materials which have been in-stalled on the work during the warranty period shall be at Contractor's expense.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equipment Manufacturers

1. Shall be of same brand, type and compatibility as the existing irrigation system within the development, unless specifically reviewed and approved by the Owner's Representative.

B. Other acceptable manufacturers:

If contractor chooses to install alternate equipment he shall submit to Owner's Representative for review the following:

1. Equipment specifications and product literature
2. Pressure loss calculations for all lateral sections.

2.02 MATERIALS

A. General:

1. Provide only new materials, without flaws or defects and of the highest quality of their specified class and kind.
2. Comply with pipe sizes indicated in irrigation design plans. No substitution of smaller pipes will be permitted. Larger sizes may be used subject to acceptance of the Owner's Representative. Remove damaged and defective pipe.
3. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (NSF) approval.

B. Plastic pipe, fittings, and connections;

1. Polyvinyl chloride pipe: ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents.
 - a. Lateral lines, Class 200.
 - b. Mainline, Class 200.
2. PVC pipe fittings: ASTM D2241 schedule 40 PVC molded fittings suitable for solvent weld, slip joint ring tight seal, or threaded connections. Fittings made of other materials are not permitted.
 - a. Size slip fitting socket taper to permit a dry unsoftened pipe end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted.
 - b. Use male adapters for plastic to metal connections. Hand tighten male adapters plus one turn with a strap wrench.

C. Copper pipe, fittings, and connections:

1. ASTM B88 Type "L" hard tempered copper tubing. Fittings shall be 150 pound working water pressure standard, solder end type, constructed of wrought copper, bronze, or brass.
2. Joints made with tin-lead solder, approximately 50-50 composition. Thoroughly polish joints and use proper flux to provide sound joints.

D. Sprinkler heads, valves, and associated equipment:

1. To be compatible with existing community irrigation system.

E. Controls:

1. To be compatible with existing community irrigation system.

F. Electric control wire:

1. The two-wire path shall be polyethylene double-jacketed or UF-B UL PVC double-jacketed two-conductor solid core designed for direct burial.
2. The 2 conductors shall be color-coded: normally one red conductor and one black conductor. Both conductors shall be the same size.
3. The conductors shall be soft drawn, annealed, solid copper conforming to ASTM B3 (non-tinned) or ASTM B33 (tinned).
4. Conductor insulation shall be 4/64-inch (1.59 mm) thick polyvinyl chloride (PVC), conforming to UL Standard #493 for thermoplastic-insulated style UF (underground feeder), rated at 140°F (60°C).
5. The 2 insulated conductors are laid in parallel and encased in a single outer jacket of 3/64-inch (1.19 mm) thick, high-density, sunlight resistant polyethylene conforming to ICEA S-61-402 and NEMA WC5, having a minimum wall thickness of .045 inch (1.14 mm).

G. Ground Wire for Controller

1. Ground wire shall be 6 gauge uncoated copper buss wire.

2.03 ACCESSORIES

A. Drainage fill: 1/2" to 3/4" washed pea gravel.

B. Fill: Clean soil free of stones larger than 1" diameter, foreign matter, organic material, and debris.

1. Provide imported fill material as required to complete the work. Obtain rights and pay all costs for imported materials.
2. Suitable excavated materials removed to accommodate the irrigation system work may be used as fill material subject to the Owner's Representative's review and acceptance.
3. Where rock is encountered, envelope pipe and wires with 4" bed of sand.

C. Clamps: Stainless steel, worm gear hose clamps with stainless steel screws or ear type clamps.

D. Low voltage wire connectors: Scotch-Lok with #3570 Sealing Pack, DBY Splice by 3M or approved equal.

E. Valve access boxes: Tapered enclosure of rigid plastic material comprised of fibrous components chemically inert and unaffected by moisture, corrosion and temperature changes. Provide lid of same material, green in color. Provide 10" Round Valve Box for gate valves. Provide 10" Round Valve Box for wire splices. Ametek, or equal. Use "Jumbo" box and locking lid for control valves (20" x 14" cover opening), Ametek #190106, or equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected and reviewed by the Owner's Representative.

- B. This Contractor to verify existing and proposed locations of all site utilities (i.e. gas, water, electric, telephone, sanitary and storm sewers, etc.) prior to any trenching and laying of pipe. In addition, this Contractor shall coordinate all irrigation work with that of all other site work trades and contractors, as applicable.

3.02 PREPARATION

- A. Lay out and stake the location of each pipe run and all sprinkler heads and sprinkler valves. Obtain Owner's Representative acceptance of layout prior to excavating.

3.03 INSTALLATION

- A. Excavating and backfilling:

1. Excavation shall include all materials encountered, except materials that cannot be excavated by normal mechanical means.
2. Excavate trenches to sufficient depth and width to permit proper handling and installation of pipe and fittings.
3. Excavate to depths required to provide 4" depth of sand bedding for piping when rock or other unsuitable bearing material is encountered.
4. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 8" depth.
 - a. Provide approved earth fill or sand to a point 4" above the top of pipe.
 - b. Fill to within 6" of final grade with approved excavated or borrow fill materials free of lumps or rocks larger than 1" in any dimension.
 - c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.
5. Except as indicated, install irrigation mains with a minimum cover of 8" based on finished grades. Install irrigation laterals with a minimum cover of 8" based on finished grades.
6. Excavate trenches and install piping and fill during the same working day. Do not leave open trenches or partially filled trenches open overnight.

- B. Plastic pipe:

1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
2. Saw cut plastic pipe. Use a square-in-sawing vice, to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
3. Make plastic to plastic joints with solvent weld joints or slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
4. Make plastic to metal joints with plastic male adapters.
5. Make solvent weld joints in accordance with manufacturer's recommendations.
6. Allow joints to set at least 24 hours before pressure is applied to the system.

7. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.
- C. Sprinklers, fittings, valves, and accessories:
1. Install fittings, valves, sprinkler heads, risers, and accessories in accordance with manufacturer's instructions, except as otherwise indicated.
 2. Set sprinkler heads perpendicular to finished grades, except as otherwise indicated.
 3. Install spray sprinklers with Schedule 80 PVC swing joints. See details.
 4. Obtain Owner's Representative's review and acceptance of height for proposed sprinkler heads and valves prior to installation.
 5. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distances indicated.
 6. Install backflow prevention device, fittings, and accessories as shown or required to complete the system.
 7. Install the controller in the location shown on the Drawings. Controller to be compatible with existing Community Controllers. Install as per manufacturer's recommendations. Exact locations to be approved by Owner's Representative.
 - a. Provide rigid conduit from controller down into grade to accommodate valve wires.
 - b. Making final connection of valve wires to controller and programming controller by labeling station position for zones and putting controller in operation. Affix laminated plan of irrigation zones to wall near controller. Coordinate location and method with Owner's Representative.
 - c. 120V electric power source to be supplied by owner and connected to irrigation controller.
 8. Install in-ground control valves in a valve access box as indicated.
 9. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.
 10. Seal threaded connections on pressure side of control valves with teflon tape.
 11. Install rain sensor in accordance with manufacturer's recommendations. Wires shall be run in conduit, painted to match surface to which attached.
- D. Control wiring:
1. Install electric control cable in the mainline piping trenches wherever possible. Place wire in trench adjacent to pipe. Install wire with slack to allow for thermal expansion and contraction. Expansion joints in wire may be provided at 50 - foot intervals by making 5-6 turns of the wire around a piece of 1/2" pipe instead of slack. Where necessary to run wire in a separate trench, provide a minimum cover of 12". When more than one wire is placed in a trench, the wire shall be taped together at intervals of 20'.

2. Provide sufficient slack at site connections at remote control valves in control boxes, and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
3. Connect each remote control valve to one station of a controller except as otherwise indicated.
4. Connect remote control valves to a 2- wire system.
5. Make wire connections to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendations.
6. Provide sealed wire joints to prevent intrusion of moisture and corrosion buildup on the joint.
7. Extra wire: If noted on Drawings, provide extra control wires to valves indicated. These wires will be used for future extension of system.
8. The distance from the controller to the end of any one wire run shall not exceed the maximum distance specified for the gauge of wire.
9. All splices shall be made in a valve box.
10. The two-wire shall be tested before decoders are installed.

E. Sleeves Under Pavements:

1. Install Schedule 40 PVC pipe sleeves under pavements as needed. Coordinate Locations with Owner.
2. Coordinate installation of sleeves with paving and other sitework contractors and schedules.
3. Sleeves must be straight lengths without bends or obstructions.
4. Accurately mark locations of sleeves on "As-Built" Drawings.

F. Flushing, testing, and adjustment:

1. The sprinkler main and all piping under paving shall be tested for a period of twelve (12) hours under normal water pressure and proved tight. If leaks occur, the joint or joints shall be replaced and the test repeated. All laterals shall be pressure tested for a minimum of one hour.
2. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
3. Perform system testing upon completion of each section. Make necessary repairs and retest repaired sections as required.
4. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
5. All nozzling shall be checked for proper coverage. Prevailing wind conditions or plant material may indicate that arc or angle of spray should be other than as shown on

Drawings. In this case, change nozzles to provide coverage at no additional expense to Owner.

6. Adjust all electric remote control valve flow control stems and pressure regulator modules for system balance and optimum performance.
7. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions.
8. Clearly label and describe zones on legend to be attached to inside of controller cover. Provide a laminated, color-coded plan indicating area of each zone; to be installed next to controller.
9. Backflow device shall be tested and certified before substantial completion will be issued.

3.04 DISPOSAL OF WASTE MATERIAL

- A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.
- B. Maintain disposal route clear, clean, and free of debris.

3.05 SUBSTANTIAL COMPLETION

- A. An inspection of the irrigation system will be made by the Owner's Representative upon request for Application of Substantial Completion by the Contractor. The irrigation system must be sufficiently complete so that all plant material can be sustained by the system.

3.06 FINAL COMPLETION

- A. An inspection of the irrigation system will be made by the Owner's Representative upon request for Final Completion by the Contractor. Provide notification of at least five (5) working days before requested inspection date.

3.07 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.