

APPENDIX H

IRRIGATION INSTALLATION STANDARDS

1. General

- 1.1 A Certified Irrigation Designer shall do irrigation design or someone approved by the City of Fort Collins Parks Division.
- 1.2 Irrigation system design and installation shall be monitored, inspected, and approved by the City. Taps should be sized so the park can be irrigated in 8-10 hours minimizing impact to users. Irrigation taps should be separate from the restroom tap so that sewer charges are not incurred on irrigation water. Irrigation systems shall be installed and maintained so that no heads spray onto any streets in such a way that they spray passing motorists or pedestrians. Heads should be adjusted wherever possible so that they do not overspray street side sidewalks.
- 1.3 The irrigation system must comply with the Uniform Plumbing Code and with the City of Fort Collins Electrical Code.
- 1.4 Any deviation in taps from the approved construction plans must be approved by the City Water / Wastewater Division prior to installation. Any water service line shall be coordinated with City of Fort Collins Water Utility. Any deviation in layout of the irrigation system from the approved construction plans must be reviewed and approved by the City Parks Division prior to installation.

1.5 Design:

The irrigation system must be designed to provide full coverage and matched precipitation rates. Main line piping shall be sized based on flow demands (gpm's); velocities shall not exceed 5.0 feet per second. Lateral piping shall be sized based on flow demands (gpm's). Velocities shall not exceed 6.5 feet per second. Principles of Xeriscape shall be utilized in the design of the irrigation system. Some design considerations include: shrub and perennial beds are to be zoned separately from turf areas; limited irrigation on medians in parking lots; consider separate bubbler zones for trees in drought situations, no valves on any sports fields; hookups for ball field on both sidelines; all part circles heads should be rotors, full circles can be either impacts or rotors; sloped areas are to have separate zoning for heads at the higher elevations from those at the lower elevation and areas with different exposures are to be zoned separately. Zones on ball fields should be independent to allow watering for seed or sad just to affect one field. Check valve-in-head should be used when head has that option to save water. Check valves in-head are to be used for all areas adjacent to walkways and at the bottom of berms and pond areas. The blowout fitting for

winterization downstream of the backflow should be 1 1/2" for mainlines 3" or larger and 1" for mainlines 2 1/2" and smaller.

2. Materials

2.1 Mainline:

Class 200 PVC, NSF approved.

- A. If 3" or larger: Ringtite pipe.
- B. If 2 W' or smaller: glue joint.

2.2 Laterals:

- A. 2" or larger: Class 200 PVC, NSF approved.
- B. 1 1/2" or 1": Class 200 PVC, NSF approved.
- C. No laterals smaller than 1" are permitted.
- D. Trickle tubing shall be weather and UV resistant material.
- E. Polyethylene Drip Pipe: NSF approved, SDR pressure rated pipe, only as approved for drip applications.

2.3 Pipe Fittings:

- A. Funny Pipe (pop-up turf heads only): to be compatible to the elbows needed for the sprinkler heads. The maximum length of funny pipe allowed is 3 foot.
- B. Lateral fittings: Schedule 40, Type 1, PVC solvent weld with ASTM Standards D2466 and D1784.
- C. Wrought copper or cast bronze fittings, soldered or threaded per installation details for all copper pipes.
- D. Mainline fittings: Ductile Iron for 3" and larger, PVC Schedule 80 for 2 1/2" and smaller.

2.4 Sleeves:

Ductile Iron Pipe or PVC under all paved surfaces.

- A. Sizes to be a minimum of two sizes larger than the pipe being sleeved. Minimum 2" diameter or larger for irrigation lines. Use full sections of pipe to minimize the number of joints under pavement.
- B. Wires to be in separate sleeve from pipe, 2" min. size pipe for control wire sleeves.
- C. Sleeves shall have marker tape on upper side and both ends for future locates.

2.5 Valves:

- A. Remote Control Zone Valves: Electrically operated, appropriate for the water supply, with manual bleed device and flow control stem. It shall have a slow opening and slow-closing action for protection against surge pressure. It shall have a pressure regulator for pop-up spray head zones. If the valve is 2" or larger it should have a brass body. If the valve is 1 1/2"

or smaller it can be either brass or plastic. Valve brand to be approved by the Parks Department.

- B. Isolation Gate Valves: Kennedy 157IX or Matco #100M, able to withstand a continuous operating pressure of 150 psi. Clear waterway equal to full diameter of pipe. Shall be opened by turning 2" square nut to the left (wheel opening is unacceptable) .
- C. Manual Drain Valve: 3/4" ball valve with tee handle. Watts, #B-6000, or approved equal.
- D. Quick Coupling Valves: 1" brass, Rainbird #5RC units with rubber cover. Keys Rainbird 55K 1" brass key.

2.6 Valve Boxes:

House valves in valve box with matching locking cover (AMETEK brand only). Only one valve per box. Install in box sizes to allow work on components.

2.7 Control System:

- A. Controller: Irritrol MC Series controller 18 Stations or equal to be approved by the Parks Department. Controller shall be remote ready and use ADAPT -1 cable. Each controller shall have a separate Eicon MRX-RR receiver. One Eicon TRX5V will be provided by the contractor for project. Frequency to be determined by Parks Department. Controller box shall be weather tight and vandal resistant, with locking exterior disconnect.
- B. Control System Enclosure: If the park has a pump house, install in pump house on same wall as the door. If there is no pump house, install in a Strong Box or equal to be approved by the Parks Department.
- C. Surge Protection: 8 foot copper grounding rod, double ott stranded copper wire, exothermic connection to ground rod, grounding buss receptacle, ground terminal strip and Irritrol SPD-587 surge protector per details.
- D. Install Mini-Clik II rain sensor (one per controller) at location near the controller but not where it will receive precipitation from the irrigation system or easily vandalized. Owner must approve location.
- E. Run valve wires to junction box in the pump house. Label wires with the identification number of the remote control valve activated by the wire. Install terminal strips and run 18 gauge wire from junction box terminal strips to controller. Wire shall be in conduit.

2.8 Electric Control Wiring:

14 solid copper direct burial UP or PE cable, UL approved, or larger, per system design and manufacturer's recommendations.

- A. Five wires with consistent color scheme throughout:
 - Red = live (one per valve)
 - White = ground (#12 solid copper direct burial Cable)
 - Black, blue and green = extra .
- B. Wire connections should be made with "pentite" type dry splices to join control wires to remote control valves.

- C. Wire splices need to be in a valve box not less than every 2500 ft. not counting remote control valve boxes.

2.9 Sprinkler Heads:

All heads shall be of the same manufacturer as specified on the plans, and marked with the manufacturer's name and model in such a way that materials can be identified without removal from the system. City will specify brand and models to match other equipment in use in public system in the vicinity.

- A. Gear driven Rotor heads: Hunter, Rainbird, or approved equal.
- B. Impact heads: Rainbird, or approved equal.
- C. Pop-Up Spray heads: Rainbird 1800 PRS SAM, or approved equal.

2.10 Backflow Preventers:

Backflow preventer shall be **Febco** brand and shall be installed and tested in compliance with the Colorado Primary Drinking Water Regulations.

3. Inspection

Locate all utilities prior to trenching and protect from damage. Required calls s1;lall include, but are not limited to the following: Call 221-6660 for Parks Division locates. Call 1-800-922-1987 for Utility Locates in the City of Fort Collins. Contact other Utilities as required. Inspect tap or other existing irrigation system, as applicable, prior to work.

4. Execution

4.1 Pipe trenching:

- A. Install pipe in open cut trenches of sufficient width to facilitate thorough tamping/puddling of suitable backfill material under and over pipe.
- B. Trench depths:
 - 1. Mainline - Minimum of 24" deep from top of pipe to finished grade.
 - 2. Lateral - Minimum of 16" deep from top of pipe to finished grade.
 - 3. Sleeves - Install sleeves at a depth, which permits the encased pipe or wiring to remain at the specified burial depth.

4.2 Sleeves:

Boring shall not be permitted unless obstruction in pipe path cannot be moved, or pipe cannot be re-routed.

- A. Mainline installed in existing sleeves at greater depth than adjacent pipe, shall have a manual drain valve at each end if the sleeve is longer than 20 feet, or at one end if the sleeve is less than 20 feet.
- B. Install sleeve so ends extend past edge of curb, gutter, sidewalk, bike path or other obstruction, a minimum of 2 feet.
- C. Mark all sleeves with an "x" chiseled in walk (or *other* surface) directly over sleeve location.
- D. Sleeves installed for future use shall be capped at both ends.
- E. Separate sleeve (2" min. size) shall be used for all wiring.

- F. Sleeves shall not have joints. If joints are necessary, only solvent welded joints are allowed.
- G. Compaction of backfill for sleeves shall be 95% of Standard Proctor Density, ASTM D698-78. Use of water (puddling) around sleeves for compaction will not be allowed.
- H. Laterals along property lines shall be installed 2-3 feet inside of property line and teed over for heads. This avoids problems with homeowners installing fences at later dates.

4.3 Pipe Installation:

- A. Use Teflon tape on all threaded joints; only schedule 80 pipe may be threaded.
- B. Reducing pipe size shall be with insert reducing bushing at the tee.
- C. Snake PYC lateral pipe from side to side within trench.
- D. Cut pipe ends square and de-burr. Clean pipe ends before using primer and solvent cement. Join in manner recommended by manufacturer and in accordance with accepted industry practices. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
- E. Backfill shall be free from rubbish, stones larger than 2" diameter, frozen material and vegetative matter. Do not backfill in freezing weather. If backfill material is rocky, the pipe shall be bedded in 2" of fill sand covered by 6" of fill sand.
- F. After puddling or tamping, leave all trenches slightly mounded to allow for settling.
- G. Compact to proper densities depending on whether surface area over the line will be paved or landscaped.

4.4 Thrust Blocks:

- A. Shall be installed where PYC mainline (2 1/2" or larger) changes direction over 20 degrees.
- B. Minimum of one cubic foot of concrete shall be used per thrust block.
- C. Keep pipe joint clean of concrete. Do not encase joint or pipe.
- D. Place wiring away from thrust block to avoid contact with the concrete. Use clear plastic sheeting to isolate the concrete from other materials.

4.5 Valve Installation:

Install at least 12" from and align with adjacent walls or paved edges.

- A. Automatic Remote Valves: Install in such a way that valves are accessible for repairs. Make electrical connection to allow pigtail so solenoid can be removed from valve with 24" (min.) slack to allow ends to be pulled 12" above ground.
 1. Flush completely before installing valve. Thoroughly flush piping system under full head of water for three minutes through furthest valve, before installing heads.
 2. Valve assembly to include ball valve and union for ease of maintenance and repair. The union should be between the ball

- valve and the electric control valve. For ball valves larger than 2", plastic ball valves may be used.
- 3. Install in valve box per details.
- B. Quick Coupler Valve: Install in 10" round locking valve box. Flush completely before installing valve. Thoroughly flush piping system under full head of water for three minutes through furthest valve.
- C. Isolation Gate Valves: Install in valve box as per detail.
- D. Valve Boxes:
 1. Brand all valve boxes with the following codes: "SV" and the controller valve number per as built plans for all remote control valves; "DV" for all drain valves; "GV" for all isolation valves; "DRGV" for all drip system isolation valves; "QC" for all quick coupling valves; "W A" for all winterization assemblies; "FM" for all flow meter assemblies; and "MV" for all master valve assemblies. Use a branding iron stamp with 3" high letters.
 2. Valve box shall NOT rest on mainline. Use brick or other non-compressible material per detail. Top of valve box to be flush with finish grade. Use add-ons to depth of valve gravel.
 3. Install valves in box with adequate space to access valves with ease. Valves shall not be too deep to be inaccessible for repairs. 3" depth of 3/4" washed gravel to be placed in the bottom of each valve box with enough space to fully turn valve for removal (see detail).

4.6 Head Installation:

- A. Set heads plumb and level with finish grade. In sloped area, heads to be tilted as necessary to provide full radius spray pattern.
- B. Flush lateral lines before installing heads. Thoroughly flush piping system under full head of water for three minutes through furthest head, before installing heads. Cap risers if delay of head installation occurs.
- C. Pop-Up Heads along walks and bikeways: Bed heads in 6" layer of sand under the base of the head. Heads should be 2" from edge of walk.
- D. Nozzles: Supply appropriate nozzle for best performance.
- E. Adjustment: Adjust nozzles and radius of throw to minimize overspray onto hard surfaces.

4.7 Electrical Connections:

New connections to be approved through City of Fort Collins Light & Power. Call 221-6700 to obtain power information and request connection. Actual connection to transformer or other power source to be done by City of Fort Collins Light and Power. Work to be coordinated and scheduled with Light & Power at 221-6700. All work other than actual connection, including access to the transformer box where applicable, to be supplied by the contractor. All materials to be provided by the contractor. When working near any City Electric facility, prior coordination and approval is required.

4.8 Controller Installation:

- A. To be installed in an above ground location suitable to prevent vandalism and provide protection from adverse weather conditions, and per City direction. If a building is available, place controller inside building. All exposed wiring to and from the controller shall be encased in galvanized metal conduit. Exterior controllers to be installed on 6" thick concrete pad.
- B. Install Controller per City direction and in accordance with manufacturers' specifications. Install surge protection, grounding rods and other accessory components as specified.
- C. Attach wire markers to the ends of control wires inside the junction box. Label wires with the identification number of the remote control valve activated by the wire. Then run 18 gauge wire to the controller.

4.9 Wiring:

- A. Comply with City of Fort Collins electrical codes
- B. Power source brought to controller to a ground fault receptacle installed within controller casing.
- C. String control wires as close as possible to mainline, consistently along and slightly below one side of the pipe.
- D. Leave minimum loop of 24" at each valve and controller and at each splice, at the ends of each sleeve, at 100-foot intervals along continuous runs of wiring, and change of direction of 90 degrees or more. Band wires together at 10' intervals with pipe wrapping tape.
- E. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted. Install three extra wires, as specified, to the furthest valve on the system and/or each branch of the system, i.e. 2 or more extra wires per 12 valves.

5. Testing

All tests to be run in the presence of City of Fort Collins Parks' representative. Schedule all tests a minimum of 48 hours in advance of tests. Repeat any failed tests until full acceptance is obtained.

5.1 Pressure Test:

Leave mainline uncovered at joints and fittings. Place a pressure gauge (capable of reading pressures up to 120 psi minimum) on a Quick Coupling valve attached to the system. Fill mainlines with water and bring to full pressure. If new system is an add-on to existing system, isolate the new system from the old system after filling. Record pressure readings at 15-minute intervals for 4 hours. Pressure shall not drop more than 10% of initial reading. If pressure drops more than 10%, a thorough walkthrough of the mainline shall be made to discover leakage and corrected. Repeat test until maximum desired pressure drop is achieved.

5.2 Operational Test:

Activate each remote control valve from the controller in the presence of City of Fort Collins Parks representative. Replace, adjust or move heads and nozzles as needed to obtain acceptable performance of system. Replace defective valves, wiring or other appurtenances to correct operational deficiencies.

6. Completion Services

- 6.1 When project construction is complete, request from Parks' representative a punch list inspection for Construction Acceptance:
- A. Demonstrate system to Parks and Recreation personnel.
 - B. Provide Parks and Recreation personnel with ordering information including model numbers, size and style for all components.
 - C. Provide two sets of as built drawings per below, showing system as installed with each sheet clearly marked "AS-BUILT DRAWINGS", the name of the project and all information clearly provided:
 1. One set of reproducible Mylar, no larger than 24" x 36".
 2. One set of all sheets reduced to 11" x 17", with each station color coded, and each sheet plastic laminated.
 3. Provide as-built drawing on computer disk in a * .DWG format.
 - D. Clean Up: Remove all excess materials, tools, rubbish and debris from site.
- 6.2 Once Construction Acceptance is obtained, begin warranty and maintenance period by contractor. Maintain irrigation system in optimal working condition for duration of period between Construction Acceptance and Final Acceptance. Make periodic adjustments to system to achieve most desirable application of water.
- 6.3 Request Final Acceptance inspection at least 30 days before the end of one-year maintenance period, from City Parks Division personnel. Provide Parks and Recreation personnel operating keys, servicing tools, test equipment, warranties/guarantees, maintenance manuals, and contractor's affidavit of release of liens. Keys, tools and other operating equipment need to be turned over to Parks. Submittal of all these items must be accompanied by a transmittal letter and delivered to the Parks offices (delivery at the project site is acceptable with signed receipt).

7. Guarantee/Warranty and Replacement

For the period following Construction Acceptance Notice by City of Fort Collins, and prior to Final Acceptance, all irrigation materials, equipment, workmanship and other appurtenances are to be guaranteed/ warranted against defects. Settling of trenches or other depressions that damages structures or landscaping caused by settling and other defects to be corrected by the contractor at no cost

to the City of Fort Collins. Make repairs within seven days of notification by the City of Fort Collins Parks' representative. Guarantee / Warranty applies to all originally installed materials and equipment, and to replacements made during the guarantee/ warranty period.