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Irrigation – Design Standards

A. Irrigation

Basis of Design

This section applies to the design and installation of underground irrigation systems for landscaped areas, lawns, and planting beds.

Design Criteria

1. Refer to University drawings 917RU-01 through 917RU-18 for existing irrigation. These drawings are updated regularly but are schematic and may not be accurate or complete.
2. Irrigation piping flow velocity shall not exceed 5 feet per second.
3. Provide an irrigation system water header with isolation gate valve, wye strainer, deduct meter, pressure reducing valve, backflow preventer (double check valve assembly or reduced pressure backflow preventer), gauges, master valve, flow sensor, quick coupler, drain, and other appurtenances. Where possible, install the water header in an adjacent building. If this is not possible, provide an adequately sized valve vault or individual valve boxes to facilitate equipment repair/maintenance.
4. Irrigation systems with a 3-inch or larger mainline shall be designed to permit gravity drainage.
5. Irrigation system static pressure range shall not vary by more than 10%.
6. Design irrigation system lateral piping to limit pressure drops to less than 20% of the average sprinkler operating pressure.
7. Provide quick coupler valves every 100 feet or less and at all mainline terminations. These quick coupler valves are used to hand water landscaped areas. Locate quick coupler valves to limit water hoses crossing walkways and roads.
8. Provide quick coupler valves as follows:
 - a. Every 100 feet or less of piping
 - b. At all mainline terminations
 - c. In a way as to limit water hoses crossing walkways and roads
 - d. Quick coupler valves are used to hand water landscaped areas. In addition to providing water sources, quick coupler valves are located at mainline terminations to allow the safe discharge of stored compressed air energy when filling empty or partially empty mainlines.
9. Install sprinkler heads and nozzle types of the same manufacturer and pressure rating within the same irrigation zone.
10. Zone the irrigation system according to microclimates and plant water requirements. Hydrozone plants with similar water requirements.
 - a. Zone turf and bed areas separately. Microclimate variables to consider are: slope, on-structure plantings, raised planters, sun and shade exposure with respect to

- structural shading, plant & tree canopy shading and seasonal sun path, reflective and radiant heat exposure, wind exposure and average prevailing wind, rain shadow, soil structure, soil texture/type, plant density and canopy layers, and the impact of plant growth/maturity size.
- b. Zones shall not be on more than one side of a building.
 - c. Provide dedicated tree zones when tree water requirements differ significantly from surrounding shrubs and groundcovers. Hydrozone tree varieties as necessary. For dedicated tree zones, non-polymer time release water gel supplement may be used in lieu of traditional irrigation with approval by Outside Maintenance Zone.
11. Require new plant materials have pots, cages and/or burlap removed, root balls scored and pruned of circular root growth, rootballs soaked in water with 1 ounce of Yuccah natural surfactant per gallon of water prior to planting (to break down surface tension of rootballs and stimulate water transfer between differing import soil and root ball soil interface), then hand watered within 24 hours of planting, and regularly hand watered thereafter in conjunction with automatic irrigation during contractor's maintenance period (typically 60 days), particularly trees.
 12. Install a manual shutoff valve to isolate the irrigation system from the water supply main.
 13. Design irrigation systems to avoid overspray, avoid spray blockage from adjacent aboveground utilities (e.g., electric transformers, light standards, etc.), and avoid misting from excessive pressure.
 14. Locate irrigation system spray heads adjacent to parking lot curbs on-center with parking stall striping to prevent damage to the irrigation system from vehicles.
 15. Consider surrounding areas affected by the work. For existing systems work limit, design and specify to protect, restore and/or alter to proper working order. Consider utilizing existing irrigation systems and components. Demo existing irrigation to be supplanted by new irrigation by capping and removing whenever possible. When necessary to abandon piping in place, as in the case of it being within the root zones of trees to remain, show it on the as-built drawings and cap all open ends. Provide smooth transitions and balanced coverage between existing and new systems.
 16. When there is an alteration to an existing irrigation system, test existing mainline, control valves, lateral lines, sprinklers, drip line, and wiring prior to alteration to establish baseline status. Determine mainline static and working pressure, lateral line working pressure, zone flow rate in gallons per minute (GPM), coverage, and electrical circuit continuity testing for control wiring.
 17. When extending an existing irrigation system, at transitions between existing & new piping, provide isolation ball valves for laterals and gate valves for mainlines, with accessible enclosures.
 18. Sprinkler swing assemblies shall not exceed 24 inches.
 19. Design all sprinkler layouts for overlapping head to head coverage. Do not stretch spacing of published sprinkler radii unless no wind conditions. Design all sprinkler layouts at 45 percent of published diameter. In areas of persistent wind, design all rotary sprinkler layouts at 40 percent of published diameter.
 20. Provide matched precipitation rates for sprinklers within the same irrigation zone. Separate unmatched precipitation rate rotary sprinklers into zones with common arcs. If necessary to

mix diverse arcs of unmatched precipitation rate rotary sprinklers in the same zone. Match precipitation rates when using diverse arcs in the same zone. Use matched precipitation spray and stream nozzles.

21. Design irrigation system so that precipitation rates do not exceed infiltration rates.
22. For interior mechanical rooms, install metallic ball valves upstream and downstream of automatic zone valves and other appurtenances on vertical risers.
23. Provide a minimum of two looping spare control and common wires for every (6) control wires on each mainline branch and to maintain terminations enclosed in a Carson 910 valve box, black, tee lid, labelled 'irrigation'. Additional non-looping spare wires and a common wire may be added during design to stage capacity for future expansion.
24. Design mainline flow based upon the largest zone GPM combined with a single quick coupler at 20 GPM. Design zones or full rated working pressure for the selected water delivery media with at least one quick coupler at 20 GPM operating simultaneously.
25. Design piping with a horizontal layout on slopes. Reduce the spacing across the slope 1% for every 1% increase in slope beyond 10%.¹ Percent of slope equals vertical rise in feet per 100 feet.² Reduce sprinkler spacing to the actual sprinkler radius at the crown of the slope and increase the spacing at the toe of the slope as to prevent overthrow beyond the bottom boundary of the slope.³ Sprinkler design layout for slopes should be proportionate to the actual lineal feet of the hypotenuse (leg C), which would be misrepresented if scaled in plan view (leg A) resulting in stretched spacing. For clarification, call out actual spacing on the drawings. Do not design with elevation changes that exceed the capacity of sprinkler check valves.

(Footnotes 1-3 reference Buckner Irrigation Systems Design Manual, 1st Edition 1988, page 2-6.)

26. Install sprinklers perpendicular to the average surrounding slope. Firmly tamp and compact soil around sprinkler heads for stability.
27. For drip irrigation for trees, install multiple emitters over rootballs via supplemental looped drip line perpendicular to line layout and/or multiple layers at incremental depths across the root zone, e.g. for a 1.5 foot diameter root ball, install 1st grid scored into soil at a 2 inch depth, the 2nd grid at a 6 inch depth, and the 3rd grid at a 10 inch depth.
28. For drip irrigation, score lines 2 inches below soil finish grade and secure with 6 inch staples.
29. Locate valve boxes, valves, and quick coupler valves in beds at least 36-inches off hardscape edges.
30. Irrigation systems must be designed and installed for year round use without winterizing. Specified covered depths should satisfy this requirement. Any atypical covered depths, must be approved in advance and will require direct bury rated insulation to emulate R-value for 12" of soil depth for laterals, and 18" of soil depth for main line.
31. Irrigation Mockups and Dedicated MEP Irrigation Pre-Installation Meetings:
 - a. Provide permanent, in-place mockups of each initial irrigation assembly for review and approval by the project team (consisting of the contractor, relevant trade partners, architects, engineers, the owner's rep, and owners end users) prior to installing additional assemblies including:
 - i. solvent welding

- ii. control wire splices
 - iii. dedicated trace wiring for mainline and each zone
 - iv. Irrigation sleeves
 - v. Sleeve seals
 - vi. gate valve assemblies (part 1 without enclosure, part 2 with enclosure and backfill)
 - vii. automatic control valve assemblies (part 1 without enclosure, part 2 with enclosure and backfill)
 - viii. quick coupler valve assemblies (part 1 without enclosure, part 2 with enclosure and backfill)
 - ix. sprinkler assemblies (part 1 without enclosure, part 2 with enclosure and backfill)
 - x. tree bubblers (part 1 without enclosure, part 2 with enclosure and backfill)
 - b. Provide dedicated pre-installation meetings prior to installing the irrigation point of connection assembly, controller, and pipe and low voltage pathways and envelope penetrations and seals.
32. Although most irrigation scope resides within the scope of the landscape architect, and possibly an irrigation designer sub-consultant, there is a critical minority irrigation scope that requires multi-disciplinary collaboration with other consultants and trade partners, including but not limited to:
- a. All disciplines shall design with safe access for irrigation appurtenances and equipment are installed per code, between 2 and 5 feet above finished floor, and in a serviceable condition.
 - b. Electrical for 120v dedicated circuits for fixed equipment to irrigation controllers, ethernet and Wi-Fi controllers, pathways through building and penetrations through building envelope, and heat trace tape and insulation for freeze protection on irrigation pipes where necessary with approval for atypical applications,
 - c. Plumbing for mechanical room point of connection downstream of master meter and upstream of building domestic pressure regulation valve, irrigation header assembly, irrigation piping distribution through building and penetrations through building envelope, irrigation pressure zones for multi-level buildings and/or booster pumps, and freeze protection insulation on irrigation pipes where necessary with approval for atypical applications.
 - d. Architectural for pathways for low voltage control wire through building and penetrations through envelope, for on-structure roof drainage, for freeze protection insulation on irrigation pipes where necessary with approval for atypical applications, for roof safe access and fall protection, and easy access via non-program spaces to ingress and egress irrigation and planting related products.
 - e. Structural for roof safe access and fall protection.

Design Evaluation

The following information is required to evaluate the design:

1. Programming Phase: Statement of design intent including irrigation area.

2. Schematic Design Phase: Utility connection and irrigation legend.
3. Design Development Phase: Piping plans, controller and header/vault location. Outline and draft specifications.
4. Construction Document Phase: Piping diagrams, pipe diameter, design calculations, and specifications.

Construction Submittals

1. Provide standard industry submittal requirements.
2. Gateway and IP addresses for Ethernet-based irrigation controllers are entered at the factory. The University provides the gateway and IP addresses. Submittal should demonstrate University gateway and IP addresses.

Related Sections

- [Civil Design Standard](#)
- [Mechanical Design Standard](#)
- [Electrical Design Standard](#)

Products, Materials and Equipment

1. Controllers:
 - a. Calsense CS3000, 8 to 48 station capacity with transient surge protector (part #TP-100), to tie into existing central control system, with one of the following hardware options: Ethernet capability, CS3-EN-10/100 Mbps. Ethernet is preferred, Cellular, CS3-GR-KIT, can be used where Ethernet is unavailable. No exceptions.
 - b. Calsense controllers and enclosures: for wall mount installation, use the Calsense wall mounted gray box. Use the Calsense Heavy-Duty Stainless-Steel enclosure (pedestal) where wall mount is not applicable
 - c. Controllers shall have electrical metallic tubing (EMT) conduit connections.
 - d. Controllers shall be protected by a locking cover to prevent unauthorized access.
2. Pressure reducing valves: Watts, Febco, or approved substitution.
3. Backflow prevention assemblies:
 - a. Double-check valve assemblies: Febco 850, Watts, or approved substitution.
 - b. Reduced pressure backflow prevention assemblies: Watts 909 Series. For exterior applications, use a lockable hotbox to enclose RPBP assembly, provide drainage for reduced pressure discharge, 100 VAC with a GFCI receptacle, and an automatic heating coil to provide the assembly with freeze protection. Required for storm water retention systems, graywater systems, and purple water systems.
4. Central control networked master valves: Superior 3300, normally open, sized to accommodate system design flow. No exceptions.

5. Central control networked digital flow sensors:

Exterior	Interior	GPM	Size	Model	Type
Yes	Yes	2 - 35	1-inch	Calsense 1" tee flow sensor, model FM	Brass
Yes	Yes	3 - 55	1.25-inch	Calsense 1.25" tee flow sensor, model FM	Brass
Yes	Yes	4 - 80	1.5-inch	Calsense 1.5" tee flow sensor, model FM	Brass
Yes	No	4 - 80	1.5-inch	Calsense 1.5" tee flow sensor, model FM	Plastic
Yes	Yes	10 - 250	2-inch	Calsense 2" tee flow sensor, model FM	Brass
Yes	No	10 - 250	2-inch	Calsense 2" tee flow sensor, model FM	Plastic

6. Flow sensor size should be based upon capturing the flow in a range covering the lowest flow zone to the simultaneous operation of the highest flow zone (GPM) at full working pressure and a single quick coupler at 20 GPM. In the case of planned expansion, consider size of future zones in sizing flow sensor.
7. Irrigation Deduct Water Meter: Krohne. See [Preferred Manufacturer List](#) for irrigation deduct meter requirements.
8. Exterior pipe mainline and laterals: PVC, Schedule 40 with solvent weld-type joints Exceptions: (1) where risers, valves, etc. require threaded joints, and (2) use Schedule 80 PVC 10 pipe diameters upstream and 5 pipe diameters downstream of Data Industrial PVC flow sensors. All lateral fittings should be installed with outlets horizontal and facing the exterior of the planting area. Inlet fittings for quick coupler valves shall be installed horizontally. Valve inlet fittings shall be installed vertically.
9. Zone valves: Use RainBird PEB Series automatic control valves. No Substitutions. Size so that the midpoint of the valve flow range is approximates the zone (GPM). Size so that optimal psi loss through valve is between 3 and 7 psi. Use PRS-D pressure regulating units for sprinkler zones only. Use PRS-D pressure regulating units per manufacturer's recommendations (see flow & pressure loss chart).
10. Manual gate valves: 2.5-inch and smaller diameter shall be bronze (ASTM B-62) valve with bronze solid wedge, integral taper seats with a non-rising stem. All valves larger than 2.5-inch diameter shall be threaded iron body, brass trimmed, resilient wedge, integral taper seats with non-rising stem, and square operating nut.
11. Ball valves: Spears TU2000 Blocked True-union Ball Valve. No Substitutions.
12. Valve boxes & extensions: Carson with non-hinged cover (black), sized to allow room for testing, manual operation, calibration, removal, maintenance of equipment, and 1-2 inch clearances between piping, valves, and valve boxes and 3-4 inches between valves and subgrade/gravel, set on compacted subgrade with masonry units under each corner; seal openings with filter fabric affixed to outside of valve box. Size as follows: gate valve – 910; wye strainer – 1419 (1.5 inch), 1220 (2 inch), backflow assemblies – 1730; master valve – 1419; flow sensor – 1410; point of connection quick coupler valve – 910; automatic control valves – 1220 (1 inch), 1324 (1.25 inch and above). Set on masonry units at each corner. For gate valves in landscape, use 8 inch PVC

vertical sleeve (sanitary non pressure rated okay); ensure sleeve is plumb, center valve in sleeve, set top of sleeve 2 inches below bottom of valve box lid (when in closed position), cut notch in sleeve to straddle supply piping with at least 1-2 inches clearance, set sleeve on 2 masonry units on compacted subgrade (not touching piping), seal gaps with filter fabric affixed to outside of sleeve. For gate valves in hardscapes, use cast iron frames and lids. For exterior multiple valve manifolds, use of a concrete enclosure with metal hinged lid may be necessary (traffic rated if applicable). No exceptions.

13. Sprinkler heads:

- a. Micro-Irrigation and dedicated tree irrigation zones:
 - a. RainBird 1800-sam-prs sprinkler bodies with standard screens and RainBird SQ Series Nozzles
- b. Short range pop-up spray nozzle sprinklers:
 - i. RainBird 1800-sam-prs sprinkler bodies with standard screens and various RainBird fixed arc matched precipitation rate spray nozzles with radii from 8-18 ft. Do not use high-efficiency variable nozzles. Standard variable nozzles are acceptable when necessary. Use 6-inch risers in regular turf, and 12-inch risers in planting beds.
- c. Short range pop-up rotary sprinklers:
 - i. RainBird 1800-sam-p45 sprinkler bodies with MP Rotator matched precipitation rate nozzles: MP800 (cannot be intermixed with other MP nozzles)
 - ii. RainBird 1800-sam-p45 sprinkler bodies with MP Rotator matched precipitation rate nozzles: MP1000, MP2000, corner, end strip, side strip.
- d. Medium range rotary sprinklers:
 - i. RainBird 1800-sam-p45 sprinkler bodies with MP Rotator matched precipitation rate nozzles: 3000 & 3500 Series.
 - ii. Hunter I-20 with 6" stainless steel riser with flow stop.
- e. Long range rotary sprinklers:
 - i. Hunter I-40 with 6" stainless steel riser.

14. Alternate Water Delivery Media:

- a. Tree watering bags – Uses may include remote plantings, and/or in lieu of a dedicated tree zone comprised of conventional irrigation.

15. Swing Joints:

- a. ½-inch inlet sprinklers: Hunter SJ-512 with additional top and bottom ½-inch Marlex street ells.
- b. ¾-inch inlet sprinklers: For flow less than or equal to 6 GPM, use Hunter SJ-712 with additional top and bottom ¾-inch Marlex street ells. For flow exceeding 6 GPM and/or for systems with less than 50 psi operating pressure, use Lasco 3/4" Four Elbow Swivel Joints, T7-412, with additional ¾" Marlex street ells on the inlet and outlet.

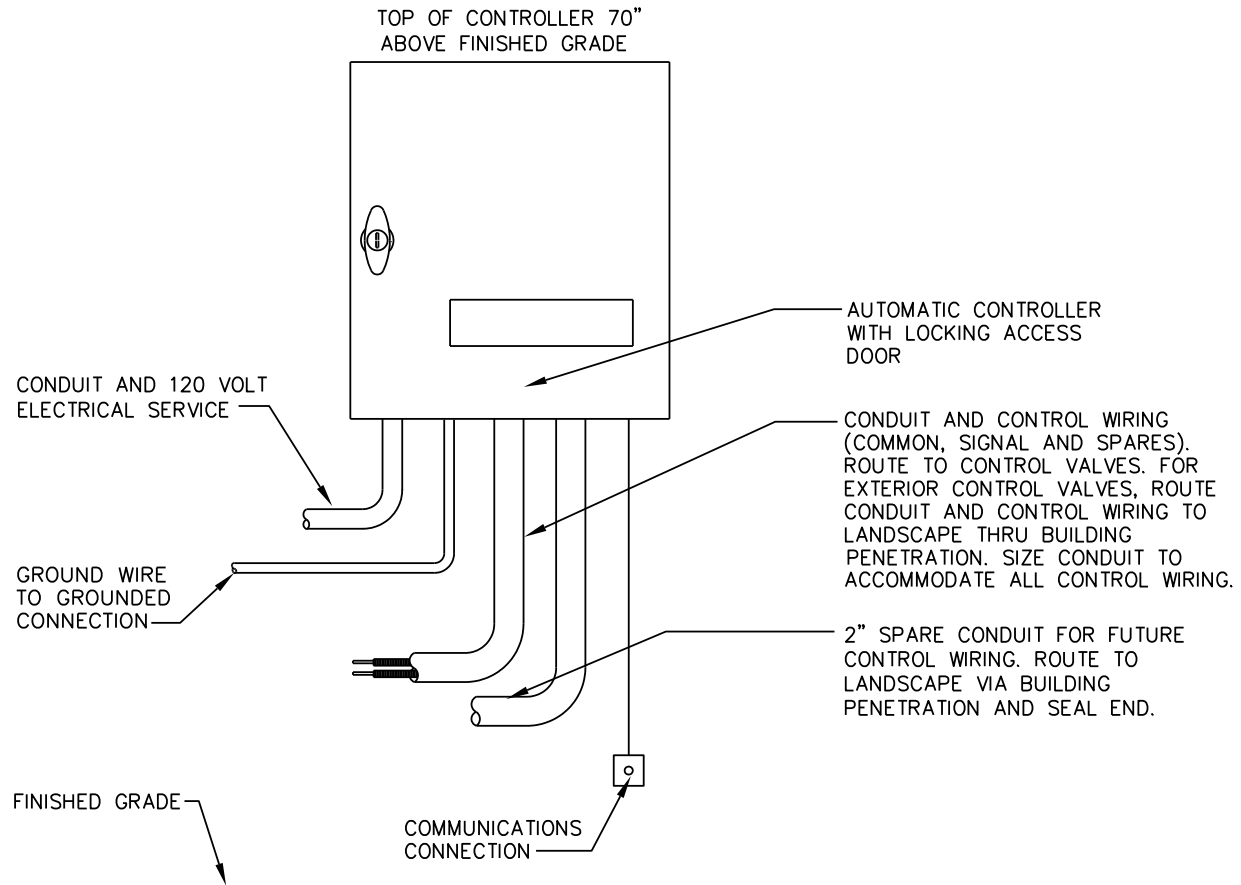
- c. 1-inch inlet sprinklers: Lasco 1-inch Four Elbow Swivel Joints, T9-412, with additional 1-inch Marlex street ells on the inlet and outlet, or Lasco G132-212, or approved substitution, with additional top and bottom 1-inch Marlex street ells
 - d. Quick couplers: Dura 1-A4-1-11-18 swing joint with DL-010 quick lock, or approved substitution.
16. Do not use Drip Irrigation on any systems.
17. Quick coupler valves: two-piece, rubber cover: Buckner QB44RC-10
18. Quick coupler keys: Buckner or Rainbird (44K) with 1-inch FIPT by 1-inch FIPT metal ball valve downstream of key, and a 1-inch FIPT by ¾-inch male hose thread hose swivel (SH-1), connected by a galvanized 2-inch nipple.
19. Control wire: Insulated single strand type UF No. 14 copper designated for 20 to 50 volts, UL approved as Type U.F. (underground feeder), no exceptions. Color code as follows:
ground/common wire – white; lead-in signal wire – red; spare signal wire – orange; moisture sensor wire – green; master valve wire – yellow; master valve dedicated common wire – white; future expansion signal spares – black; future expansion common – white.
20. Shielded cable for flow sensor: RainMaster EV-CAB-SEN 2-conductor direct burial shielded copper wire, or Houston Wire D1501802, or approved substitution (direct bury, shielded, 2-18 gauge copper wires, with drain wire).
21. Splice kits: 3M-DB Series, sized for wire size & quantity per manufacturer's recommendations, i.e. DBY, DBR, or approved substitution.
22. Drain valves: Buckner No. 72-2 inch or approved substitution. Do not use on irrigation zones unless piping is greater or equal to 3-inches. Use at irrigation P.O.C.
23. Wye Strainer: Zurn/Wilkins SXL
- a. If POC is downstream of building wye strainer, secondary strainer is not necessary

Installation, Fabrication and Construction

- 1. Trenching: Provide minimum 12-inch soil cover (not including mulch) for lateral lines, with minimum 18-inch soil cover (not including mulch) for sprinkler mains and quick coupling lines; and minimum 24-inch soil cover (not including mulch) between the main water line and double check valve assembly.
- 2. Trenching: Install piping side-by-side, to be separated by 2 inches of clean fill. Stacking of piping is not permitted.
- 3. All zones and mainlines shall independent dedicated trace wire. Secure 14-gauge trace wire to all irrigation piping at 10-foot intervals. Solder tracing wire to all lateral irrigation piping. Do not cut and splice main trace wires to control valves.
- 4. Sleeve all irrigation piping and control wires installed below pavement. Provide piping sleeves 1.5 times the diameter of the irrigation piping.
- 5. No bending of pipe. Use fittings for directional changes.
- 6. Construct all plastic-to-metal joints with plastic male adapters.
- 7. Provide 4-inch thick concrete base for all pedestal-mounted controllers. 'Quick Pad' valve box mounting may be used only with approval from Outside Maintenance Zone.
- 8. Provide schedule 80 PVC piping upstream and downstream of the flow sensor per manufacturer specifications (10 pipe diameters upstream and 5 pipe diameters downstream from flow sensor,

straight pipe, no fittings) when using PVC tee mounted flow sensors; for exterior points of connection only.

9. Seal sleeve ends with servicable duct tape or bunched filter fabric to prevent soil intrusion (before and after install).
10. Tape control wiring at 10-foot intervals and lay adjacent to irrigation mainline piping. Provide a minimum 3-foot coil of wiring at each valve box.
11. Do not splice lead control wiring between control valves and controllers. Separate lead or "hot" wire to each control valve. Common ground wiring is acceptable. Locate all wiring splices in valve boxes. Provide redundant control wiring to remote control valves.
12. Provide all valve access boxes with size extensions to bring valve boxes to finish grade.
13. Locate automatic control valve boxes within the irrigation zone, do not cluster valve boxes.
14. Do not backfill piping or fittings until inspected and pressure tested. Mainlines to control valves shall be hydraulically pressure tested at 125 psi for 15 minutes, and have 0 psi pressure drop during the 15 minute test period. Test lateral lines at 80 psi for 15 minutes, with no more than 5 psi pressure drop during the 15 minute test period. Perform all hydraulic pressure testing in the presence of a University representative.
15. Automatic control valve boxes shall be placed in the irrigation zone they serve. Do not cluster automatic control valve boxes together. Locate valve boxes orthogonally to adjacent features.
16. Mount an 11x17 color coded laminated zone control map adjacent to the controller, showing the location of main valves, numbered zone valves, associated color coded laterals, and a listing of zone numbers & descriptions, e.g. "turf, west side of building".
17. Landscape and irrigation inspections and performance testing – provide landscape and irrigation inspections and performance testing for review and approval by the project team at key milestones including subgrade, irrigation mainline and lateral pressure testing, finish grade including soil tapers at hardscapes, irrigation coverage testing, trees and plants upon delivery, trees and plants upon installation, mulching.
18. The Contractor shall meet with the project team consisting of the contractor, relevant trade partners, architects, engineers, the owner's rep, and owners end users to review/evaluate final irrigation system installation prior to final acceptance.
19. Refer to the following drawings:
 - a. [Interior Irrigation Controller Wall Mounted](#)
 - b. [Exterior Pedestal Mounted Controller](#)
 - c. [Exterior Irrigation Controller Wall Mounted](#)
 - d. [Irrigation Point of Connection Assembly](#)
 - e. [Quick Coupler Anchor Assembly and Installation](#)
 - f. [Exterior Single Zone Valve Assembly](#)
 - g. [Pop-Up Sprinkler Assembly and Installation](#)
 - h. [Pop-Up Head Set-Back and Location](#)
 - i. [Tree Bubbler Detail](#)



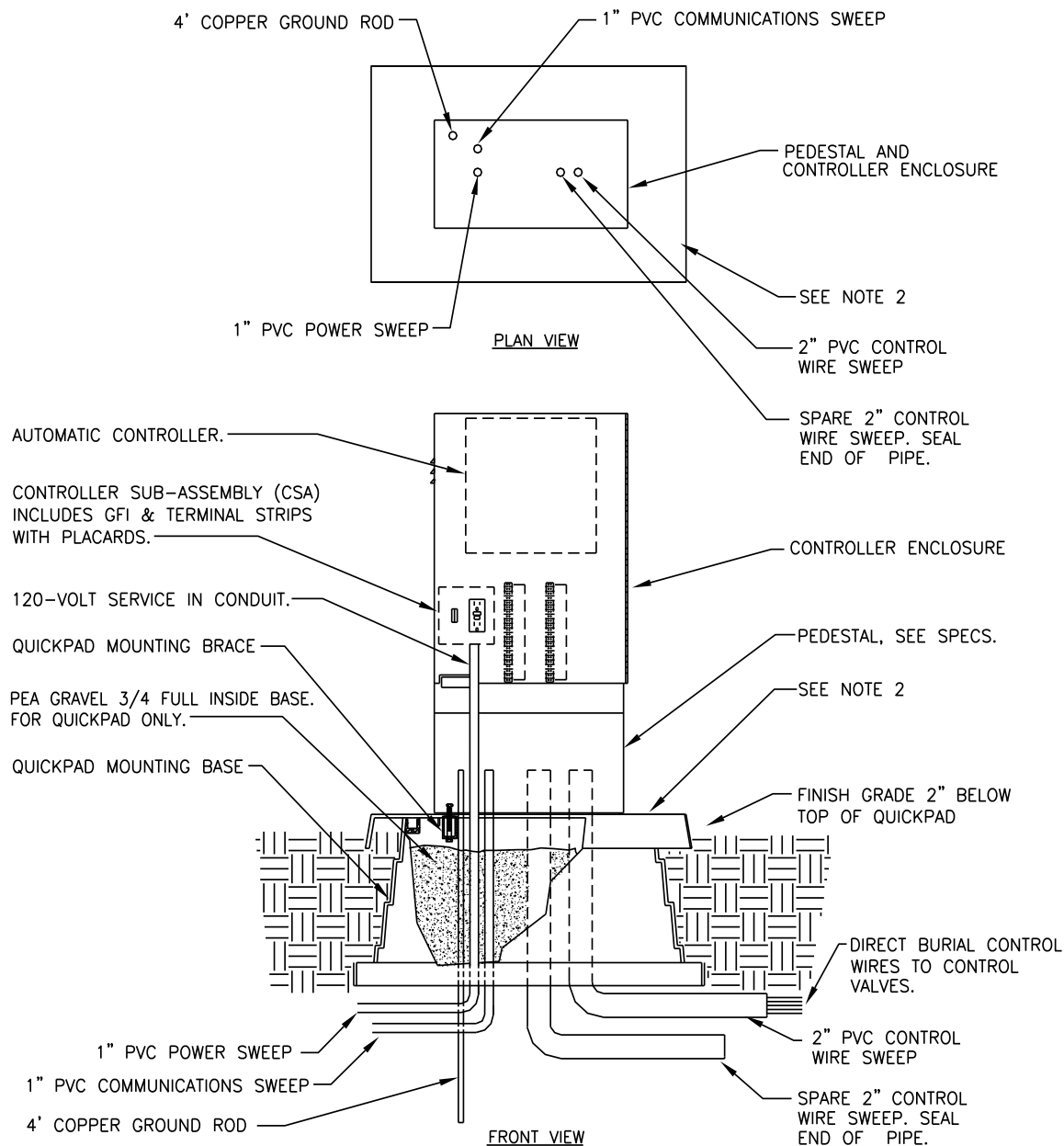
NOTES:

1. ALL WIRES TO BE INSTALLED AS PER LOCAL CODE.
2. VERIFY LOCATION PRIOR TO INSTALLATION.
3. INSTALL CONTROLLER PER MANUFACTURER'S INSTRUCTIONS.
4. PROVIDE COMMUNICATIONS CONNECTION AND JACK TO CONTROLLER LOCATION.

NOT TO SCALE

SD-CI-30

Interior Irrigation Controller Wall Mounted



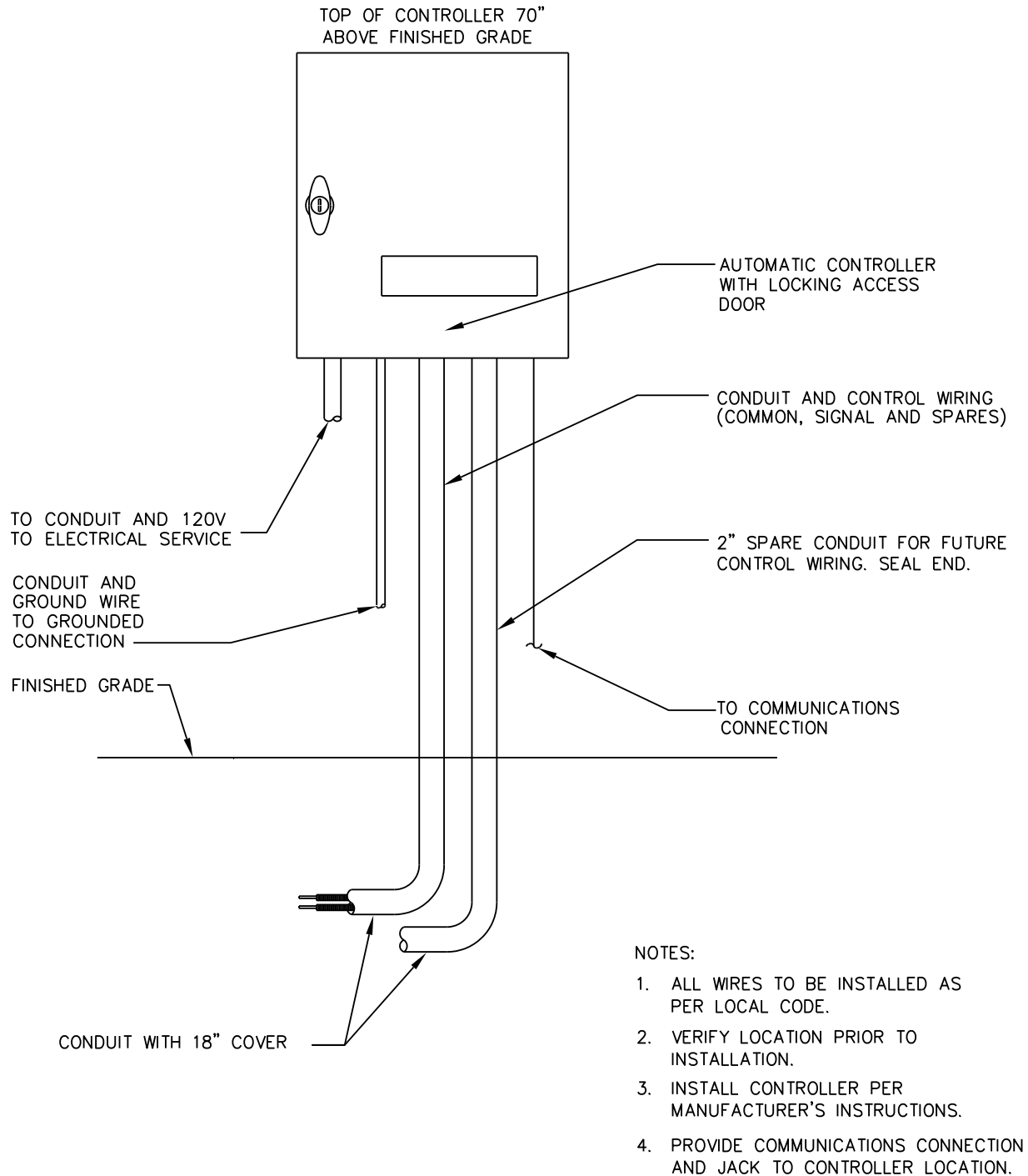
NOTES:

1. FLAG LOCATION FOR APPROVAL BY LANDSCAPE ARCHITECT.
2. QUICKPAD - 3/16" MINIMUM THICKNESS ALUMINUM POWDER COATED PREFORMED PAD FOR STRONGBOX ENCLOSURES, OR CONCRETE BASE PER MANUFACTURER INSTRUCTIONS. SEE SPECS.

NOT TO SCALE

SD-CI-20

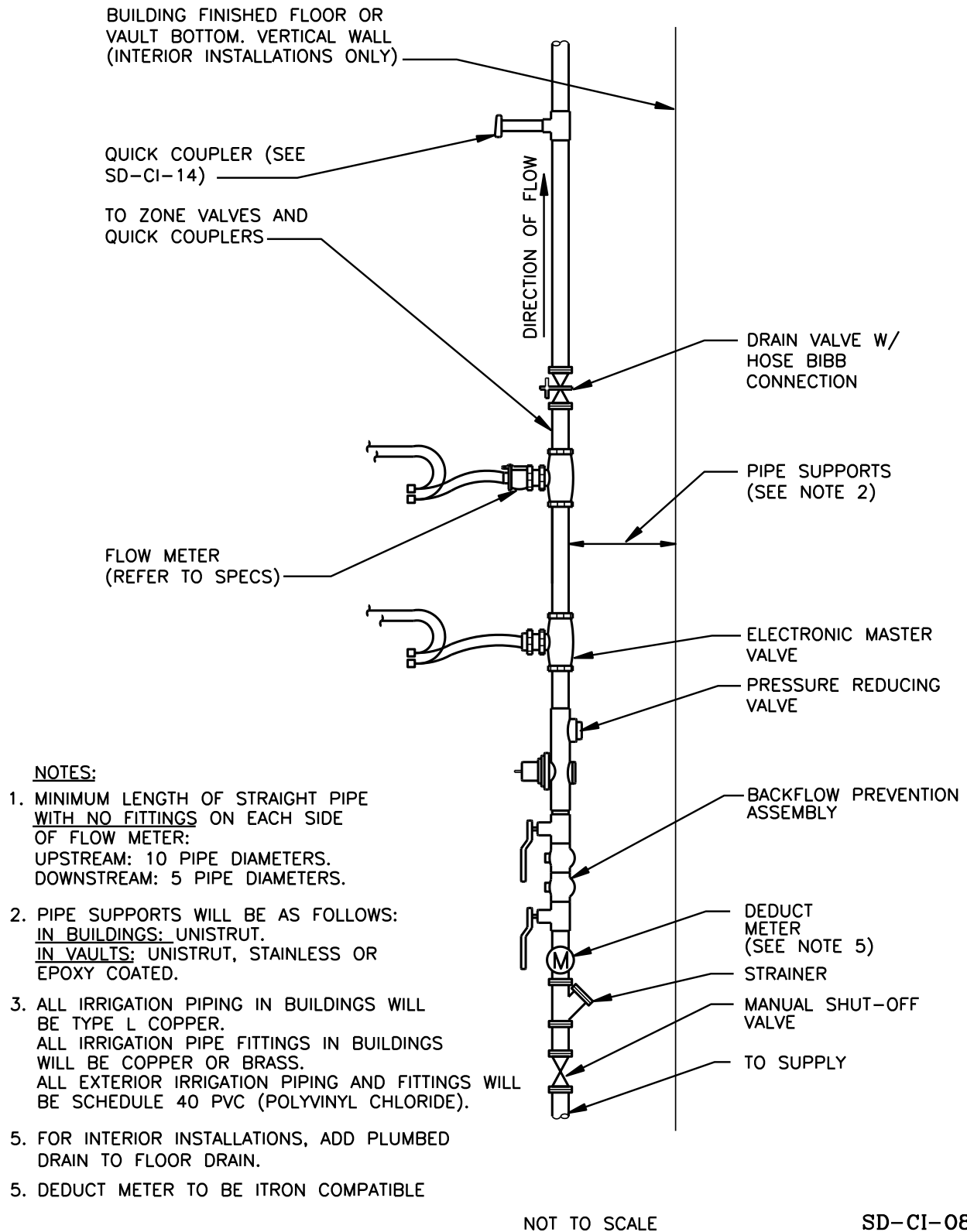
Exterior Pedestal Mounted Controller



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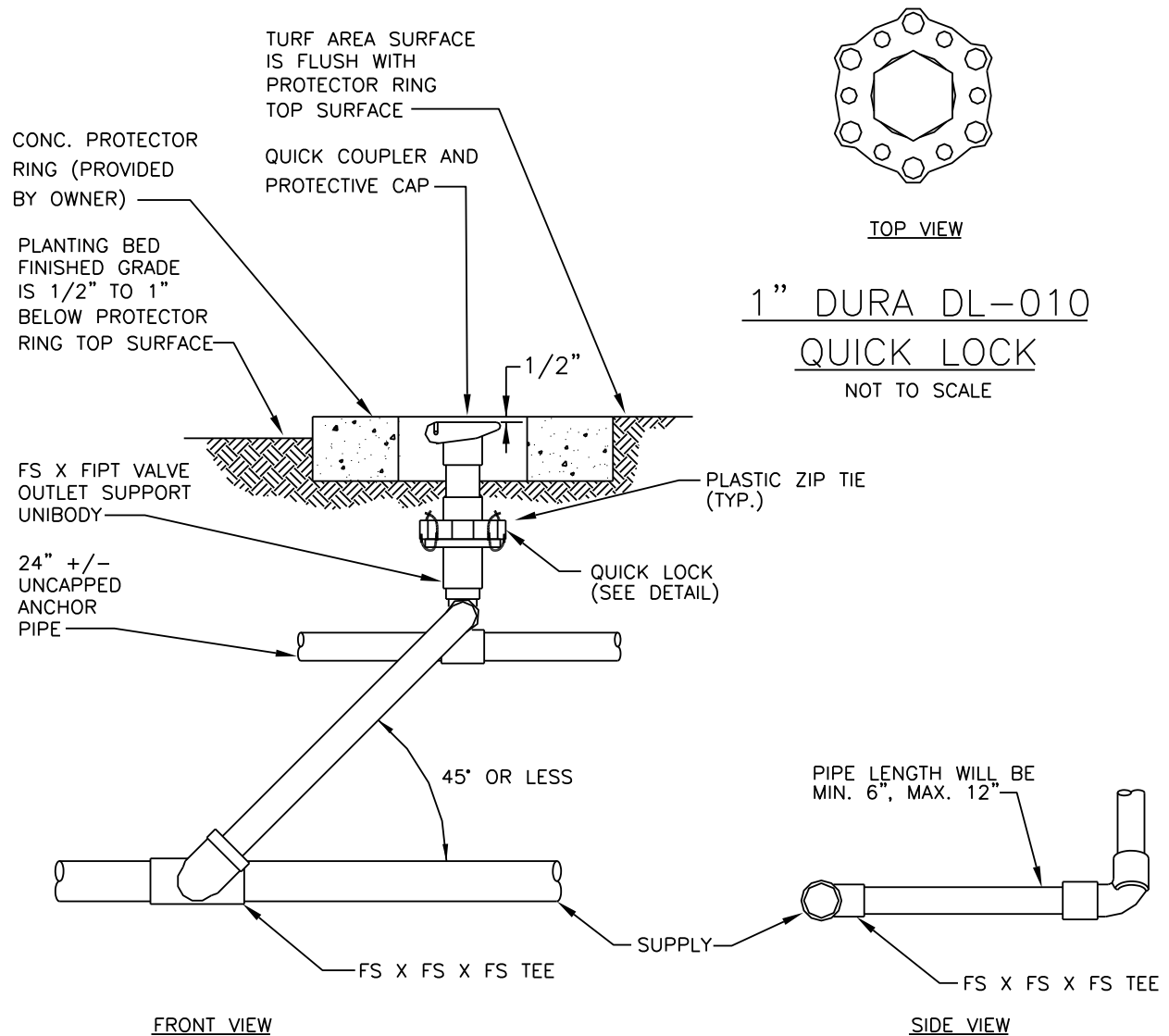
SD-CI-33

Exterior Irrigation Controller Wall Mounted



SD-CI-08

Exterior Irrigation Point of Connection Assembly

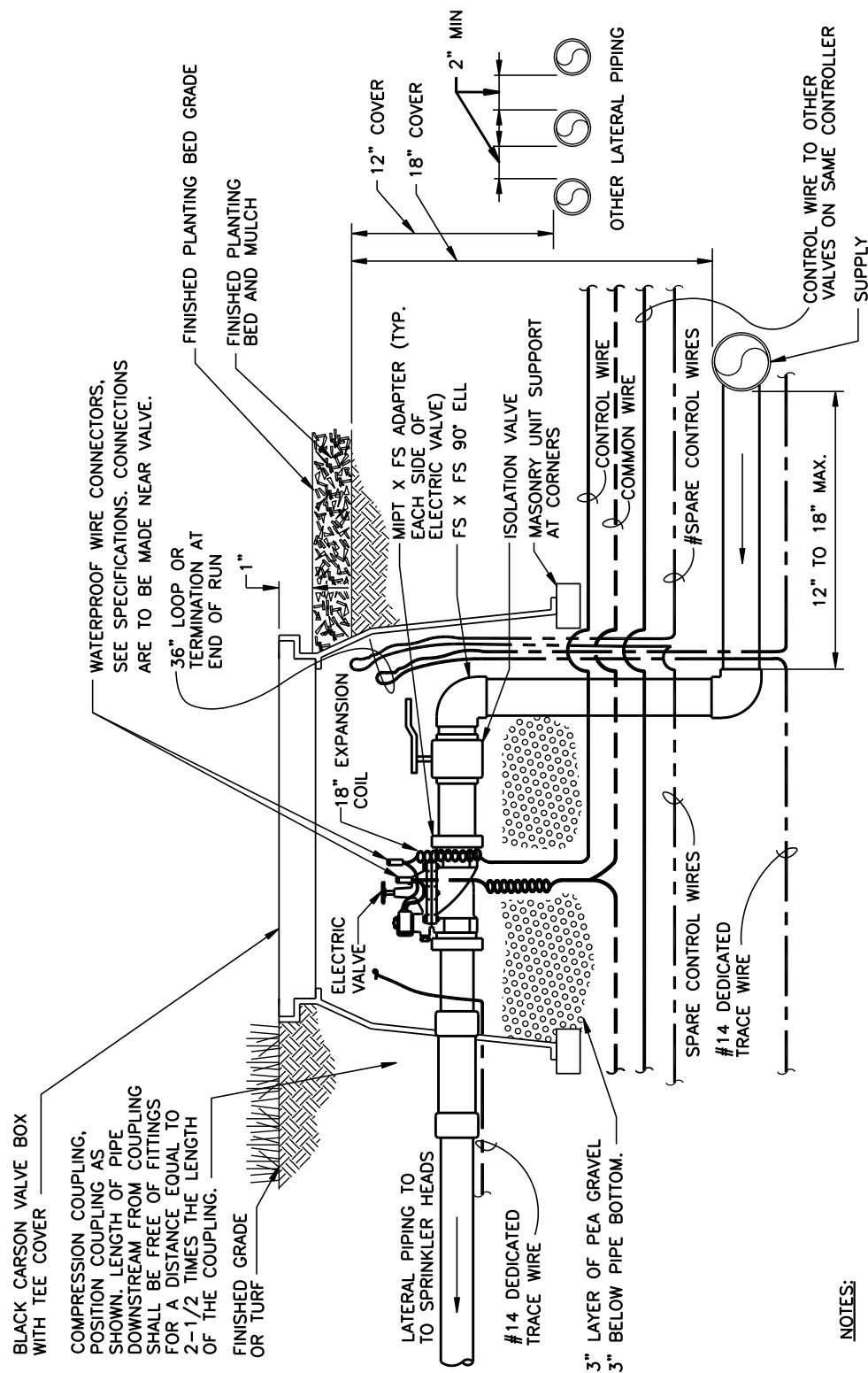


DURA QUICK COUPLER SWING ASSEMBLY 1-A4-1-11-18

NOT TO SCALE

SD-CI-14

Quick Coupler Anchor Assembly and Installation



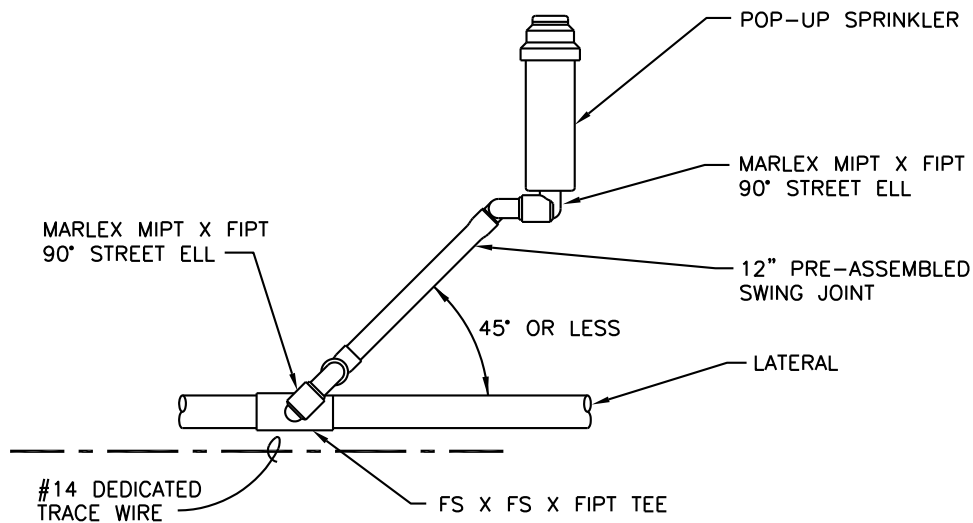
NOTES:

1. ALL WIRE INSTALLATIONS WILL BE IN COMPLIANCE WITH APPLICABLE CODES.
2. TAPE AND BUNDLE WIRE EVERY TEN FEET.
3. PROVIDE EXPANSION COILS AT EACH WIRE CONNECTION IN VALVE BOX.
4. COMPACT SOIL AROUND VALVE BOX TO SAME DENSITY AS UNDISTURBED ADJACENT SOIL.
5. ALL PIPE AND FITTINGS WILL BE SCHEDULE 40 PVC.
6. VALVE BOX SHALL NOT REST ON PIPES. SEE SPECIFICATIONS.
7. NO PIPING UNDER VALVE BOXES (EXCEPT INLET SUPPLY).

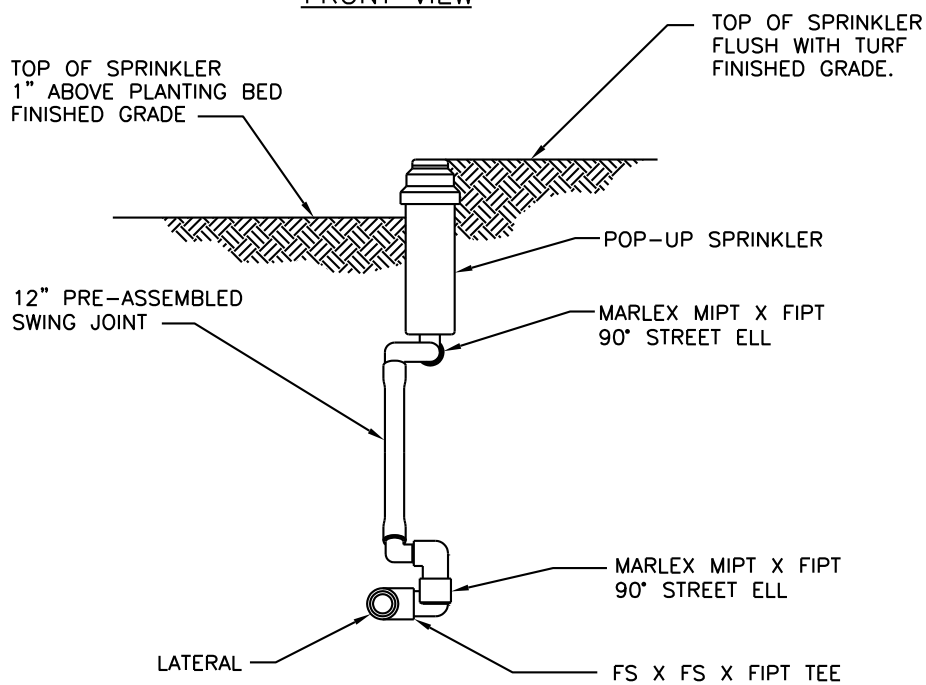
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SD-CI-11

Exterior Single Zone Valve Assembly



FRONT VIEW



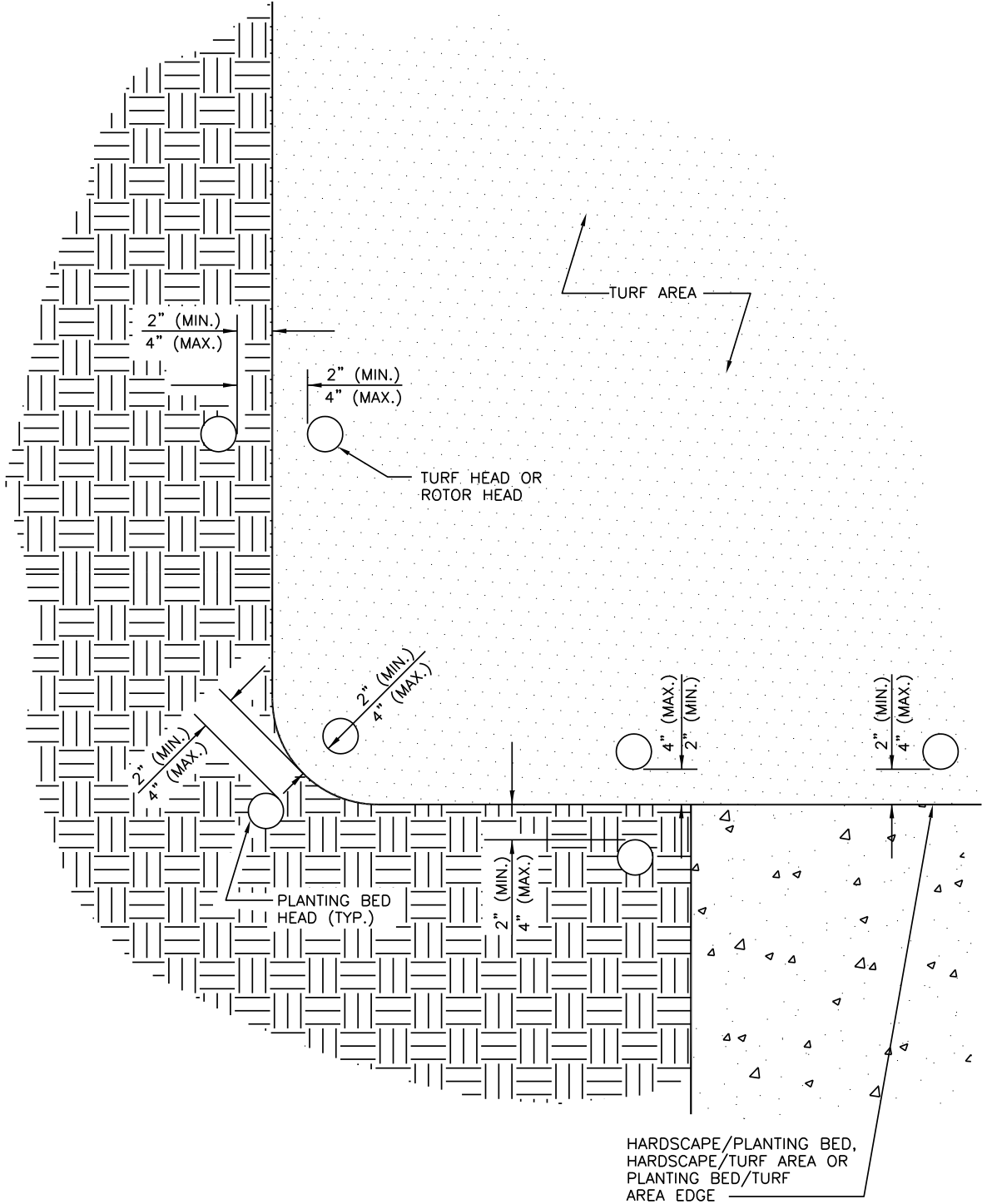
SIDE VIEW

POP-UP SPRINKLER AND PRE-ASSEMBLED SWING JOINT CONNECTION ASSEMBLY

NOT TO SCALE

SD-CI-16

Pop-Up Sprinkler Assembly and Installation



NOT TO SCALE

SD-CI-17

Pop-Up Head Set Back and Location