Irrigation System Design

BMP Type			
Design			X
Installation			
Maintenance/Operation			
Green Industry Relevance			
ASLA	X	GCC	X
ALCC	X	ISA	X
CALCP	X	RMSGA	X
CGGA	X	WFC	
CNA	X		

Description

Design the irrigation system for the efficient and uniform distribution of water.

This BMP is based largely on practice guideline 2 from "Turf and Landscape Irrigation Best Management Practices" (The Irrigation Association 2001).

Basic Practice Guidelines

Design Principles

1. Design irrigation systems based on a comprehensive understanding of soil type and infiltration rate; plant type, treatment and placement; site microclimates; site grading, slopes, exposure to wind and sun; water availability and source; size of irrigated area; available flow and pressure; water quality; water cost; historical evapotranspiration (ET) rate and annual rainfall; and the construction budget.

2. Consider site hydraulics such as pressure, flow principles, friction losses, gravity drainage and extreme pressure circumstances when designing irrigation systems.

3. All irrigation systems should be designed to avoid runoff, low-head drainage, overspray or other conditions where water flows onto adjacent property, non-irrigated areas or hard surfaces such as sidewalks and roads.

4. Meet all applicable plumbing and electrical codes and specify proper protection of the water source (e.g., backflow prevention devices).

5. Follow the "three rules" of maximum safe flow with the lowest safe flow prevailing as the design guideline:

   - The maximum allowable pressure loss through the meter should be less than 10 percent of the inlet pressure at the meter.

   - The maximum flow rate through the meter should be 75 percent of the maximum safe flow for the meter.

   - The velocity of water flow through the service line supplying the meter should not exceed 7 feet per second.

6. Provide for a designed Distribution Uniformity (DU) of 75 for the entire site.

7. Establish an irrigation schedule for all zones that meets peak demand for water.

8. Properly size pipes with no more than 10 percent variation in pressure within a zone between sprinkler heads and not to exceed 5 feet per second flow within the piping system.

9. Base zone layout on soil properties, slope, plant material water requirements, root zone depth, weather conditions, site conditions, supply pressure and minimum acceptable application rates. Irrigation system design goes hand-in-hand with the landscape design—irrigation zones should correspond to hydrozones on landscape plans. Always zone turf separately from plants and shrubs.

10. Specify the size and type of equipment to be used to meet the demands of an efficient system. Properly size valves and pipes to maintain proper pressure and coverage in irrigation systems. Changes in specified equipment should meet or exceed the minimum criteria DU of 75. The selected equipment should be appropriate for the size and use of the area in the landscape to minimize water waste.

11. Design the system in accordance with the manufacturer's recommendations for efficiency.

12. Sprinkler heads and emitters should be selected for proper area coverage, consistent application rates, operating pressure, adjustment capability and ease of maintenance. Never mix different types of sprinkler heads within the same zone, or mix sprinkler heads from different manufacturers.

13. For drip irrigation systems, properly size drip emitters to meet the different water needs of plants. On slopes, drip emitters should be placed uphill of the plants. A properly designed drip system is typically 90 percent efficient or higher.

14. Properly space sprinkler heads based on nozzle performance and pressure requirements to provide uniformity of coverage, making sure to account for influences such as slopes. Since each sprinkler is effective to approximately 60 percent of its radius, the best spacing to obtain uniform coverage is head-to-head. Ensure that irrigation laterals have matched precipitation rates for sprinkler arcs.

15. Ease of installation, operation, repair and maintenance should be considered in the design.

16. Specify equipment such as type of controller, sensors, etc., to facilitate management of the system. The selection of pipe, electrical wire and other materials should be based on environmental conditions and code requirements. The sprinkler head placement should be based on the best performance criteria including pressure, spacing and other site factors or local environmental conditions.

17. Include provisions for future expansion, as needed, such as installation of spare zone control wires or larger upstream components such as mainline pipe, etc.

Alternative Water Sources

18. Use recycled or non-potable water to the greatest extent possible, as limited by supply and/or regulation. Non-potable water supplies should be explored for large landscaped areas such as

parks and golf courses in particular. Designs should be compatible for use with non-potable sources, should they become available.

19. Water should also be harvested from rainfall and snowmelt for landscape irrigation purposes to the extent practicable.

20. When designing systems using reclaimed water, ensure that applicable regulations are followed. For example, provide for required signage and cross-connection inspection in accordance with Colorado Department of Public Health and Environment Water Quality Control Commission *Regulation No. 84: Reclaimed Domestic Wastewater Control Regulation*.

Water Conserving Equipment and Methods

21. Design low-volume irrigation for long, narrow or small irregularly-shaped landscape areas to reduce evaporation losses and to avoid applying water on hardscapes such as roadways, parking areas, driveways, sidewalks, patios and decks. Planting beds and narrow turf strips can be particularly well suited to subsurface and drip irrigation systems. Do not install overhead sprinkler systems for median strips less than 10 feet wide.

22. Install a master valve to minimize system leakage.

23. Use of low-pressure (i.e., less than 50 pounds per square inch) irrigation systems for large turf areas can reduce operational costs, system wear, potential for misting and water waste. Pressure-compensating heads should be used where appropriate to regulate pressure requirements.

24. Consider soil infiltration rate, slope, and design precipitation rate when selecting sprinkler heads to reduce the potential for runoff.

25. Specify low-angle sprinkler heads to mitigate the effects of wind.

26. Specify water-conserving devices such as check valves, pressure regulators or climate sensors such as rain, freeze and wind sensors, etc., to suspend irrigation when unfavorable weather conditions exist. Proper location and installation are necessary in order for these technologies to be effective.

27. Install anti-drain (check) valves in strategic locations to minimize or prevent low-head drainage, or use heads with a built-in anti-drain feature.

28. Regulate water pressure with valves, as needed. Prevent water hammer and line and sprinkler head drainage. Pressure-compensating outlets should be used where pressure varies more than 20 psi or 20 percent from design operating pressure.

29. Specify water-conserving irrigation management methods such as the use of ET controller technology (or ET data) or soil moisture sensors to minimize over-watering.

30. Specify a controller that allows for flexible irrigation scheduling and water management, including features such as the use of repeat cycles to minimize runoff, water budgeting and interfaces with various climate or environmental sensors to manage programmed irrigation schedules.

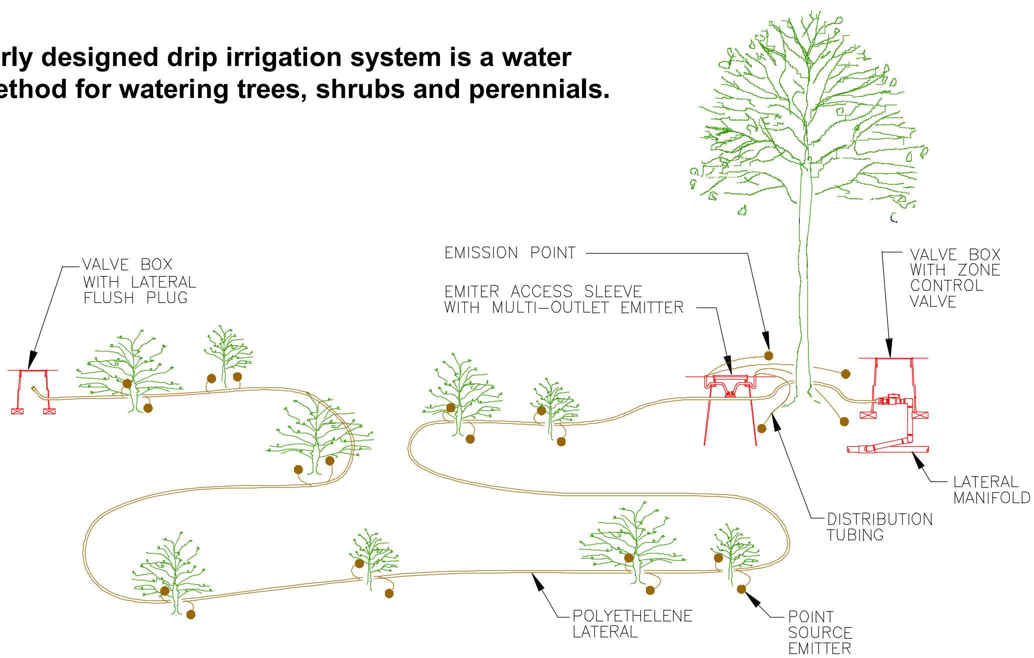
31. Particularly for large landscapes, controllers should have the capability to permit simultaneous multiple-cycle irrigation, seasonally variable programming, manual override and effective use of low-volume irrigation zones (i.e., long run-time at infrequent intervals).

32. Avoid oscillating sprinklers and sprinkler heads that produce mists or fine sprays.

33. Consider pump intake filters for irrigation systems where source water quality is an issue to promote better functioning of irrigation equipment.

34. Consider installing a dedicated water meter or flow sensor with a readable output to measure the flow and quantity of water being applied to the landscape.

A properly designed drip irrigation system is a water efficient method for watering trees, shrubs and perennials.



Source: Stephen Smith, Aqua Engineering.

Documentation and Follow-up

35. Provide for temporary irrigation plans to establish new vegetation.

36. Written irrigation plans should include: the precipitation rate for each zone; the calculated flow rate for each emitter or low-volume zone; a schedule of irrigation for both the establishment and post-establishment periods; and a general operating schedule of run-times based on projected ET for each zone during each week of the irrigation system. The manufacturer and catalogue number of specified parts should also be provided.

37. Assure overall quality of the irrigation system by ensuring that the properly-designed irrigation system is properly installed and maintained.

Regional or Industry Considerations/Adaptations

1. For landscape managers or growers who obtain water from irrigation companies, it is particularly important to identify and understand the method used to measure the amount of water provided, the delivery schedules and water rights issues when designing the irrigation system.

2. In areas where drain ditch water is used, water may not be of sufficient quality for irrigation. A salt test should be conducted on such water prior to selecting plant materials.

Key References

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