Best Management Practices for Landscape Irrigation

Brent Q. Mecham
Landscape Water Management & Conservation Specialist
Northern Colorado Water Conservancy District
Loveland, Colorado
www.ncwcd.org

Purpose of this Document:

The purpose of this document is to identify and define Best Management Practices (BMPs) and Practice Guidelines (PGs) for turf and landscape irrigation.

The BMPs support the design, installation, maintenance and management of turf and landscape irrigation systems in ways that enable the efficient application and protection of water.

Practice Guidelines are also identified and defined that make it possible to implement the Landscape Irrigation BMPs based upon local conditions and situations with the desired goal of conserving and protecting water resources.

The overall intent is to provide all parties who are affected by landscape irrigation systems such as landscape irrigation designers, irrigation contractors, maintenance personnel, irrigation system owners and water purveyors with the tools to understand and manage efficient landscape irrigation systems.

Definition of BMP:

A **Landscape Irrigation Best Management Practice** is a voluntary irrigation practice that is designed to reduce water consumption and protect water quality. It is economical, practical and sustainable and will maintain a healthy, functional landscape without exceeding the water requirements of the landscape

Tenets of Irrigation BMPs:

1. States broad requirements that are applicable to any location, while allowing for local interpretation and implementation through the related Practice Guidelines.
2. Water conserving through protection of water quality and quantity.
3. Sustainable by using current technology and allowing for improvement through new technology.
4. Economical in installation and use.

Landscape Irrigation BMPs:

1. **Assure Overall Quality of the Irrigation System**
2. **Design the Irrigation System for the Efficient and Uniform Distribution of Water**
3. **Install the Irrigation System to Meet the Design Criteria**
4. **Maintain the Irrigation System for Optimum Performance**
5. **Manage the Irrigation System to Respond to the Changing Need for Water**

BMP 1 Assure Overall Quality of the Irrigation System

The purpose of an irrigation system is to apply supplemental water that is needed by turf and landscape plants when natural moisture and rainfall are not sufficient. A quality irrigation system is required to effectively distribute this supplemental water in a way that maintains healthy turf and landscape plants while conserving and protecting water resources. The irrigation system shall be designed to be efficient and to uniformly distribute the water. The irrigation system shall be installed according to the irrigation design specifications, and in a way that results in an efficient and uniform distribution of water. The irrigation system shall be regularly maintained to keep the integrity of the design and to sustain the efficient and uniform distribution of water. Ultimately, it is the management of the system to deliver adequate water when needed, thus protecting and conserving water resources.

BMP 2 Design the Irrigation System for the Efficient and Uniform Distribution of Water

The irrigation system shall be designed to be efficient and to uniformly distribute the water. Specific criteria that shall be considered in the design include soil type, slope, root depth, plant materials, microclimates, weather conditions, water source (e.g., quantity, quality and pressure), peak demand and watering windows. To conserve and protect water resources, the irrigation designer (or engineer) shall select appropriate equipment components that meet site and local code requirements and that result in an efficient and uniform distribution of the water.

BMP 3 Install the Irrigation System to Meet Design Criteria

The irrigation system shall be installed according to the irrigation design specifications. To conserve and protect water resources, the installed components shall meet the irrigation design specifications, manufacturer's specifications, and site and local code requirements. The installation shall result in an efficient and uniform distribution of the water. The irrigation contractor (or installer) shall be licensed, experienced, and reputable.

BMP 4 Maintain the Irrigation System for Optimum Performance

The irrigation system shall be regularly maintained to keep the integrity of the design. To conserve and protect water resources, the serviced components shall meet the irrigation design specifications, manufacturer's specifications, and site and local code requirements. The maintenance shall result in sustaining an efficient and uniform distribution of the water. The maintenance contractor (or owner, manager, or irrigation contractor) shall be licensed, experienced, and reputable.

BMP 5 Manage the Irrigation System to Respond to the Changing Need for Water

To conserve and protect water resources, the irrigation schedule shall be changed or controlled as required to provide supplemental water for maintaining healthy plants and turfgrass without wasting water.

Proposed Practice Guidelines for Colorado:

A ***Practice Guideline*** (PG) is a recommendation that is locally applied and that fulfills the requirements of the related Landscape Best Management Practice. The identified practice guidelines are to be used to facilitate the creation of specific requirements that address local needs.

PG 1 - Practice Guideline for Assuring Quality of the Irrigation System

This Practice Guideline meets the requirements of BMP 1. To assure that a quality irrigation system is designed, installed, maintained, and managed:

- A qualified irrigation designer (qualified shall include certified, formally trained, licensed or some other similar qualification to meet local requirements) shall properly design the system for the efficient and uniform distribution of water based on the requirements of PG 2.
- A qualified irrigation contractor shall properly install and/or maintain the irrigation system based on the requirements of PG 3. The irrigation contractor shall thoroughly test the completed system to verify that the system operates according to the design criteria.
- The architect, irrigation designer or local water district representative shall perform one or more field observations during system installation to check for adherence to the design. The purpose of the observation is to check for proper installation and function of the back flow prevention assembly, main line, pipes, valves, sprinkler heads, control wire, controller, and water conserving devices.
- The irrigation system shall be properly maintained for sustained optimum and efficient performance based on the requirements of PG 4.
- The water distribution of the irrigation system shall be properly managed to respond to the changing need for water in the landscape as based on PG 5.
- Within 60 days of installation of a new system, and periodically as set by local standards, a field performance audit shall be conducted using an accepted procedure such as the Certified Landscape

Irrigation Audit technique from the Irrigation Association. The audit shall check the performance of the system for conformance with local requirements including meeting the minimum precipitation rate and distribution uniformity (DU) standards, and installation of all system components including appropriate sensors. The audit shall also verify that the programmed irrigation schedule meets the supplemental water needs of the plants without wasting water. Those systems that are not in compliance within 45 days of the audit shall be remedied as per requirements of the local water purveyor or owner of the property.

PG 2 - Practice Guideline for Designing an Irrigation System

This Practice Guideline meets the requirements of BMP 2. To ensure that the irrigation system is efficiently and uniformly designed to distribute the water, and to conserve and protect water resources:

- The irrigation design shall meet all applicable plumbing and electrical codes.
- The irrigation design shall specify proper protection of the water source.
- The irrigation design shall follow the "three rules" of maximum safe flow with the lowest safe flow prevailing as the design guideline:
    1. The maximum allowable pressure loss through the meter should be less than 10% of the inlet pressure at the meter.
    2. The maximum flow rate through the meter should be 75% of the maximum safe flow for the meter.
    3. The velocity of water flow through the service line supplying the meter should not exceed seven feet per second.
- The specified water source (size and pressure) shall be adequate to meet peak demands for water with a watering window of no more than 10 hours per day on a daily basis.
- The irrigation system shall have a designed Distribution Uniformity (DU) of 75 for the entire site.
- The design shall include an irrigation schedule for all zones that meets peak demand for water.
- The design shall have appropriate pipe sizing with no more than 10% variation in pressure within a zone between sprinkler heads and not to exceed 5 feet per second flow within the piping system.
- Zone layout shall be based on soil properties, slope, plant material water requirements, root zone depth, weather conditions, site conditions, supply pressure, and minimum acceptable application rates.
- The design shall specify the size and type of equipment to be used to meet the demands of an efficient system. Changes in specified equipment shall meet or exceed the minimum criteria DU of 75. The selected equipment shall be appropriate for the size and use of the area in the landscape to minimize water waste.
- The design shall minimize installation and maintenance difficulties.
- The design shall specify equipment such as type of controller, sensors, and so forth to facilitate management of the system. The selection of pipe, electrical wire and other materials shall be based on environmental conditions and code requirements. The sprinkler head placement shall be based on the best performance criteria including pressure, spacing and other site factors or local environmental conditions.
- The design may include provisions for future expansion such as installation of spare zone control wires or larger upstream components such as mainline pipe etc.

The design may incorporate the following design concepts or equipment to improve landscape water management efficiency:

- Install a dedicated water meter or flow sensor with a readable output to measure the flow and quantity of water being applied to the landscape.
- Consider using an alternative water source where practical and allowed by law, such as untreated raw water, reclaimed / recycled water or "harvested" water etc.
- 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.
- Consider soil infiltration rate, slope, and design precipitation rate when selecting sprinkler heads to reduce the potential for runoff

- Specify low-angle sprinkler heads to mitigate the effects of wind.
- Specify water-conserving devices such as check valves, pressure regulators or climate sensors such as rain, freeze, wind etc. to suspend irrigation when unfavorable weather conditions exist.
- Specify water-conserving irrigation management methods such as the use of evapotranspiration (ET) data or soil moisture sensors to minimize over-watering.
- Specify a controller that allows for flexible irrigation scheduling and water management including such features such as the use of repeat cycles to minimize runoff, water budgeting, interfaces with various climate or environmental sensors to manage programmed irrigation schedules.

PG 3 - Practice Guideline for Installing an Irrigation System

This Practice Guideline fulfills the requirements of BMP 3. To ensure that the irrigation system is installed to efficiently and uniformly distribute the water, and to conserve and protect water resources, the irrigation contractor (or installer) shall:

- Before commencing installation, verify that water tap, flow rate and pressure meet design criteria.
- Install the irrigation system's components according to the design specifications and manufacturer's published performance standards. The design shall reflect the practices defined in PG 2. If a design does not exist, then go no further until one is created.
- Where deviations from the design are required (for example, running pipe around a tree or other structure or adding sprinkler heads to an area larger than the plan shows), consult with the designer prior to making the change to ensure that the change is within design performance specifications.
- Furnish record drawings to the owner of the system. The record drawings shall describe the system layout and components including all changes from the original design.
- Test the irrigation system to verify that the system meets the design criteria.
- Perform an irrigation audit using an accepted procedure and provide the end user (or owner) with system specifications and a zone performance summary report that includes individual zone precipitation rates in inches per hour. The measured DU should be at least 90% of the designed DU. A reference of each zone's precipitation rate should be retained at the controller.
- Create an irrigation schedule based on PG 5. Review the irrigation schedule, specifically the rationale for and how to set irrigation days, zone run times and start times. Review advanced programming features such as multi-cycle irrigation to prevent run-off and the use of the percentage water increase/decrease function.
- Explain to the end user (or owner) the location and operation of the controller, valves, sensors, pressure regulators, backflow device and sprinkler heads. Educate the owner on features and capabilities of the system including the maintenance requirements of PG 4.
- Provide the end user (or owner) with recommendations for landscape water conservation. Provide the end user (or owner) with product warranties and operating instructions for all equipment.

Additional points to consider when selecting a contractor:

- Is the contractor licensed, experienced and reputable? Is the contractor legally authorized to install and maintain irrigation systems in the project area?
- What permits are required of the contractor prior to installation of the sprinkler system? Are any inspections of the system required? What parts of the system will be inspected? Who will do the inspections?
- Will the contractor provide a design at the beginning of the project? Will the contractor provide record drawings at the completion of the project?
- Prior to beginning work, will the contractor call appropriate utility companies to locate underground utilities including gas lines, electrical, telephone, cable, and so forth? Will the contractor fix any problems he creates, such as cut sewer lines or utilities, at his own expense and in a timely manner?
- Will the trenches be dug outside the drip line of the tree, or will tree roots be cut? Is landscape restoration part of the scope of work?

Obtain a written contract. The contract should at a minimum include the scope of work, price, permits required, warranty, necessary exclusions, and payment terms. Request that the contractor address the above questions in the language of his contract.

PG 4 - Practice Guideline for Maintaining the Irrigation System

This Practice Guideline fulfills the requirements of BMP 4. To ensure that the irrigation system continues to efficiently and uniformly distribute the water, and continues to conserve and protect water resources, the maintenance contractor (or owner, manager, or irrigation contractor) shall:

- Establish a systematic maintenance schedule for inspection and reporting of performance conditions to the end-user (or owner) of the irrigation system. Report any deviations from original design. If none exists, create a color-coded zone map for ease of system inspection and controller programming.
- Verify that the water supply and pressure are as stated in the design.
- Verify that the backflow prevention device is working correctly.
- Periodically perform a thorough inspection of the system components to verify that the components meet the original design criteria for efficient operation and uniform distribution of water:
    - Adjust valves for proper flow and operation. Adjust valve flow regulators for desired closing speed.
    - Verify that heads are properly adjusted – nozzle, arc, radius, level and attitude with respect to slope.
    - Verify that sensors used in the irrigation system are working properly and are within their calibration specifications.
- Repair or replace broken hardware and pipe; restore the system to the original design specifications. Test all repairs
- Ensure that the replacement hardware used for system repairs matches the existing or original hardware, and is in accordance with the design.
- As plant material matures, add or relocate system components (or like hardware) as required to maintain uniform distribution of water. Ensure that system modifications do not exceed the system watering capacity.
- Establish a “winterization” protocol (if required) and a corresponding process for system activation in the spring.

The maintenance contractor shall be licensed, experienced and reputable. The maintenance contractor shall be legally authorized to maintain irrigation systems in the project area.

PG 5 - Practice Guideline for Managing Supplemental Irrigation

This Practice Guideline fulfills the requirements of BMP 5. To conserve and protect water resources, the irrigation schedule shall be changed often enough to provide supplemental water for maintaining healthy plants without wasting water. The irrigation manager (end-user, owner, maintenance personnel, or contractor) shall:

- Understand the capacities and capabilities of the irrigation system.
- Establish a water budget based upon system performance and plant water requirements.
- Measure and compare actual water usage to the amount of water need.
- Perform irrigation audits if current data doesn’t exist to obtain data needed to create irrigation schedules
- Understand and use a reliable source for Reference Evapotranspiration (ET) rates. Appropriately modify the Reference ET to calculate local water needs for the various plant materials and turfgrass in the landscape. Identify soil types and root depths of each zone and determine soil-water capacities. Calculate the run time of each zone to supply the needed water based upon the actual precipitation rate of the sprinkler zones, the water holding properties of the soil, the changing weather conditions and the plant’s water requirements. Set the schedule to minimize runoff in situations where runoff can occur.
- Conserve water by frequently adjusting the irrigation schedule to meet the changing need for water.
- Periodically verify that sensors in the irrigation system are working properly.
- Periodically verify that the plant material is healthy and that soil moisture is adequate. Use a soil probe to visually inspect root depth, soil structure and moisture.

- Prepare a written irrigation management site plan to respond to the following situations so that corrective actions can take place promptly as required:
    - Adequate water supplies
    - Water use restrictions
    - Public water supply emergency
    - Water shortages
    - Drought—including the various stages of drought and the required response for managing landscape irrigation for each stage.

The plan shall clearly identify soil types and soil properties combined with plant root depth to determine plant available water and the managed allowable depletion before supplemental irrigation is required to keep plant materials alive. The plan shall include projected irrigation events based upon historical ET information and the maximum amount of time between irrigation events. The plan will include using concepts such as deficit irrigation. The plan shall identify high priority areas to be watered down to the lowest priority areas where water would first be withheld when responding to water shortages or drought. The plan will be part of a comprehensive landscape management plan that will address other cultural practices and issues such as mowing, fertilizing, etc.

The irrigation system is a management tool and cannot replace the sound judgement of trained professionals.