General Landscape Irrigation Audit Procedures

Landscape irrigation auditing is an effective tool for maximizing water use efficiency in urban landscapes such as home lawns, commercial properties and sports fields. An audit can be used to improve the efficiency of existing irrigation systems.

Irrigation audits consist of three main activities: site inspection, performance testing, and irrigation scheduling. Each activity in itself can result in significant water and cost savings. Together, these activities provide landscape maintenance personnel with a customized irrigation program based on site specific conditions and irrigation system performance.

Site Inspection

Over time, even the most efficiently designed irrigation system will begin break down. In absence of a regular maintenance program, minor operation and performance problems can continue for months resulting in excessive water use and poor efficiency, which can reduce plant quality. Sunken sprinkler heads that do not “pop-up” properly, misaligned spray patterns that throw water onto streets, sidewalks or hardscapes, and broken or missing sprinkler heads resulting from vandalism or mower damage can result in significant water waste. Performance problems are often inherent in an irrigation system. A sprinkler system where the heads are spaced too far apart will result in poor water distribution and/or dry (or “hot”) spots on the landscape. In order to compensate for this poor uniformity, the system is often set to operate longer, which in turn over-waters most of the landscape. Insufficient or excessive operating pressure will also lead to high water loss through wind drift or poor coverage. Low water pressure is generally caused by insufficient static pressure and/or high pressure losses through valves, meters, piping and other components of the irrigation system. Visual indications of low water pressure include large water droplets and short sprinkler throw. High water pressure, on the other hand, indicates an absence of proper pressure regulation devices. High pressure is generally characterized by excessive misting of water that is easily evaporated or carried by the wind.

Performance Testing

Sprinkler application devices, including pop-up spray heads, rotors, micro-sprays and bubblers are designed to operate within specific operating pressures and head spacing. Manufacturer’s specifications catalogs rate the performance, mainly flow rate (in gallons per minute) and precipitation rate (in inches per hour), based on these parameters. Commonly, the rated performance listed in the catalogs does not accurately represent actual performance.

For irrigation scheduling purposes, the most accurate determination of precipitation rate is achieved by conducting catch can tests. Catch can tests measure the amount of water that actually hits the ground at various points within the landscape, and also serves to measure application uniformity. Since irrigation systems commonly use different types and brands of sprinklers, it is important to conduct catch can tests for each individual zone or “station” on an irrigation system.

Following is the general approach to conducting catch can tests:

1. Turn on the irrigation system, one zone at a time, to locate and mark sprinkler heads.

2. Starting with zone 1, layout catch devices only on the part of the landscape covered by zone 1. Catch devices should be placed in a grid-like pattern throughout the zone to achieve an accurate representation of sprinkler performance.

Note: Try not to place catch devices too close to sprinkler heads to avoid altering spray patterns.

3. Turn on zone 1, allowing water to partially fill the catch devices. Keep track of the number of minutes that the zone is allowed to operate.

4. After a measurable amount of water has fallen, measure the depth of water (in inches) contained in each device using a ruler. (It is recommended that the ruler measure in "tenths" of inches). Record these values on a data sheet. Also record how long (in minutes) the zone was operated. If catch containers do not have 'parallel sides", then water volume may need to be measure and then corrected for container opening area.

5. Repeat steps 1-4 above for each remaining zone on the system.

Using the data from catch can testing, we can now determine the precipitation rates for each individual zone on the irrigation system. The simple equation for calculating precipitation rate is given below:

Precipitation rate = (average catch can depth ÷ run time) x 60

Where: Precipitation rate is in inches per hour
Average catch can depth is in inches

Note if containers do not have parallel sides then it is best to measure volume (in mL which is equivalent to cm^3) and determine depth by dividing volume by area (in cm^2)of the container's opening.

Remember: Area of circle = πr^2 & 1 inch = 2.54 cm

Our catch cups have an area of 44.18 cm^2, so in this case 56.10 mL = ½ inch water

Irrigation Scheduling

The answer to the question, "when do I irrigate and how long?" has been based on assumptions and generalizations in regards to sprinkler system performance and plant water requirements. Audits replace many of the assumptions we make in irrigation scheduling. With irrigation auditing, we customize our irrigation schedules based upon on catch can results. Rather than using the longtime recommendation of "fifteen minutes, three times per week", run times can be adjusted for individual zones based on measured precipitation rate.

Determining when to irrigate should be based upon the depth of the plant's root zone and the type of soil therein. Together, root depth and soil type define the amount of water that is available for plant use. A six-inch clay soil, for example, will hold more water that will six inch of sand. Thus, the number of irrigations per week will be less in the clay, though the amount of water the plant needs will remain the same. Root depth also influences irrigation frequency. Shallow rooted turfgrass, for example, will require more frequent irrigations than will a turfgrass with a deeper root zone.

The first step in determining how long to irrigate is to first determine how much water that you should apply each irrigation event. Plant water requirements vary significantly in urban landscapes due to the variety of plant species, maintenance practices and microclimates. Water requirements also vary with climate trends and rainfall patterns. Turfgrass, which is generally assumed to be the highest water user, requires up to 1-inch per week during the summer with less in the spring and fall. Once it is determined how much water (in inches) is needed each irrigation, the conversion to zone run time is simple. The following equation is used to determine zone run times:

Run Time per Irrigation = (Targeted irrigation depth ÷ Zone precipitation rate) x 60

Where: Run Time per Irrigation in minutes
Targeted irrigation depth in inches
Zone precipitation rate in inches per hour

Irrigation Audit Datasheet adapted from *aggiehort agentdemo.*

LANDSCAPE IRRIGATION AUDIT DATASHEET

Site:

Date/Time:

Auditor:

	Broken Heads	Mis-aligned Heads	Sunken Heads	High Pressure	Low Pressure	Mixed Head Type	Site Inspection
Zone #							Comments
1							
2							
3							
4							
5							
6							

CATCH CAN RESULTS

Zone #	1	2	3	4	5	6
Test Run Times (minutes)						
Catch Can Dept (inches)						
Precipitation Rate (in/hr) = Average Can Depth (in) ÷ Test Run Time (minutes) x 60	Precipitation Rate (inches/hour)					

QUANTIFYING IRRIGATION WATER USE

Determining Inches of Water Applied per Irrigation

Inches Applied per Irrigation = (Run time x Precipitation rate) ÷ 60

Example: Zone 1 is set to operate 30 minutes. According to the catch can test, Zone 1 has a precipitation rate of 0.5 inches per hour.

Inches Applied per Irrigation = (30 minutes x 0.5 inches per hour) ÷ 60 = 0.25 inches

Determining Inches of Water Applied per Week

Inches Applied per Week = Inches Applied per Irrigation x Number of Irrigations per Week

Example: Zone 1 applies 0.25 inches per irrigation. Zone 1 is set to operate three days per week.

Inches Applied per Week = 0.25 inches per irrigation x 3 irrigations per week = 0.75 inches

Converting Inches per Irrigation to Gallons per Irrigation

Gallons per Irrigation = Inches per Irrigation x Landscape Area x 0.6234

Example: Zone 1 applies 0.25 inches per irrigation. The area covered by Zone 1 is 1000 square feet.

Gallons per Irrigation = 0.25 inches per irrigation x 1000 square feet x 0.6234 = 155.85 gallons

Converting Inches per Week to Gallons per Week

Gallons per Week = Inches per Week x Landscape Area x 0.6234

Example: Zone 1 applies 0.75 inches per week. The area covered by Zone 1 is 1000 square feet.

Gallons per week = 0.75 inches per week x 1000 square feet x 0.6234 = 467.55 gallons

Other Conversions:

Gallons to Inches: Gallons ÷ Landscape Area ÷ 0.6234 = Inches
Gallons to 100 Cubic Feet: Gallons ÷ 748 = ccf
325,851 gallons = one acre-foot of water
27,154 gallons = one acre-inch of water