

IRRIGATION AUDIT DATASHEET

Auditor	Site Name	Date/Time
	Address	

SITE INSPECTION							
Zone #	Broken Heads	Mis-aligned Head	Sunken head	High pressure	Low pressure	Mixed Head Type	Comments
1							
2							
3							
4							
5							
6							
7							
8							

CATCH CAN RESULTS

Zone #	1	2	3	4	5	6	7	8
Test Run Time (minutes)								
Catch Can Depth (inches)								
Precipitation Rate (in./hr) = Average Can Depth (inches) ÷ Test Run Time (minutes) x 60	Precipitation Rate (inches/hour)							

Root Zone Depth (inches)	Soil Type			Landscape Area (square feet)
	Clay	Loam	Sand	

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. Having recognized the benefits of auditing, several Texas municipalities and water utilities are including irrigation auditing as part of their overall water conservation programs to reduce outside water use and to improve the efficiency of existing irrigation systems. The Extension Service continues to promote irrigation auditing for Master Gardener volunteers.

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 spacings. 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 do not accurately represent actual performance. For example, insufficient or excessive operating pressure and improper head spacing will significantly increase or decrease precipitation rate.

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 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.
5. Repeat steps 1-5 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:

$$\text{Precipitation Rate (in./hr)} = (\text{Average Can Depth (inches)} / \text{Test Run Time (minutes)}) \times 60$$

Where: Precipitation rate – inches per hour
 Average catch can depth – inches

Irrigation Scheduling

When water supplies are limited, it becomes even more important that every drop of water we pay for is utilized to the fullest. 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, site-specific soil conditions and plant water requirements. Rather than using the long-

time recommendation of “fifteen minutes, three times per week”, we are now able to adjust run times 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 than will a six-inch 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. Due to limited water storage capacity in the plant’s root zone, two or three irrigations per week may be required. 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:

$$\text{Run Time Per Irrigation} = (\text{Targeted irrigation depth} \div \text{Zone precipitation rate}) \times 60$$

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

IRRIGATION AUDITING – PROPOSED RESULT DEMONSTRATION

- LOCATION:** Any automatic irrigation system suspected to suffer from hardware problems, declining plant quality as a result of over-irrigation, or lack of attention to proper irrigation scheduling. Potential sites include home lawns, small commercial sites, courthouse properties, etc.
- PURPOSE:** To identify irrigation system hardware problems and test individual zone performance to improve water use efficiency.
- METHOD:** Each zone is turned on separately to identify any hardware or operation problems that contribute to poor irrigation efficiency. Common problems include misaligned, broken, or malfunctioning sprinkler heads, sunken heads, broken piping, mixed sprinkler head types on a single zone, and high or low operating pressure. A catch can test is performed for each zone on the system to determine actual precipitation rate (in inches per hour). All data is recorded on a data sheet and a copy provided to the landscape manager.
- RESULTS:** A site inspection checklist with recommendations for improving irrigation system efficiency and a list of precipitation rates for individual zones is provided to the landscape manager. Recommendations on adjusting zone run times based on differences in precipitation rate is also provided.
- CONCLUSION:** Document improvements made to irrigation system hardware, changes in irrigation scheduling practices (i.e., zone run times), and overall response from the landscape manager on information gained from the irrigation audit. Specify plans for quantifying water and cost savings over the long-term (i.e., after one year, two years, etc.). The one-pager “Quantifying Irrigation Water Use” contains useful equations and conversion factors needed to evaluate water consumption. Complete a demonstration evaluation form with comments and recommendations for improvement.

QUANTIFYING IRRIGATION WATER USE

Determining Inches of Water Applied per Irrigation

$$\text{Inches Applied per Irrigation} = (\text{Run time} \times \text{Precipitation rate}) \div 60$$

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.

$$\text{Inches Applied per Irrigation} = (30 \text{ minutes} \times 0.5 \text{ inches per hour}) \div 60 = 0.25 \text{ inches}$$

Determining Inches of Water Applied per Week

$$\text{Inches Applied per Week} = \text{Inches Applied per Irrigation} \times \text{Number of Irrigations per Week}$$

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

$$\text{Inches Applied per Week} = 0.25 \text{ inches per irrigation} \times 3 \text{ irrigations per week} = 0.75 \text{ inches}$$

Converting Inches per Irrigation to Gallons per Irrigation

$$\text{Gallons per Irrigation} = \text{Inches per Irrigation} \times \text{Landscape Area} \times 0.6234$$

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

$$\text{Gallons per Irrigation} = 0.25 \text{ inches per irrigation} \times 1000 \text{ square feet} \times 0.6234 = 155.85 \text{ gallons}$$

Converting Inches per Week to Gallons per Week

$$\text{Gallons per Week} = \text{Inches per Week} \times \text{Landscape Area} \times 0.6234$$

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

$$\text{Gallons per week} = 0.75 \text{ inches per week} \times 1000 \text{ square feet} \times 0.6234 = 467.55 \text{ gallons}$$

Other Conversions

$$\text{Gallons to Inches: } \text{Gallons} \div \text{Landscape Area} \div 0.6234 = \text{Inches}$$

$$\text{Gallons to 100 Cubic Feet: } \text{Gallons} \div 748 = \text{ccf}$$

$$325,851 \text{ gallons} = \text{one acre-foot of water}$$