Scheduling Turfgrass Irrigations
Worksheet #1: Water Available to the Grass from the Soil

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This is the first work sheet in a series of three that will establish an annual irrigation program for growing turfgrass in the Las Vegas valley. Once the worksheets are completed, the irrigation clock can be changed monthly according to a schedule you create in Worksheet #3.

Worksheet #1 will take approximately fifteen minutes to complete for every acre of grass in the complex.

Determining water used between irrigations involves four steps:
• Determine how much water the soil will hold after an irrigation.
• Determine how deep grass roots are growing.
• Determine the level of maintenance (high vs. low) required at the site.
• Determine how much water will be available to the grass after irrigation.

The next worksheet will help you determine how much water is lost during an irrigation (irrigation efficiency).

1. What Is My Soil Texture?

Soil: the unconsolidated mineral layer on the surface of the earth that helps provide for plant growth. A soil is a mixture of particles (sand, silt and clay) in various percentages. This mixture is called a soil’s texture. The percentages of each particle determine its texture. Soil scientists classify soils into specific textures that must conform to certain standards. For example, a sandy soil must contain at least 85 percent sand. A clay soil must contain at least 40 percent clay while silt soils must have a minimum of 55 percent silt. Loam is a category of soil that possesses about 40 percent sand, 40 percent silt and 20 percent clay. If sand predominates, then it is termed a "sandy" loam. Similarly, if the silt percentage were highest, it would be classified as a "silt" loam. Table 2 lists some common soil textures that might be found in the Las Vegas valley. The jar test will be used to estimate you soil texture.

The jar test.

If a soil’s texture can be determined, then the amount of water it holds after irrigation can be estimated from Table 2. Select four areas in the lawn and sample the soil to the root depth. Mix these samples together in a bucket and remove rocks larger than one quarter of an inch and debris from a one quart volume of soil. This will be the sample used for the jar test.

Determining soil texture from a jar test. Sand, silt and clay particles are of different sizes: sand being the largest and clay the smallest. When suspended in water at the same time, sand falls to the bottom of the jar very quickly while, soon afterwards, silt and clay fall in a second and third layer. The clay particles are so small that they may remain suspended for hours before they drop, making the final layer. Jar test, continued

Fill a one quart jar half full with the soil free of pebbles and debris. Put 1 teaspoon of detergent in the jar and fill the jar with water to within one inch of the top. Close the lid and shake it vigorously until the soil is thoroughly suspended in the water.

Place the jar on a flat surface. Let the soil in the jar settle for 24 hours undisturbed. Measure the total soil depth in the jar and record it in Table 2.
Using a wax pencil, mark the upper boundary of the sand layer. Sand particles range in size from 2 to .05 mm and can be seen with the naked eye. The approximate top of the sand layer is where particles are no longer distinguishable with your eyes. The layer remaining is a combination of the silt and clay layers. Measure the depth of the sand layer and record in “A” (page 2). Determine the percent sand of the total soil layer. If the percent sand is 65 percent or more then the water held per foot of soil is 1.0 inch. You can record this in Table 2 and ignore the depth of the other two layers.

The remaining layer is clay. By adding the sand and silt layer and subtracting from 100, the clay layer can be estimated. Record the uppermost layer, the clay layer, in “C”. Keep in mind, these are all rough estimates of the percentages of sand, silt, and clay.

Compare these percentages to the percentages in Table 2. Identify the soil texture in Table 2, which is nearest in texture to the soil being evaluated. Record the name of this soil and the amount of water it can hold in the spaces provided below.

<table>
<thead>
<tr>
<th>Jar Layer</th>
<th>Depth of Layers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Bottom (sand):</td>
<td>inch(es) divide by Total then X 100= % SAND</td>
<td></td>
</tr>
<tr>
<td>B. Middle (silt):</td>
<td>inch(es) divide by Total then X 100= % SILT</td>
<td></td>
</tr>
<tr>
<td>C. Top layer (clay):</td>
<td>inch(es) divide by Total then X 100= % CLAY</td>
<td></td>
</tr>
</tbody>
</table>

*In some soils you may only see two distinct layers after completing a jar test. In this case consider the top layer to be a silt/clay layer and ignore the middle layer.

Sometimes you may only see two distinct soil layers. If this is the case then record this layer as a silt/clay layer. The soil texture can be determined by approximating it from Table 2. Find the percentage of sand, silt, and clay in Table 2 that is closest to the percentages you listed for your soil above. Record it below.

<table>
<thead>
<tr>
<th>Texture</th>
<th>Percentage of sand, silt or clay</th>
<th>Water Holding Capacity (inches of water per foot of soil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAND</td>
<td>90% sand, 10% silt/clay (Two layers)</td>
<td>1.00</td>
</tr>
<tr>
<td>SANDY LOAM</td>
<td>90% sand, 10% silt/clay (Two layers)</td>
<td>1.80</td>
</tr>
<tr>
<td>LOAM</td>
<td>45% sand, 40% silt, 15% clay</td>
<td>2.50</td>
</tr>
<tr>
<td>SILT LOAM</td>
<td>20% sand, 65% silt, 15% clay</td>
<td>2.75</td>
</tr>
<tr>
<td>CLAY LOAM</td>
<td>30% sand, 35% silt, 35% clay</td>
<td>2.00</td>
</tr>
</tbody>
</table>

2. Water Holding Capacity: (estimated from Table 2) inch(es) per foot of soil

3. What Is The Maintenance Level You Desire?

The amount of water needed for turfgrass varies with the level of maintenance of the grass. Turfgrass maintained at higher levels uses more water than turfgrass maintained at lower levels. Higher levels of maintained require more frequent applications of fertilizer and/or higher rates. Golf courses may want to select high maintenance. Parks and school properties may select lower maintenance to enhance savings. Property managers may select the high maintenance factor for parts that have high traffic and the low maintenance factor for other parts. Low maintenance lawns may save water but they will not maintain the same quality as their high maintenance counterparts. The maintenance level is a decision about the quality of the lawn versus water savings.

High maintenance lawns are watered when forty percent of the water has been consumed from the soil. Low maintenance lawns are watered when sixty percent of the water has been consumed. This is reflected in the maintenance factor used in calculating the water available to the grass.
Low maintenance, use the factor: .60  
High maintenance, use the factor: .40

3. Maintenance Factor: _________

4. How Deep Are The Roots?  
From the four locations in the lawn area where soil samples were taken, dig to the depth of the grass roots with an auger, probe or shovel. Most tall fescue lawns sampled in the Las Vegas valley have root depths of two to 12 inches.  
Turfgrass rooting depth is affected by the texture of the soil, degree of compaction, mowing height, fertilizer and irrigation practices. Bermudagrass roots can grow considerably deeper.  
Record the depth of the grass roots in the space below.

4. Rooting Depth: ________Inches

5. How Much Water Is Available To The Grass?  
Using the information above, calculate the following and record in the space provided. Save this calculation for Worksheet #3.

Water Available = Water Holding X Maintenance X Rooting Depth (4) To The Grass (5)  
Capacity (2)  Factor (3)  12

5. Water Available To The Grass: ________Inch(es)

This is the amount of water that is available to the turfgrass between irrigations given the quality of the grass you want to obtain. As you can see, the quality of a stand of turfgrass is dependent upon, to some degree, the amount of water available to it.

Glossary Of Terms

 Allowable depletion – the percentage of available water in a soil that can be used before the next irrigation: affects turfgrass quality, tolerance to wear and recuperative potential.

 Average catch-can volume – the average depth of water collected by catch-cans during a precipitation test.

 Booster pump – an accessory pump in an irrigation system used to raise the operating pressure.

 Catch-cans – straight-sided cans of equal dimensions used to catch irrigation water during a precipitation test.

 Core aerifying – turfgrass maintenance practice that creates holes in the soil where turfgrass is growing; improves drainage, decrease runoff, improves air movement to the roots of turfgrass.

 Distribution uniformity (DU) – an irrigation uniformity calculation that focuses on one fourth of the catch-cans with the smallest irrigation volumes; minimizes irrigation “hot spots”.

 Infiltration rate – how fast water can enter a soil.

 Irrigation run time – the length of time a valve(s) is opened; how long an irrigation station is on.

 Irrigation uniformity – a decimal value (sometimes expressed as a percentage) calculated from a precipitation test that reflects how evenly water is applied to an area during an irrigation. A value of 1.00 (100percent) is perfect uniformity.

 Jar test – procedure used to estimate a soil’s texture by measuring the layers of sand, silt and clay that form after these particles are separated by shaking them in a jar of water.

 Loam – a soil texture having a mixture of sand, silt and clay.

 Maintenance factor – refers to the level of use or expectation from a turfgrass stand; the maintenance factor determines the allowable depletion.

 Matched precipitation – irrigation nozzles designed to deliver the same precipitation rate regardless of whether the nozzle is a quarter, half or full are.

 Operating pressure – water pressure of the irrigation system as it is running.

 Precipitation rate – amount of water applied by an irrigation system over a time period, usually in inches per hour.

 Puddling – standing water after an irrigation.

 Rooting depth – the depth to which the majority of a plant’s root system will grow.

 Rotating head – irrigation head that distributes irrigation water by moving or rotating.

 Runoff – irrigation water applied in excess of the soil’s infiltration rate.

 Soil particle – a particle of sand, silt or clay.

 Soil penetrants – chemicals added to the soil or irrigation water to decrease the surface tension of water and improve infiltration and decrease runoff and puddling.

 Soil texture – the percentage of sand, silt and clay in a soil; affects water holding capacity, runoff, puddling, and irrigation run time.

 Spray head – a stationary spray head that emits water as an affine spray; usually used for small turfgrass areas.

 Subcycles – a valve run time or irrigation run time divided into smaller run times to prevent runoff and puddling.

 Valve run time – see Irrigation run time.

 Water holding capacity – the amount of available water a soil can hold usually designated per inch or per foot of soil.