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Why Conserve Water?

*When the well is dry, we know the worth of water.*
- Benjamin Franklin

Water is a non-renewable resource that we tend to undervalue. In Oklahoma, home landscapes consume 30-40 percent of household water use. It is possible to have an attractive landscape while conserving water. The choices made by the individual, as a steward of the land, are what determine how efficiently water is used.

The purpose of this guide is to highlight water conserving options that exist in the home landscape. This guide will cover basic design concepts, plant material selection, proper irrigation, and general maintenance steps to care for the landscape beyond establishment. Each topic will begin with some simple tips and practices called “The Big Drips,” that when applied will create a more sustainable and more resilient landscape that will help conserve Oklahoma’s precious water resources.
Soil Testing

A healthy home landscape starts with a healthy soil. Homeowners should collect a soil sample to ensure the area has the desired pH and available nutrients required for plant growth. Choosing the correct fertilizer and applying it properly creates a healthy landscape and reduces nutrient losses that can be a threat to water quality. A healthy landscape should only be fertilized according to soil test results and plant needs. Homeowners should have the soil tested every 1-3 years.

Collect a Useful Sample

1. Separate your yard by zones or differences in soil fertility, such as: vegetable garden, flower bed and turfgrass (Figure 1).
2. Do not sample unusual or non-representative areas.
3. Use a soil probe or shovel and take a soil sample from the surface to a depth of 6 inches from 15-20 locations in each separate area (Figure 2).
4. Mix the samples in a clean bucket (Figure 3) and completely fill a soil sample bag (2 cups) which can be obtained from the local county extension office or a plastic bag (Figures 4 & 5). The bag should be full to ensure the lab has ample amount of soil to test.
5. Repeat for each area in your landscape making sure to label each bag according to the zone or area collected.
6. Drop your sample off at the local extension office. Your soil test results will include soil test interpretations to ensure proper fertilization rates.

FERTILIZER SELECTION

When selecting a fertilizer, check the numbers on the bag. The numbers represent the percentage of nitrogen (N), phosphorus (P), and potassium (K) in the bag. For example, a 50 pound bag of 10-8-6 contains 10 percent N, 8 percent P₂O₅ and 6 percent K₂O. The remaining materials are inert. Incorrectly applying fertilizer may be harmful to water quality.
Soil Texture

Soil texture is based on the percentage of sand, silt and clay particles and affects soil water infiltration rates and nutrient and water holding capacity. Knowing the texture of your soil will allow you to water more effectively.

Sand particles are larger than silt particles, which are larger than clay particles (Figure 6). Sand sized particles allow for larger pore spaces between soil particles, allowing water and air to flow into the soil. Since the pore spaces are large, sandy soils may need to be watered more often due to low water holding capacity. Small particle sizes, such as clays, have smaller pore spaces between particles having less space for water and air flow into the soil. Clay soils may need to be watered less often due to high water-holding capacity.

Many homes are built on compacted “fill dirt” introduced during the construction process. The compacted soils reduce water infiltration rates and restrict root growth. Loosen the soil by aerating or incorporating organic matter to increase water infiltration.

To reduce the potential of water runoff during irrigation consider the “cycle and soak” approach. This is especially effective for clay soils and slopes. Turn the sprinklers off when water begins to puddle or runoff; allow the water to soak deeply into the soil and then turn the sprinklers back on. Repeat this process until the root zone has adequate water to encourage deep root systems.

What’s your soil texture?

The Oklahoma State University Soil, Water and Forage Analytical Laboratory can determine the specific soil texture of your soil or you can approximate your soil texture with the “texture by feel” method. Percentage of sand, silt and clay particles determines the type of soil. For example, a soil that has 30% clay and 40% silt is classified as a clay loam (Figure 9). To determine your approximate soil texture start by kneading moist soil in your hand and squeeze it between your fingers (Figure 10).

**SOIL MOISTURE**

Use a screwdriver to check soil moisture before watering, if it goes in easily do not water. Soil may appear dry on the surface but moisture may be sufficient throughout the soil profile (Figures 7 & 8).

<table>
<thead>
<tr>
<th>Sandy soil</th>
<th>Loam soil</th>
<th>Clay soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feels gritty and will not stay in a ball. Water drains quickly through sandy soil relative to clay soil since it has large pore spaces.</td>
<td>Feels partly gritty and partly smooth. It forms a ball that breaks easily when squeezed. This type of soil is easy to work and has a high water holding capacity.</td>
<td>Feels smooth and sticky and sticks to shoes. Clay soils hold water very tightly and drain slowly relative to sandy soils.</td>
</tr>
</tbody>
</table>

Figure 6: Relative size of sand, silt and clay particles.

Figure 9: Soil textural triangle used to determine specific soil texture.

Figure 7: Screwdriver does not easily pass through dry soil.

Figure 8: Screwdriver easily passes through moist soil.

Figure 10: Knead soil between your fingers to determine texture.
Improve Soil Quality

Adding organic matter is beneficial for all soil types. For clay soils, it helps decrease compaction and increase drainage. Sandy soils benefit from increased aggregation and higher nutrient holding capacity. Organic matter is also rich with nutrients that are important for plant growth. Organic matter can be added to the soil directly or as compost which is decomposed organic matter.

Compost

Using compost recycles natural materials, reduces the need for chemical fertilizer, and increases the life of landfills. Composting can be achieved through different mechanisms. The type best suited to your situation depends on the size of the yard, availability of materials and the time you are willing to commit. There are numerous ways to make a composting system, from just piling yard waste to building a compost bin. Following a few guidelines will ensure a successful composting system.

- Add layers of green and brown vegetation to the pile and keep it moist.
- Turning the compost pile speeds up decomposition of plant materials.
- The finished compost can be incorporated in the soil and supplies beneficial organisms and nutrients. The following list contains organic materials that can incorporated into a compost bin (Figure 11b).

Ingredients for compost:

- Grass clippings (avoid composting weeds or grass clippings from the lawn that have received persistent herbicide applications. Always follow herbicide label directions.)
- Leaves and pine needles
- Twigs
- Non-fat containing food scraps (meat and fatty foods attract pests)
- Straw
- Chipped branches
- Coffee grounds
- Farm animal manure
- Shredded newspaper

Trench Composting

Another way to increase soil quality is by the trench compost method. Trench composting is one method that is easy to do and beneficial for your soil.

- Dig a trench or hole and add materials that are compostable and bury it.
- Rotate where you dig the trenches so the entire garden will benefit from the organic matter additions.
- Make sure to cover bare soil with leaves or mulch to reduce evaporation and erosion.
- Over time, the materials are decomposed by beneficial microbes and eventually the scraps will improve the soil structure and water holding capacity.

Figure 11b: Starting materials for composting.

11a: Organic matter that has been composted.
**Set Goals**

1. **Plan**

Conduct a site evaluation.

Proper planning will ensure the elements of your landscape are appropriate for your location and environment. Before you begin choosing plants, think about the areas of your landscape conditions and how they should be utilized. Conduct a site evaluation to record environmental and site characteristics (Figure 12).

Use this information to draw a base map of the property showing the following characteristics.

- Location of the house
- Sun orientation
- Existing vegetation
- Sun exposure: full sun (8 or more hours of sun), part sun (4-8 hours per day), or shade (less than 4 hours a day)
- Areas that collect water or dry out quickly
- Local hotspots (along south facing walls or near air conditioning units)

2. **Design**

Determine the end use of the area.

When planning a new landscape or renovating an existing one, determining the end use and function of the landscape will ensure a successful design. Creating a low water using landscape begins in the planning stages. The following list may help you determine your site specific goals.

- What will be the function of the landscape?
- What will your outdoor activities consist of?
- Do you need areas for recreation, outdoor dining, or relaxation?
- Identify and record where you plan on incorporating a patio or additional structures.
- How can you incorporate low water use plants or hardscapes?
- Determine any special features like a sculpture, rock, or a vegetable garden that you would like to incorporate in your landscape.

**Catch The Big Drips**

Set landscape goals based on the end use of the space

Conduct a site evaluation

Design the space, eliminate odd shaped turf areas, arrange plants properly, and use mulch

**Follow the Steps**

1. Set Goals
2. Plan
3. Design

Incorporate rain water harvesting systems into the landscape. Not only will this help reduce storm water runoff, it will also be a beneficial source of water during dry periods.

**RAIN COLLECTION**

Figure 12: Example site analysis and base map of a property.
The next step to creating a water efficient landscape is design. The relationship of elements in a landscape such as plants, hardscape and other fixed features is important in how they relate to each other in scale, color, texture, and form. Drawing these elements on a plan will help ensure you create an interesting landscape that works well for your space. A very interesting design can be achieved using simple shapes (Figure 13).

Consider architectural features of the home and how planting bed edges or focal elements can align with doors and windows. This will establish a strong indoor/outdoor relationship and make the landscape more appealing as it relates to the home (Figure 14).

Place plants with like water needs in the same areas. Separating the plants into water use zones ensures plants receive only the amount of water they require. If plants with high and low water requirements are mixed into the same zone over or under watering the planting bed will occur, which will harm plants and waste water.

Plants inside like water zones should also be arranged in a way that respect their size, color, and texture. Place taller plants towards the back of beds and layer down in height to the front of beds. Use plants that have either complimentary or contrasting colors as well as texture next to each other to create variety and added visual interest.
Designing with Ecology in Mind

An enjoyable aspect of having a garden is being able to watch wildlife such as birds, butterflies and other attractive animals benefit from the plants and help beautify the landscape. Not only are these critters fun to watch on a cool summer evening, but they often provide hidden benefits typically overlooked such as pollinating flowers and trees and reducing certain unwanted pests. Most plant suppliers and other horticulture guides can direct you toward plants that can perform well in Oklahoma and attract wildlife. Refer to Extension Circular E-1037 for a list of drought-tolerant plants.

Other Considerations for a Successful Design

How much time am I willing to commit to my landscape?

- Everyone wants striking curb appeal, but plants are living things and require a certain amount of care.
- Inputs required to maintain an ideal landscape can often be costly and very time consuming.
- A routine schedule of responsible watering, pruning, deadheading, mowing, fertilizing, applying pesticides, and auditing irrigation systems, soil conditions, and mulch depth makes a big difference in the appearance of a landscape.

What are the limiting factors of my property's environment?

- Each property has unique growing conditions varying across the site including soil type, sun exposure, wind exposure, and foot traffic from pets and people.
- A proper site evaluation should indicate clues on how these factors can be utilized or amended to drive design decisions based on desired form and function of outdoor areas.
- Plants survived in unfavorable environments long before ornamental landscaping was developed by people. Look beyond aesthetic qualities of plants and find tough plants that can thrive well in your specific environmental conditions while still achieving an attractive landscape.
Reducing water runoff from a landscape or property provides two major water conservation purposes. Firstly, reducing runoff keeps water on-site allowing it to soak into the soil which reduces need for future irrigation. Secondly, reducing runoff decreases the amount of non-point source pollution such as fertilizers, pesticides and automotive fluids introduced into waterways.

To retain water on-site, property owners can utilize a few different strategies which include:

- Rainwater harvesting
- Rain gardens
- Pervious surfaces
- Greenroofs

These techniques can be used together or separately in the landscape to reduce water runoff and provide an alternative source of water.

### Rainwater Harvesting

An average residential roof will produce a large amount of runoff with very little rainfall. Rainwater harvesting systems can be as simple as a rain barrel under a gutter with a spigot at the bottom used to water a flowerbed, or they can be designed for much larger holding capacities. Rain barrels should be elevated to allow for gravitational flow. Multiple rain barrels can be connected to maximize water holding capacity. For more information and instructions on how to build your own rainwater barrel go to squeezeeverydrop.com.

### Rain Gardens

A rain garden is a small depression behind a berm in the landscape that is designed to catch runoff and allow it to drain into the soil over a 24 to 48-hour period. This allows any pollutants in the runoff to be absorbed into the rain garden soil, instead of running off into a stream or lake. Rain gardens are usually planted with a mixture of perennial flowers, ornamental grasses and woody shrubs that are adapted to both wet and dry conditions. Rain gardens should not be located close to the foundation of a house. The design and location of the rain garden depends on the amount of water draining to the area. Carefully plan the garden before getting started on construction. Consider the following criteria when designing the rain garden:

- Determine if the soil is suitable for rain water infiltration.
- Carefully select an appropriate location where it can capture the most runoff.
- Determine the depth, size and shape of the rain garden. Typical gardens are 4 to 8 inches deep depending on the slope.
- Select plants that are adaptable to rain garden conditions.

For plant selections and more information and about constructing your own rain garden check out the “Additional Resources” section.
Pervious Surfaces

Using pervious surfaces allows water to soak into the soil rather than running off. Capturing stormwater and allowing it to soak into the ground helps increase soil moisture and recharge groundwater. Pervious pavement creates a strong surface that has voids which allows water to pass through. Pervious pavement can be used one of two ways.

- Concrete and asphalts that are made with very low amounts of fine materials. When made this way, the larger aggregates are held together, but still have plenty of voids between them which allow water to pass through.
- The second type of pervious surfaces are structural pavers. This method uses individual pieces such as open celled grids or interlocking blocks.

These structural pavers will have porous elements mixed with traditional construction media such as concrete blocks filled with gravel. Appropriate applications for pervious pavement include commercial parking lots, driveways, sidewalks, and roads with low volume traffic.

Greenroofs

A greenroof is a low-maintenance, vegetated roof system constructed for the benefits of reducing rainwater runoff and conserving energy lost through thermal exchange. These unique structures reduce storm water runoff significantly by retaining large amounts of water in the soil to be absorbed by the vegetation later. Studies have shown that a 4 inch green roof can retain up to 50 percent of total rainfall over a series of storm events.

The reason that greenroofs are able to provide such significant energy savings is because the air trapped in the drainage layer and in the soil acts as an insulator between the buildings and the outside temperatures. A greenroof can reduce the heat lost through the roof in the winter by 25 percent. A greenroof will also reduce local levels of carbon dioxide and increase the local levels of oxygen and humidity.

Greenroofs are similar to conventional roofs in their basic construction. Both start with a waterproof membrane over roof sheathing. Greenroofs will also include a root barrier, a drainage layer, filter fabric, and 2-6 inches of lightweight growth substrate with very little organic content. Too much organic content results in settling or too-rapid plant growth. Regionally appropriate plants are then planted in the growth substrate. Sedums and other succulents have been popular choices for greenroofs around the world. In Oklahoma, native wildflowers and grasses have also sometimes been shown to perform better in hot Oklahoma summers than some succulents. A professional should be consulted before making a large investment in plants for your greenroof.

It is important to note that greenroofs require moderate structural support. But this can be easily accommodated during design for new construction. Existing roofs may require additional structural supports that can be added during re-roofing or renovation. A greenroof may weigh approximately 10-25 pounds per square foot when fully saturated, whereas a conventional rock ballast roof weighs approximately 10-12 pounds per square foot. The added upfront costs of a greenroof are typically offset over time, since greenroofs will last much longer than conventional roofs. This is because the structural portion of the roof is protected from the intense heat and UV rays from the sun. For more information about greenroofs go to lid.okstate.edu/green-roofs.

Pervious pavers. Interlocking blocks with gravel to allow water to infiltrate.
Plant Selection

Catch The Big Drips
- Water use is determined by the type of plants selected. Choose wisely!
- In order for plants to thrive, they should be placed in the correct location
- Plants do not waste water, we do
- Plant spacing is determined by the mature plant size; not size of the plant at planting time

Plants add value to the home, provide shade, define spaces and elevate mood. Deciding which plants to choose and where to place them in the landscape can be a rewarding task. Oklahoma supports hardiness zones 6a, 6b, 7a, 7b and 8a depending on which part of the state you are located. Make sure the plants you choose can survive in your hardiness zone.

Deciding the goals for the landscape and conducting a site evaluation precede plant selection and placement. Within a landscape there may be micro climates where particular plants thrive while others may perform poorly (i.e. close to the south facing wall of a house, under a large shade tree, etc.). Think about the plant maintenance needs such as proper watering, fertilizing, mulching, mowing, and pest management. Determining the environmental conditions that exist within the landscape and choosing the right plant for the right space ensures successful landscape results. Consider the following five plant selection factors when choosing plants for the landscape.

1. Water Requirements

Proper plant selection and placement in the landscape ensures water savings for the future. Choose plants that are well adapted to Oklahoma's climate. Consider the potential placement of the plant and water use requirements. Plants under a large shade tree require less water than plants that receive direct sunlight. Plants conserve water by particular physical characteristics such as:

- Hairs on leaves and stems
- Waxy cuticle
- Bulbs and tubers
- Dormancy
- Leaf size and shape
- Small plant size
- Fleshy leaves
- Grey leaves

Keep in mind that plants do not waste water, we do. Check the soil moisture before watering to increase deep, strong root growth. Place plants with similar water and light requirements together to help conserve water while also keeping plants healthy. Newly planted plants require more frequent watering than established plants.

2. Mature Height

Before a beautifully mature landscape is achieved, there is a grow-in phase. Remember that the plants are going to grow for several years, depending on the plant. Annuals, which only live for one year, typically grow fast. Perennials may grow fast or slow, depending on the species and cultivar. Trees and shrubs may take 3-5 years or more to become established. Some plants will grow very tall and should not be placed close to a structure or right next to surrounding plants. Give plants time to grow into the space. Once the plants have been established they require less water so make sure to adjust irrigation schedules accordingly.

PROPER PLANTING

Proper planting techniques are essential for plant health. After selecting the correct location, dig a hole that is one-half to three times the width of the root ball. Next, break up the root ball which will ensure strong root growth and help plants survive drought conditions. Some plants become severely root-bound and may need to be soaked in water prior to planting. Carefully place the plant in the hole directing roots downward and fill the hole with the excavated soil and firmly compress the soil around the plant. The root ball should be at or slightly above the surrounding soil. Add plenty of water and cover the soil with mulch to prevent evaporation.
3. Color

Choosing plants with different bloom times and colors creates year long interest. Three basic color schemes work well in the garden (Figure 15).

- Analogous colors: Colors that are next to each other on the color wheel add contrast in the garden.
- Complementary colors: Colors directly opposite on the color wheel intensifies each individual color.
- Monochromatic colors: Colors of a single hue and creates a peaceful appearance.

![Color wheel]

Figure 15: Use the basic color schemes to create variety and interest in the garden.

Place plants with different bloom times and complimentary bloom colors together. Some plants may flower early in the spring or late in the fall. Plants with warm, bright colors, like yellow and white, work best for shade areas. All colors work well in sunny areas.

The bloom of a plant is not the only aspect of importance when choosing plant location. Select plants with interesting foliage colors to provide beauty in the landscape between flowering times (Figure 16). This can also be used to highlight focal points in the landscape. Also consider how foliage may change during the different seasons to create a landscape that has year-round interest. Certain plants may not be as attractive during the late fall months and can be placed near more showy selections like ornamental grasses and evergreen plants to help balance the appearance of the landscape.

![Figures 15 and 16]

4. Form

Form or object shape should be considered when placing plants in the landscape. Different shapes in the landscape provide visual interest and variety. Evergreen and deciduous attributes of plants can be a major contributing factor to a plant’s form. Deciduous plants tend to vary slightly in form throughout seasonal changes while evergreen plants tend to maintain a consistent form with slight variations depending on different environmental conditions. Below are typical plant forms that may assist in choosing the right plant for the right place.

![Plant forms]

5. Texture

Plant textures are typically defined as coarse, medium, and fine. Texture provides contrast and interest in the landscape. Plants with a coarse texture have large leaves or flowers and fine-textured plants have small leaves and create a soft look (Figure 17). Fine elements provide a soft background and coarse textured plants can be used to create contrast in the landscape.

![Figures 17 and 18]

Selecting the correct plant for the right location can look attractive and also help reduce water waste in the landscape.
Turfgrass Management

Catch the Big Drips
- Select the right turfgrass for your site
- Keep turfgrass areas simple
- Reduce thatch and aerate to increase water, air and nutrient infiltration

Turfgrass serves a vital role in the landscape. It reduces soil erosion, provides a place for outdoor recreation and increases the value of residential property. Establishing and maintaining a healthy turfgrass yard requires planning and proper upkeep.

- Choose the right turfgrass for the location
- Test the soil and fertilize appropriately
- Mow correctly
- Irrigate efficiently
- Reduce thatch
- Aerate the lawn

Turfgrass Selection

Turfgrass selection starts with choosing a grass well adapted to Oklahoma’s variable temperature and moisture, site conditions and your personal need. The table below provides sun requirements, heat tolerance, and irrigation requirements of particular turfgrasses. For more information see extension fact sheet “Selecting a Lawn Grass for Oklahoma” HLA-6418.

<table>
<thead>
<tr>
<th>Turfgrass</th>
<th>Region</th>
<th>Sun Requirements</th>
<th>Drought Resistance</th>
<th>Heat Tolerance</th>
<th>Irrigation Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warm-Season Turfgrass</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bermudagrass</td>
<td>Statewide (May be susceptible to winter kill in Northern areas)</td>
<td>Full sun</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Low</td>
</tr>
<tr>
<td>Buffalograss</td>
<td>Central and Western</td>
<td>Full sun</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Low</td>
</tr>
<tr>
<td>St. Augustinegrass</td>
<td>Southern along the Red River</td>
<td>Full sun to light shade</td>
<td>Good</td>
<td>Excellent</td>
<td>Medium</td>
</tr>
<tr>
<td>Zoysia grass</td>
<td>Central and Eastern</td>
<td>Full sun to light shade</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Cool-Season Turfgrass</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td>Northern and Eastern</td>
<td>Full Sun to Shade*</td>
<td>Good</td>
<td>Fair</td>
<td>High</td>
</tr>
<tr>
<td>Perennial Ryegrass</td>
<td>Northern and Eastern</td>
<td>Full Sun to Shade*</td>
<td>Poor</td>
<td>Fair</td>
<td>High</td>
</tr>
<tr>
<td>Tall Fescue</td>
<td>Statewide</td>
<td>Full Sun to Shade*</td>
<td>Good</td>
<td>Good</td>
<td>High</td>
</tr>
</tbody>
</table>

*Recommended for lightly shaded areas in Oklahoma, requires more maintenance and irrigation in full sun.

Test the Soil

Plants require nitrogen, phosphorus, and potassium, along with other elements. Nitrogen is needed in the greatest amount and affects plant quality. Phosphorus and potassium are also required for plant growth however adding unneeded phosphorus fertilizer to soils does not increase turfgrass quality, but can run-off and be harmful to surface water quality. Check the fertilizer nutrient content to ensure the correct amount and type is used. A healthy landscape should only be fertilized as needed.

Collect a Useful Sample

1. Use a soil probe or shovel and take random soil samples from the surface to a depth of 6 inches from 15-20 locations in the lawn.
2. Mix the samples in a clean bucket and collect a pint of soil or completely fill a soil sample bag from the local county extension office. The bag should be full to ensure the lab has an ample amount of soil to test.
3. Drop the sample off at your local county extension office.
4. Your soil test results will include soil test interpretations to ensure proper fertilization rates.
Mow Correctly

Increasing the mowing height to 2-3 inches for warm season grass and 3-4 inches for cool-season grass during the summer will help conserve soil moisture. Grass acts as a natural mulch, retaining soil moisture and shading out weeds. Keep lawn mowing equipment sharp and in good operating condition.

Irrigate Efficiently

Avoid watering frequently and lightly which causes shallow rooting, thatch accumulation, and weed seed germination. Turf should not be watered on a regular schedule and instead should be watered based on need and weather conditions. The amount of water your turfgrass needs is influenced by the soil texture and changes in weather (humidity, precipitation, wind, temperature, etc.). Only water turfgrass when it shows the first signs of water need or wilt. The leaves will begin to roll or fold and wilt.

Enough water should be applied to wet the soil to a 6-inch depth. If water begins to puddle or runoff before it reaches 6 inches, turn the system off and allow water to soak into the soil. Repeat this cycle until the proper amount of water is applied. Warm season grasses may require 0.5-2 inches of irrigation per week during a dry summer to maintain green color if natural precipitation is insufficient. Similarly, cool season grasses may require 2-3 inches of irrigation per week during the summer to maintain green color. The average monthly irrigation needs are listed on page 13, however, these are averages over a 19 year period and weekly irrigation should be based upon current soil moisture and weather conditions.

Reduce Thatch

Thatch is dead, un-decomposed roots and stems that is caused when plant tissue production exceeds decomposition. Excessive thatch can reduce water, air, and nutrient movement into the root-zone of the soil. This can lead to shallow root development. The thickness of the thatch layer can be determined by observing a 3- to 4- inch plug. If the thatch is thicker than 0.5 inch, the yard would benefit from dethatching. Dethatch warm-season grasses like bermudagrass and zoysiagrass before the grass greens up in the spring. Use a dethatching machine or a power rake to reduce the thatch layer. For small lawns use a thatch rake to reduce thatch layers.

How to prevent thatch
- Only fertilize as needed
- Aerate the lawn
- Raise the mower height
- Water deeply but infrequently to encourage deep root growth

Aerate the Lawn

Aerating is the process of taking small plugs out of the ground or forcing tines into the soil to reduce soil compaction. In high traffic areas, soil can become compact which prevents air flow, water infiltration, and nutrient intake. Aeration will benefit turfgrass by increasing the effectiveness of irrigation and fertilization. Different types of aerating machines can be rented or purchased from local stores.
Irrigation Check List

- Catch the Big Drips
- Conduct a simple irrigation audit
- Drip irrigation is the most efficient method. Use it when possible
- Irrigation systems should be separated into zones to maximize water conservation
- Periodically check for leaks and stuck or plugged sprinkler heads

Water is essential for plant photosynthesis, nutrient transport and transpiration. Proper irrigation management maintains healthy plants while also conserving a limited resource. Homeowners may overwater their turfgrass, which can potentially cause disease and fungal growth. Establishing a periodic maintenance schedule will prevent water waste while also supporting healthy plant growth.

The following checklist is intended to assist homeowners with irrigation system maintenance.

- **Sprinkler types in each zone are the same.**
  - Mismatched sprinkler heads reduce uniformity and cause wet and dry spots in the yard. The widely fluctuating precipitation rates lead to over watering to compensate for dry areas. Replace mismatched heads with the appropriate type of sprinkler head. Consult an irrigation professional to ensure proper design.

- **Irrigation system has head to head coverage.**
  - The output from a sprinkler head should cover the area to the adjacent sprinkler head (Figure 18). The amount of water applied decreases as the distance from the sprinkler head increases. Head to head coverage ensures uniformity throughout the yard and reduces the need to compensate for dry areas in the yard.

![Figure 18: Head to head coverage ensures uniform water distribution.](image)

- **The irrigation system pressure is compatible with the sprinkler heads.**
  - Misting or a steady stream of water with large droplet size indicates high and low pressure. Misting wastes up to 50% of water applied during an irrigation event because mist droplets are carried to non-target locations by wind. Low pressure leads to poor water distribution and dry spots in the yard. Sprinkler types perform efficiently under a specific pressure range. Check manufacturer specifications to ensure the system is effectively applying the correct amount of water.

**PRESSURE REGULATION**

You can install pop-up spray heads with in-head pressure regulation. At 50 psi, without pressure regulation (PR) the flow would be 4.8 gallons per minute (GPM). With PR at 30 psi, flow would be 3.3 GPM, 1.5 GPM less. If there are 10 pop-up spray heads on that zone and you run the zone for 10 minutes, you’ve saved 150 gallons each time you irrigate that zone!
Know how much water the plant needs.

- The term evapotranspiration (ET) combines evaporation and plant transpiration or how much water the plant uses for metabolic processes. In Oklahoma, the most widely used warm-season grass is bermudagrass and the majority of cool-season grass is tall fescue. Warm season grasses have a lower ET rate and therefore require less water than cool season grasses. Table 1 shows the approximate average monthly irrigation needed for warm and cool season turfgrasses. The Oklahoma Mesonet has a simple irrigation plan website to help homeowners determine the amount of time needed for irrigation, available at SIP.mesonet.org.

<table>
<thead>
<tr>
<th>Month</th>
<th>Average ET&lt;sub&gt;turf&lt;/sub&gt;</th>
<th>Average Precipitation</th>
<th>Average Irrigation Need&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Average ET&lt;sub&gt;turf&lt;/sub&gt;</th>
<th>Average Precipitation</th>
<th>Average Irrigation Need&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Season Turfgrass</td>
<td>Cool Season Turfgrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>3.6</td>
<td>3.3</td>
<td>0.3</td>
<td>4.7</td>
<td>3.3</td>
<td>1.5</td>
</tr>
<tr>
<td>May</td>
<td>4.0</td>
<td>3.8</td>
<td>0.2</td>
<td>5.3</td>
<td>3.8</td>
<td>1.5</td>
</tr>
<tr>
<td>June</td>
<td>4.6</td>
<td>4.8</td>
<td>0.0</td>
<td>6.1</td>
<td>4.8</td>
<td>1.3</td>
</tr>
<tr>
<td>July</td>
<td>5.4</td>
<td>3.0</td>
<td>2.4</td>
<td>7.2</td>
<td>3.0</td>
<td>4.1</td>
</tr>
<tr>
<td>August</td>
<td>4.9</td>
<td>3.3</td>
<td>1.5</td>
<td>6.5</td>
<td>3.3</td>
<td>3.1</td>
</tr>
<tr>
<td>September</td>
<td>3.4</td>
<td>3.3</td>
<td>0.1</td>
<td>4.5</td>
<td>3.3</td>
<td>1.2</td>
</tr>
</tbody>
</table>

1 Average ET from measurements recorded at the Spencer Oklahoma Mesonet site in Oklahoma County from 1994-2012 (www.mesonet.org).
2 Average Precipitation from measurements recorded at the Spencer Oklahoma Mesonet site in Oklahoma County from 1994-2012 (www.mesonet.org).
3 Average irrigation need assuming all precipitation infiltrated into the soil profile and no water was lost through surface runoff.

Periodically adjust sprinklers to only water the landscape.

- Properly adjusted irrigation systems should only water the landscape. Sidewalks, streets, and other hardscapes should not be watered (Figure 19).

Irrigation has proper zones.

- Irrigation zones should be designed based on the water requirement of the plant. Separate the zones based on the type of plants in the area.
- Plants have different rooting depths which should be considered when watering (Figure 20).
  - Trees have a rooting depth of 18-36 inches. They require less frequent but deep watering.
  - Shrubs have a rooting depth of 12-24 inches. Shrubs and trees are better irrigated with drip or micro-spray irrigation.
  - Herbaceous plants and turfgrasses have a rooting depth of 6-12 inches. Turf areas are better suited for sprinkler irrigation.
- Consider the sun and wind exposure. Plants in full sun require more water than plants in shade.
- Determine the type of soil. Sandy soils drain quickly relative to clay soils and may need to be watered more often.
Irrigation Equipment

When installing or updating irrigation systems consider efficient technology, proper design, installation and maintenance. Installing drip irrigation uses 50 percent less than in-ground sprinklers. Additionally, using water-efficient sprinkler technologies can reduce water use by 30 percent compared to standard pop-up sprinklers.

Low-Volume Irrigation

Drip irrigation and soaker hoses deliver water slowly and near the ground, so that it is not wasted through runoff and evaporation. Drip irrigation can be manually operated or as part of a zone with automatic irrigation. The emitters minimize water contact with the above ground portion of the plant which decreases incidence of disease. Drip irrigation is the most efficient watering method and works well for a water-smart landscape. Since the plants are individually watered, weeds become less competitive. Drip irrigation works well in flower beds, vegetable gardens, and around shrubs and trees. Similar to drip irrigation, soaker hoses slowly emit water into the soil. Water is emitted over the entire surface of the hose and efficiently waters shrubs, trees, and flower beds.

Smart Technology

Watering the landscape based on a set schedule rather than plant requirement wastes water and may prevent plants from growing deep roots. Smart Water Application Technologies (SWAT) consist of climate-based controllers, soil moisture sensor-based controllers, and rain sensors. These smart controllers can save water and time if they are properly installed. There are many irrigation system controllers available that schedule irrigation according to plant needs. The Environmental Protection Agency has a list of WaterSense products that are independently certified to minimize excess irrigation while maximizing irrigation effectiveness. Purchasing a smart irrigation controller may be more expensive up front, but is likely to pay off with water savings and ease of scheduling. Additionally, soil moisture sensors that plug into existing irrigation controllers are also available to homeowners and have shown water savings between 30 and 50 percent.

Consider installing a rain sensor that interrupts the irrigation cycle during and immediately after rainfall events. When updating or replacing an irrigation system, work with the contractor to design and install a water efficient irrigation system.

Types of Sprinkler Heads

Some types of sprinkler heads are more efficient than others. In general, rotary spray heads that deliver water in a thick stream are more effective than mist spray heads. Efficient sprinkler heads can help save water if installed and used properly. They should be part of a properly designed irrigation system. Sprinkler heads should be operated between 30 and 40 PSI. Below, different types of sprinkler heads are listed along with the best use for each type.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Type</th>
<th>Best Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Micro-spray</td>
<td>Containers, shrubs, trees, flower beds</td>
</tr>
<tr>
<td>2</td>
<td>Bubbler</td>
<td>Trees, shrubs, flower beds</td>
</tr>
<tr>
<td>3</td>
<td>Matched Precipitation (MP) Rotator</td>
<td>Large turf areas</td>
</tr>
<tr>
<td>4</td>
<td>Spray head</td>
<td>Medium to small sized turf areas</td>
</tr>
</tbody>
</table>

Up to 50 percent of water can be wasted due to misting caused by high pressure. Pressure can be regulated at the valve or sprinkler head. Make sure your sprinkler heads are operating at the correct pressure. You can check the pressure yourself or call a professional irrigation company.

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Simple Irrigation Audit

Effective irrigation design and scheduling are a crucial part of maximizing water conservation in the landscape. Determining the amount of water that your yard is receiving can be estimated by a simple irrigation audit. Homeowners often wonder how long they should irrigate their lawns, but the amount of water cannot be measured by time. A simple irrigation audit can be performed by any homeowner and will give you an estimate of irrigation output in terms of inches per hour.

The distribution uniformity (DU) can also be calculated and sprinklers may need to be adjusted to ensure an even application of water. To determine the DU, take the average irrigation output of the lowest quarter of values obtained from the irrigation audit and divide it by the average irrigation output of the total area. For a home lawn, a good DU is between 0.60-0.75.

Many homeowners find that they have been overwatering their turfgrass. Remember, this figure is the output per hour every time you water. For example, if your output number was 0.6”/hour, and your sprinkler system was set for 1 hour every day, this would apply 4.2” of water per week which is about 4 times more than what an established bermudagrass yard actually requires.

Your output number is a good indicator of potentially causing needless water runoff. Therefore, excessively irrigating your lawn causes water to runoff into streets, storm drain systems or into lower areas of neighboring properties. This is a great example of the phrase, “pouring money down the drain.” Also, with excess irrigation runoff, there is a good chance that soil sediment, pesticides, and fertilizers applied to the lawn and landscape are running off into our creeks, streams, watersheds, and reservoirs.

1. Gather 9 short, plastic rain gauges or use tuna cans to make your own.
2. Place the rain gauges in a grid throughout the irrigated turfgrass areas.
3. Irrigate the lawn for 20 minutes on a relatively non-windy day.
4. After irrigating for 20 minutes, combine and measure the amount of water in all of the rain gauges, divide that by 9, then multiply by 3. The answer is the average volume of water in 1 hour.
Mulch

Benefits of Mulch

Maintaining a layer of mulch in flower beds, vegetable gardens and around trees and shrubs is an easy way to save water in the landscape while also complimenting plant materials. Many types of mulches are available depending on your need. Applying mulch in flower beds, around trees and shrubs provides many advantages. Mulch in the landscape:

- Creates an attractive landscape (Figure 21).
- Reduces soil moisture loss so you can water less.
- Regulates soil temperature which insulates and protects plants.
- Prevents soil compaction and erosion.
- Protects plants from soil-borne diseases.
- Prevents weed seeds from germinating.
- Prevents trunk damage from weed whackers and lawn mowers.
- Provides a home for beneficial organisms like earthworms.
- Organic mulch increases soil tilth as it decomposes.

Proper Mulching

Correctly applying mulch and maintaining a mulch layer keeps plants and soils healthy.

- Add mulch to a depth of 2-3 inches near plants. Adding too much mulch can harm plants by reducing water and air infiltration into the soil.
- Coarse textured mulch can be added to a thicker depth than fine textured mulch.
- Apply coarse texture mulches at a 3 inch depth and fine texture mulches at a 2 inch depth.
- Avoid mounding mulch around plants and trees because it can cause trunk rot (Figures 22 and 23).

![Figure 21: Different types of mulch may be used to compliment the existing landscape.](image)

![Figure 22 & 23: Avoid mounding mulch which causes trunk rot.](image)

- Rake old mulch to prevent matting and keep an attractive appearance.
- Mulch may need to be replaced as it breaks down or washes away (Figure 24).

![Figure 24: Replace mulch as it breaks down or washes away.](image)
Types of Mulch

Different types of mulch are available in Oklahoma and have advantages and disadvantages. **Organic mulches** are derived from natural materials such as straw, wood chips or leaves. They are relatively low cost, can deter pests, increase soil quality as it decomposes and allows water infiltration. **Inorganic mulches** include rubber, recycled glass or rocks. It does not need to be replaced as often but may hold heat which can be tough on plants. Table 1 describes the type of organic mulch, and the advantages and disadvantages of each.

There are many factors to keep in mind when selecting a mulch for the landscape. Consider the following factors when choosing a mulch for your landscape:

- Cost
- Color
- Origins of the mulch
- Durability
- Nutrient content
- Appearance and Texture

### PURCHASING MULCH

Buying mulch by the bag is convenient but can be more expensive than buying mulch in bulk quantities. Consider purchasing mulch in large quantities to save money.

<table>
<thead>
<tr>
<th>Types of organic mulch</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyed mulch</td>
<td>Long lasting</td>
<td>Supplier uses available wood, dye fades</td>
<td>Retains moisture, decrease weed growth</td>
</tr>
<tr>
<td>Shredded bark, bark chips</td>
<td>Long lasting, does not easily blow away</td>
<td>May float in the rain</td>
<td>Works well for walkways</td>
</tr>
<tr>
<td>Wood chips, shavings</td>
<td>Long lasting, readily available</td>
<td>Color and texture may not be uniform</td>
<td>Increases organic matter as it breaks down</td>
</tr>
<tr>
<td>Eastern red cedar mulch</td>
<td>Long lasting, can be purchased from local companies</td>
<td>May be difficult to find</td>
<td>Supports the local economy, more sustainable than cypress mulch</td>
</tr>
<tr>
<td>Cocoa-bean hulls</td>
<td>Attractive dark brown color</td>
<td>May be cost prohibitive and attracts pets</td>
<td>Smell like chocolate and decomposes within a season</td>
</tr>
<tr>
<td>Leaves</td>
<td>Easy to find, may be composted and used as a soil amendment</td>
<td>Unattractive</td>
<td>Composting or shredding leaves recycles nutrients and saves landfill space</td>
</tr>
<tr>
<td>Pine needles</td>
<td>Does not easily wash away, allows air and water to infiltrate</td>
<td>May be difficult to find</td>
<td>Does not create a crust, remains loose allowing water to infiltrate</td>
</tr>
<tr>
<td>Straw</td>
<td>Protects plants in the winter</td>
<td>Easily blown away and may introduce weeds</td>
<td>May be more suitable for a vegetable garden</td>
</tr>
<tr>
<td>Grass clippings</td>
<td>Great mulch for the lawn, provides nitrogen</td>
<td>Do not spread clippings around plants after chemical application on the lawn</td>
<td>Use a mulching lawn mower. Don’t bag it, recycle your grass clippings</td>
</tr>
<tr>
<td>Pecan hulls</td>
<td>Slow to decompose, work well for acid loving plants</td>
<td>May be cost prohibitive</td>
<td>Easy to find in Oklahoma</td>
</tr>
</tbody>
</table>
Landscape Maintenance

Irrigation System Maintenance

- **Do a regular maintenance check on your irrigation system.** Check nozzles and emitters to make sure they are watering properly.
- **Fix or replace broken sprinkler heads.** Heads and nozzles are relatively inexpensive. First dig out around the sprinkler head. Then unscrew the sprinkler head making sure not to get dirt into the riser. Take the broken irrigation head with you when you go to buy a new one to ensure you buy the right one.
- **Repair stuck sprinkler heads.** If you have a pop up sprinkler that is stuck in the up position unscrew the spray head and clean whatever is stuck in the wiper seal.
- **Check for leaks.** If you have a sudden increase in your water bill, dry or soggy areas in your yard, or have overgrown turf areas, you might have a leak. To figure out where the leak is, locate your water meter and turn off everything that uses water indoors and outdoors. If your water meter dial is still moving, you have a leak. Check your control valves and each irrigation zone. A good contractor can also check for leaks.
- **Realign sprinkler heads** so sidewalks, roadways, and other hardscapes are not being watered.
- **Consider low volume, micro irrigation** for gardens, trees, and shrubs. Drip irrigation and micro irrigation slowly apply water which minimizes evaporation and runoff.
- **Check for buried or clogged sprinkler heads.** If they are clogged or broken, make sure to replace them.
- **Consider upgrading to a “smart” controller.** Smart controllers evaluate weather or soil moisture conditions and automatically adjust the irrigation schedule to meet the specific requirements of your landscape.
- **Install a rain sensor.** This inexpensive sensor can be retrofitted to most systems and will turn your irrigation system off during a rain event.
- **Update the system based on the season.** If you have an automatic timer, during the winter set it to water once a month or less depending on precipitation and temperature.

Plant Maintenance

- **Maintain large plants.** Trim and maintain plant materials to preserve system performance.
- **Prune lightly at the right time.** Pruning stimulates growth which increases the amount of water the plant is using. Most plants should be pruned in the fall or winter time when they are dormant.
- **Raise the mower height.** Mowing the yard is a type of pruning. If you raise the mower height you will encourage deeper root growth and reduce water demand. Additionally, the taller grass acts as natural mulch, reducing evaporation.
- **Know how to check for signs of water stress in plants.** Turfgrass will turn a dull green and blades will wilt and roll inward.
- **Check for weeds periodically.** Weeds compete with desirable plants for water so hand weed and use mulches to keep weeds in check.
- **Reduce fertilizer rates and use slow-release fertilizer.** Like pruning, improper fertilizing stimulates plant growth and increases water use. Take a soil test before fertilizing to ensure proper application rates.
Additional Resources

Soil

• Soil Testing...the Right First Step L-249
• Soil, Water and Forage Analytical Laboratory: soiltesting.okstate.edu
• Oklahoma Homeowner's Handbook for Soil and Nutrient Management E-1003
• Backyard Composting in Oklahoma BAE-1744
• Improving Soil Quality L-435
• Oklahoma County Extension Office
  930 N Portland
  Oklahoma City, OK 73107
  Phone: 405-713-1125
  Website: OCES.okstate.edu/oklahoma

Landscape Planning and Design

• Homeowner Garden Design Series: Elements and Principles of Design HLA-6441
• Homeowner Garden Design Series: Planning the Landscape HLA-6440
• Drought-Tolerant Plant Selections for Oklahoma E-1037
• Xeriscape Demonstration Garden L-332
• Xeriscape Garden Plants L-333
• Landscape Planning L-431
• Native Plants for Oklahoma Rain Gardens lid.okstate.edu/oklahoma-rain-garden-plant-guides

Turfgrass Management

• Lawn Management in Oklahoma HLA 6420
• Thatch Management in Lawns HLA-6604
• Establishing a Lawn in Oklahoma HLA-6419
• Don't Bag it: Leaf Composting L-252

Irrigation

• Simple Irrigation Audit for Home Lawns in Oklahoma HLA-6610
• Irrigation L-343
• Design of Rainwater Harvesting Systems in Oklahoma BAE-1757

Mulch

• All You Need to Know About Mulch L-346
• Mulching Garden Soils HLA-6005

Websites

• Oklahoma Cooperative Extension Service Fact Sheets OSUfacts.okstate.edu
• Oklahoma State University Water Conservation: Thinkwater.okstate.edu
• Simple irrigation plan: SIP.mesonet.org
• Oklahoma City Utilities Department: Squeezeeverydrop.com
• EPA Water Sense: EPA.gov/watersense/
• OSU Department of Horticulture & Landscape Architecture: okstate.edu/ag/asnr/hortla/
• OSU Turfgrass Science: turf.okstate.edu/
• Oklahoma Proven: Oklahomaproven.okstate.edu
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Squeeze every drop

The City of Oklahoma City has partnered with the Oklahoma State University Department of Horticulture & Landscape Architecture and the Oklahoma Cooperative Extension Service to help promote outdoor water conservation.

For more information about how you can save water outdoors check out these websites:

- squeezeeverydrop.com
- thinkwater.okstate.edu
- sip.mesonet.org