

Conserving Oklahoma's Water

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Conserving Oklahoma's Water

Because water is usually so plentiful, available and cheap, we often casually disregard its importance and consider it an almost limitless resource. But world water usage has tripled since 1950 and users and suppliers in the U.S., especially in California, Nevada, Colorado and Florida, have been forced to deal with the harsh reality of dwindling water supplies.

While many regions of Oklahoma are blessed with abundant water supplies, other areas, particularly in the semi-arid west, are not. And the distance between the state's water supplies and many rural residents who need it is so great that the expense of delivering that water is prohibitive. From a hydrological standpoint, evaporation and percolation preclude immediate use of approximately 80 percent of Oklahoma's water. Average annual lake evaporation ranges from 48 inches in the east to 65 inches in the southwest, amounts that far exceed the average yearly rainfall in those areas.

Episodes of water shortages and drought are inevitable in Oklahoma. While local and

state governments are working toward becoming prepared to deal with these emergencies, decision-makers, water managers and citizens must also realize that there are water use guidelines that can often stave off critical dry periods and the hardships associated with them. Growing concern for the preservation of state rivers, fisheries and recreational opportunities, combined with the high costs of water development, necessitate better planning, innovative water management and water conservation to maintain supplies and satisfy increasing demands.

Conservation of our water resources -- specifically, activities designed to reduce water demand and improve efficiency of use -- and ensuring the availability of fresh water for future generations involves changing habits and altering the manner in which we conduct our daily routines. Water conservation is both a physical and hydrologic process that involves using less water and a behavioral concept that emphasizes using water more efficiently and economically, thereby preserving and extending limited supplies. Although many water-using activities seem so mundane and unimportant compared to the many other aspects



of our lives, change will be difficult. But, both individually and collectively, it can make a difference.

In the home, the key is starting simply, such as turning off water when it is not being used, then gradually taking more advanced steps to reduce water consumption. On a larger scale, improved landscape designs, irrigation scheduling and better methods of irrigating crops, reclamation and reuse of wastewater, water budgeting and adoption of rate controls have all had considerable success in reducing both use and demand. Although water conservation by cities, industries, rural systems and the agricultural community is more widely practiced today than ever, there is still a need to improve water use efficiency and reduce losses.

For approximately \$10 to \$20, the average homeowner can install two low-flow showerheads, place dams or bottles in the toilet tanks, put low-flow aerators on the faucets and repair dripping faucets and leaking toilets. Worn-out washers, one of the most common causes of leaky faucets, is also the easiest and cheapest to fix. In just one year, these modifications can pay for themselves, saving a family of four from 10,000 to 25,000 gallons of water. Outdoors, even more water and money can be saved through water conservation in lawn and garden areas.

Community water conservation programs can prevent or delay the costly construction of new or upgraded water/wastewater

treatment plants. Water conservation can also have environmental benefits, such as a reduction in wastewater discharged into rivers and streams.

Who Uses Our Water?



- ◆ According to the 1990 report of estimated water use for Oklahoma, domestic, industrial and public water supply uses account for approximately 36% of all water withdrawn each year.
- ◆ Fueling the state's prolific agricultural industry, water for irrigation accounts for approximately 42% of withdrawals, primarily from groundwater sources in the west.
- ◆ Lesser amounts of water are utilized for livestock, thermoelectric power generation and other purposes. In all, Oklahomans used more than 1.4 billion gallons of water per day during 1990, 53% from surface sources and 47% from groundwater aquifers.
- ◆ According to the U. S. Geological Survey, per capita water use in Oklahoma is about 194 gallons per day.

WATER CONSERVATION

Inside Your Home

Of the water used by a typical family in a year, flushing the toilet accounts for the largest single use inside the home, followed by bathing/showering, laundry, dishwashing, drinking and cooking. During the winter months, more than 90% of household water use occurs inside the home. About 75% of in-home use occurs in the bathroom, primarily through the toilet and shower; 8% is used in the kitchen.

Indoor water conservation begins with simply turning off the water when it is not needed, which may require a surprisingly difficult change in our traditional water use routines. Once that challenging obstacle is removed, the next step is to regularly maintain household water fixtures and appliances, including replacement of water-guzzling appliances with newer, water-saving models.

From a community standpoint, water suppliers should consider the potential benefits of implementing appropriate water supply management programs, such as metering, leak detection and repair efforts; pressure reduction; and watershed management. Demand management options -- such as water pricing, regulation and education -- can also result in impressive savings of both water and money to the community and its customers. Technical and financial assistance is often available from state and federal water agencies to assist water suppliers.

Follow these indoor residential water use tips to reduce water consumption and decrease household energy and utility bills:

IN THE BATHROOM

• ***Adapt plumbing with flow-restricting or other water-saving devices.*** Shower flow restrictors, shower control/shut-off valves, faucet aerators and similar conservation accessories are usually inexpensive and easy to install. Shut-off valves eliminate the need to adjust water temperature when temporarily stopping water flow.

• ***Install low-flow showerheads*** which restrict flow to 3 gallons per minute or less can save more than one-half of the water used in the shower.

They are also inexpensive and easy to install.

• ***Install flow control devices,*** such as orifice restrictors that fit into water supply lines, to limit the rate of flow from shower heads and faucets.





How much water do you use in your home?

What can you do to use less?

Clothes washer (large load)	50 gallons/load	up to a 40% reduction through use of a water-saving model or washing only full loads
Shower (5 gallons/minute)	25 to 50 gallons	up to a 60% reduction through use of a flow restrictor or low-flow shower head which reduces flow to 3 gallons/minute
Flushing toilet	5 to 7 gallons/flush	1.6 to 3.5 gallons for low-flush toilets
Bath	35 gallons	fill tub to lower level
Dishwashing by hand (water running)	30 gallons	run sufficient water into the basin and shut off faucet
Leaky faucet	10 to 30 gallons/day	repair or replace the leaky faucet
Shaving (water running)	20 gallons	run sufficient water into the basin and shut off faucet
Dishwasher	13 gallons/load	reduce by 20% by using water-saving models or washing only full loads
Brushing teeth (water running)	2 to 5 gallons	use a cup of water instead

Total daily use for a typical individual

60 gallons

THINK ABOUT YOUR WATER USE HABITS AND CONSERVE!

- **Take a shower instead of a bath**, which usually requires more water, and limit showers to five minutes.

- **Install toilet tank displacement inserts** or dams to reduce the volume of water in the tank and the amount used per flush in conventional toilets. It is the height of water in the tank, more so than the volume, that causes the bowl to flush. A plastic jug or similar receptacle, filled with stones or water to weight it down, can be used as an alternative to purchased inserts.

- **Find and fix leaks in toilets as soon as detected.** The most common causes of toilet leaks are worn flush valve balls, improperly adjusted water levels, worn valve seats and leaking fill valves. Leaks can occur silently. To identify a leak, place a few drops of food coloring or a dye tablet in the upper toilet tank. Observe for about 10 minutes. If the color appears in the bowl, a leak is present.

- **Install low-volume flush toilets**, most of which use only 1.6 gallons per flush, when building a new home or remodeling a bathroom.

- **Do not use the toilet to flush away objects** that should be thrown away.

- **Find and fix leaks in faucets** and other water-using appliances. Such problems can usually be fixed cheaply and quickly by replacing worn washers or “O” rings.

- **Wash hands with cool water** instead of hot.

- **Use sink and tub stoppers** to avoid wasting water when shaving, washing hands, washing dishes and related activities.

- **Turn off the faucet while brushing teeth** and use a glass of water for rinsing.

- **Turn water faucets off** tightly after use.

IN THE KITCHEN

- **Use dishwashers only** when they are full. The average dishwasher uses up to 16 gallons of water per load.

- **Use the stopper in the sink** or a pan of water to soak pots, pans, dishes and cooking utensils, then hand wash to save water, energy, detergent and money.



• **Use the sink garbage disposal sparingly** by peeling/preparing vegetables or other foods on newspapers. Rather than throwing organic waste in the trash, start a garden compost pile.

• **Use a small pan of cold water when cleaning fruits and vegetables**, rather than using running water.

• **Thaw frozen foods by placing them in a pan of hot water.**

IN THE LAUNDRY ROOM

• **Wash only full loads of laundry** in your automatic clothes washing machine

or use the lowest water level setting possible for light or partial loads. Most automatic clothes washing machines use from 32



to 59 gallons of water per load. A newer water-saving washing machine can reduce water use by as much as 30%.

• **Water for laundering** is the third leading use of water in the home (up to 50-62 gallons per large load).

• **Laundry clothes in cold water** as often as possible to save energy and conserve hot water for uses which cold water cannot serve.

How to verify a water line leak? It's easier than you might think.



1. Turn off all indoor/outdoor faucets and water-using appliances.
2. Read the dial(s) on the water meter, usually located in the front yard near the street.
3. After 15 to 20 minutes, recheck the meter and compare the current reading with the previous one.
 - If the reading has changed, there is a leak in the plumbing system. (The rate, in gallons per minute, can be determined by dividing the number of gallons by the elapsed time.)
 - If you have a well, listen to see if the pump kicks on and off while the water is not in use. If it does, you have a leak.
 - If you cannot locate and/or repair the leak, call a plumber or qualified water utility employee.

APPLIANCES & PLUMBING

- Check all water line connections and faucets** for leaks, especially between the water meter and house.
- Learn to read your water meter** and keep track of water bills so that you can judge how much water you use and when you use it.
- Insulate hot water pipes and the hot water heater** itself to reduce time spent waiting for water to run hot. Pipe insulation is inexpensive and easy to install.
- Check the thermostat** on your water heater to ensure it is not set too high. Extremely hot settings (above 125 degrees) waste water and energy because hot water must often be cooled with cold water before it can be used. However, automatic dishwashers require a water temperature of at least 140 degrees to clean effectively.
- Locate your hot water heater** as close as possible to the bathroom, kitchen and/or laundry areas to reduce hot water use. Consider using two small water heaters placed in strategic locations, rather than one large unit.
- Turn off your electric water heater** at the circuit breaker if you are going to be away from your home for more than a few days.

•**Check the water requirements** of various models and brands when shopping for new appliances, such as dishwashers and washing machines. Some use considerably less water than others.

During water shortages, rationing and related emergencies:



- Take shorter showers and shallower baths.
- Reduce the number of toilet flushes per day.
- Don't use the garbage disposal.
- Use non-phosphate detergent and save laundry water for lawns and plants.
- Turn off the shower or engage the cut-off valve while soaping up, then on again only to rinse.

WATER CONSERVATION

Outdoors

Outside, where the vast majority of summer home water use occurs, landscaping consumes the greatest amounts of water. Outdoor watering accounts for up to one-half of the total water used per residence each year. In the summer, lawn, shrub and garden watering typically accounts for 50 to 80% of home water use.

The keys to outdoor water conservation are to eliminate overwatering and reduce evapotranspiration. Landscapes are typically overwatered by as much as 20 to 40%, primarily



because the homeowner lacks information on how much water the lawn really needs. Over-irrigation encourages disease, weed growth and pests, so watering plants only when they need it will result in healthier plants, reduced weeding, lower pest and disease control costs and less fertilizer. Water should be applied deeply to lawns. In outdoor gardens, mulch not only holds moisture but inhibits weed growth.

Trickle or drip garden irrigation systems can use 80 to 90% less water than hose or sprinkler methods. The trickle system waters closely spaced plants through a small plastic tube or hose with many tiny holes that runs along the ground. Drip system tubing utilizes holes or openings at strategic places to water plants, such as tomatoes, that are more widely spaced.



Efficient landscaping can save between 40 and 90% of the water used in a traditional garden. "Xeriscape," one of the most popular and water-efficient forms of landscaping, incorporates intelligent and attractive landscape design utilizing native/ adapted vegetation which requires less water, and limitation of lawn size to save both water and energy. Xeriscape plants are

drought-tolerant and more resistant to disease and damaging insects. They also provide year-round color as well as excellent wildlife habitat. Because they are water and energy efficient, xeriscape landscapes require less maintenance and need less chemicals and fertilizers than traditional landscapes. Wise planning and staged conversion are essential in transforming an existing garden/lawn to native or xeriscape-type vegetation. Local nurseries can provide invaluable advice in choosing suitable landscape vegetation and in establishing a water-efficient landscape.

Follow these tips to shorten watering time, reduce evaporation and lower costs for water:

THE LAWN

- ***Water your lawn only when it really needs it***, i.e., when the leaves begin to roll or show other signs of wilt, when the grass does not spring back when stepped on and/or when it takes on a dull, grey-green appearance. Most lawns require only about 1 to 1.5 inches of water, or enough to wet the soil to a depth of 4 to 6 inches, every 5 to 7 days during the growing season.

- ***Water slowly and thoroughly***, rather than frequently, to encourage root system growth and avoid runoff. Too much water can overload the soil so that air

cannot get to the roots; it also encourages plant diseases and salt buildup. Lawns on sandy soil require more frequent watering than lawns on loam or clay soils. Water can be applied less often to clay and loam, but it should be applied more slowly to prevent runoff.



• **Place sprinklers near the top of a slope** to avoid runoff on sloping areas. Apply water slowly for 5 to 15 minutes, then turn it off 15 minutes, then on again for 5 to 15 minutes, etc. until the correct amount of water has been applied.

• **Water during the early morning hours** when temperatures and wind speed are relatively low. The next best time to water is right after the sun sets; however, watering too late in the evening or at night can encourage the growth of fungus. Evaporation can be up to 60% higher during the heat of the day.

• **Position sprinklers to water the lawn**, not the pavement.

• **Avoid watering during high winds.** This increases evaporation and causes water from sprinklers to fall unevenly or blow onto sidewalks, driveways and streets.

How much water does my sprinkler apply?Find out.



1. Turn off all indoor and outdoor faucets and water-using appliances.
2. Set 3 to 5 empty cans at different distances from the sprinkler with the last can near the edge of sprinkler coverage;
3. Run the sprinkler for 30 minutes;
4. Add the inches of water in all cans and divide the total inches by the number of cans to obtain an average; then
5. Multiply the average by 2 to determine how many inches of water are applied in 1 hour.

• **Use a sprinkler that applies water as slowly as possible.** Use a sprinkler that distributes large droplets on a low trajectory close to the ground and/or one that simulates a gentle rain, rather than a fine mist which is more easily lost to evaporation.

• **Condition soil with mulch, compost or related materials** before planting to promote water penetration and retention in grass and flower beds. If the soil is rocky, shallow or a heavy clay, add 2 to 4 inches of organic material (such as peat, compost, decomposed rice hulls and rotted manure) or topsoil which is compatible with the soil type. Soil composed of heavy clay or fine sand can be improved by tilling organic material into it.



• **Group landscape plants according to their water needs** to avoid overwatering certain plants. Water turf areas separately from shrubs, flowerbeds and other plantings. Turf areas are best watered with sprinklers while trees, shrubs, garden flowers and ground covers are more efficiently watered with low



volume drop, spray or bubbler emitters. Use native, adapted and other low water-use plants.

- **Replace turf and vegetation** in seldom-used side and front yard areas with attractive rocks, gravel, wood chips or other materials that require no water.

- **Use and maintain the proper outdoor watering equipment.** Use hose washers between spigots and water hoses to eliminate leaks; check connections regularly. Be familiar with the operation of your automatic sprinkler system and adjust it according to the season. Set it to



provide thorough, but infrequent, watering and shut it off during moderate or heavy rain events or during wet periods. Check sprinkler systems and timing devices at regular intervals. Watch for broken or misdirected sprinklers.



- **Aerate lawns** to allow water easier access to roots. Punch holes six inches apart. Apply surfactants (wetting agents) and/or aerate your lawn to improve the soil/water infiltration rate.

- **Fertilize lawns at least twice a year** (lightly in the spring, then again in the early fall) to stimulate root development, but do not overfertilize. Grass with a good root system makes better use of water and is more tolerant to drought. Overfertilization increases the lawn's need for water. Use a slow-release, less soluble nitrogen fertilizer to reduce water requirements. A fertilizer with a 3-1-2 ratio of nitrogen (N), phosphorus (P) and potassium (K) -- such as 15-5-10 -- is recommended to help grass withstand stress.

- **Mow grass at a higher level**, at least two to three inches, to reduce evaporation and root stress. Cut grass fairly often with a sharp blade and not to less than one-third of the original height.



- **Use a mulching mower** that leaves grass clippings on the lawn. Mulching helps grass retain water and reduces the amount of fertilizer needed to maintain a healthy and attractive lawn.

- **Control insects and other pests** that can damage

grass, but don't over-apply pesticides.

TREES, SHRUBS, VEGETABLES, FLOWER GARDENS AND GROUNDCOVER

- **Use a soaker hose or drip irrigation system** to water trees, gardens, landscapes, vineyards, orchards and all types of vegetation that have a higher water requirement than grass. Drip irrigation applies water directly to the roots, providing an efficient and uniform method of

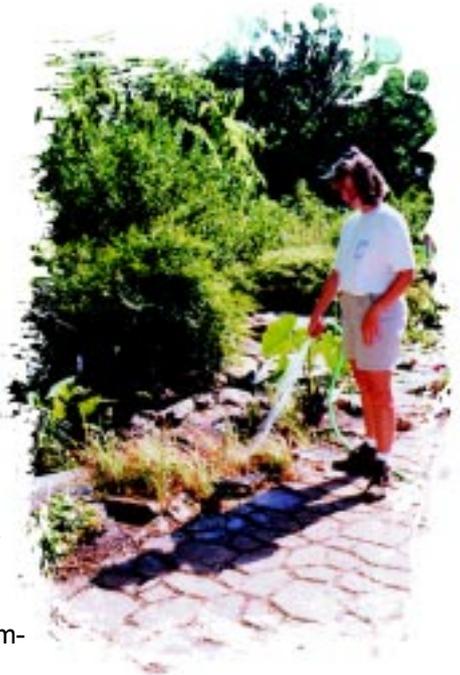


watering. It greatly reduces evaporation and eliminates deep percolation. Because drip irrigation requires only moderate amounts of water and energy, operating costs are relatively low. Drip irrigation inhibits weed growth and, with proper scheduling, eliminates plant stress. It also allows successful irrigation of steep slopes and problem soils.

- **Eliminate weeds** when they occur to reduce competition for water.

- **Check the soil moisture** before watering. While the surface may be dry, adequate moisture may be retained just beneath the surface.

- **Water small trees, shrubs or groundcover** by flooding diked areas or through placement of low-output sprinkler heads, bubblers or drip irrigation systems close to the roots of plants or underground. Use soil moisture probes (tensiometers) for large trees.



- **Shape the soil around large plants and trees** into earthen basins to catch and retain water. Keep soil loose to allow easy penetration of water.

- **Water plants growing in full sun** more often than those in the shade.

- **Water established plants about once a week during the summer**, applying enough water to wet the soil to a depth of at least 12 inches. New plantings require more frequent watering during the first two years, although watering can be reduced up to half after establishment.

- **Use mulches** in flower and shrub beds. Mulches cover and shade soil, minimize evaporation, reduce weed growth and



slow erosion, as well as add a decorative appearance to the landscape.

- **Mulch to reduce evaporation.** A two- to three-inch layer of wood chips, pine needles, grass clippings or straw around plants and between rows holds moisture and keeps the soil cool in summer. Mulch also increases the attractiveness of your landscape and retards weed growth.

- **Don't fertilize during the summer.** Fertilizing increases the need for water.

- **Plant in the fall or spring** when water requirements are generally low.

- **Choose native plants or species with low water demand** when planting groundcovers, shrubs and trees in your landscape. In addition to requiring less water after the first two years of establishment, native plants normally need less maintenance and fertilizer than imported species and have fewer problems with pests, diseases and extreme weather conditions.

OTHER OUTDOOR AREAS

- **Clean your swimming pool filter often** to reduce the frequency of water replacement. Run the filter backwash from pools and hot tubs onto the lawn rather than down the street or storm sewer. Consider replacing an older filter with a newer,

water-saving model that typically uses 180 to 250 gallons less during a single back-flushing. Cover hot tubs and pools when not in use to reduce evaporation.

• ***During water shortages and rationing***, cut back on the frequency of watering lawn and inedible plants. Lawns can go dormant and turn brown without being permanently damaged. Provide only minimal amounts of water to vegetable gardens and food trees on an individual basis. Give priority to trees and shrubs that are more expensive and harder to replace than grass and annual plants. Delay seeding or sodding of new lawns. Discourage children from playing with hoses, sprinklers or water toys. Limit car washing. Save rainwater or used household water (from bathing, dishwashing and clothes washing) for outside watering, if permitted by local health officials.

• ***When washing your car or boat, use a bucket of soapy water*** and the hose only for rinsing. If you take your car to a commercial wash, choose one that recycles water.



WATER CONSERVATION

Agriculture

Farmers and ranchers throughout the U.S., especially in the west, are currently facing numerous water-related challenges which, depending upon how they respond, will forever dictate the future of agriculture in this country. Intensified competition for limited water supplies, episodes of intermittent drought less favorable conditions for development of additional supplies and various economic factors are just a few obstacles which must be overcome by the agricultural community. This situation is magnified in Oklahoma, where the leading use of water resources is for various agricultural purposes. Irrigation accounts for approximately 42% of water withdrawals in the state (74% of groundwater withdrawals) while livestock use accounts for about 9% of the total.

Increasingly, farmers face pressure to meet more stringent environmental and water quality regulations related to instream flows and wetlands requirements, possible contamination by pesticides and fertilizers, and soil erosion. At the same time, those dependent upon the Ogallala Aquifer and other groundwater sources essential to Oklahoma's agriculture industry must contend with potential overdraft of their water supply and the associated increase in pumping costs as water well levels decline. In addition, shifting governmental policies may disrupt agriculture's past reliance on crop subsidies, federally supplied irrigation water and exemptions from environmental regulation.

Generally, irrigators have responded well to the dynamic social and political factors which have prompted dramatic

changes in traditional water use methods. Many producers plant crops that require less water (or those that have shorter growing seasons), adopt conservation-minded irrigation techniques, capture and reuse runoff, and implement various other water-efficient practices. However, no single procedure can solve all of the water quantity and quality problems confronting irrigated agriculture; additional research and development of innovative irrigation technologies is imperative to continued success of the industry. Advanced methods that allow precise water and soil moisture management, fully automated irrigation and use of reclaimed water for irrigation can stretch limited supplies, mitigate adverse environmental impacts and help farmers stay competitive in an increasingly global economy. Continued implementation of such practices will not only result



in significant reductions in energy and operation costs, but also also increased crop yields.

How much water does it take to make...



One two-pound loaf of bread?	1,000 gallons
One pair of jeans made from cotton?	1,800 gallons
One pound of hamburger?	4,000 gallons

While more research is needed to develop integrated irrigation and conservation tillage practices that maintain crop production, reduce nutrient and pesticide losses, minimize water pollution and reduce soil evaporation losses for irrigated agriculture, there are many promising techniques currently available to Oklahoma irrigators. For example, furrow diking conserves water by trapping irrigation water or rainwater in small earthen dams. Water held between the dams can slowly infiltrate into the soil, thereby increasing soil moisture. Increasing



infiltration time is particularly important in soils with low permeability. Through surge irrigation, where water is applied to the furrows in a series of pulses, or surges, rather than in a continuous stream, furrow application efficiencies can be improved 10 to 40%. A time-controlled valve alternately switches the water flow between irrigation sets. Pumpback systems may also be utilized to recover and reuse irrigation tailwater.

Low Energy Precision Application (LEPA) center pivot sprinkler systems can achieve irrigation application efficiencies as high as 98% by applying water directly in the furrow, thus reducing losses to deep

percolation, wind drift and evaporation. Drip irrigation, similar to the method used in home gardens, employs flexible tubing with emitters to apply water either at the soil surface at plant base or buried below land surface

between rows of plants. Buried drip lines have virtually no surface evaporation losses. Conservation tillage, the widely accepted practice of leaving crop stubble on the soil/field



surface, assists in both retaining soil moisture (because soil is not turned over and exposed to the air) and reducing wind and water erosion. Conservation

tillage also reduces cultivation costs.

Many producers utilize soil moisture monitoring -- a relatively simple, cost-effective technique -- to improve their irrigation water management. Soil moisture monitoring devices, such as gypsum blocks and tensiometers, help producers determine when to irrigate and how much water they need to apply to fill the root zone soil profile. This helps reduce the likelihood of applying too much or too little water. Also, employment of automated water delivery allows better control of the timing and rate of water flow from the head of the field into furrows.



An "ideal" irrigation system should store most of the applied water in the soil root zone where it is available to the crop; enable each irrigation to replace nearly all of the soil water deficit in the root zone; and uniformly distribute applied water to all parts of the field.

Two basic water management approaches may be applied to agricultural water conservation -- decreasing demand and increasing supply.

DEMAND MANAGEMENT

These water conservation strategies may be used to stretch water supplies on farms and ranches in Oklahoma:

- ***Reduce water deliveries*** through irrigation scheduling and control, understanding crop water requirements and monitoring the moisture status of associated soil(s). Irrigate only when the crop has depleted the available water in the root zone to an established level for that particular crop and soil conditions.

- ***Increase irrigation efficiency*** by reducing surface water diversions or groundwater pumping, enhancing deep percolation and decreasing runoff water on the field or farm. Consider physical measures such as canal lining, piping, land leveling, control structures, terracing, and improved and automated irrigation systems.

- ***Reduce water evaporation*** by implementing these measures. Use tank/reservoir covers to reduce evaporation from livestock watering tanks or small reservoirs. Reduce



the water surface area. Store water in deep, small reservoirs rather than shallow ones. For larger facilities, transfer water between ponds so that one pond, or only a few deeper ponds, are kept full while others are dry. Practice conservation tillage, such as no-till, reduced or minimum tillage, ridge tillage, stubble mulching and other forms of residue management.

- **Reduce evaporation from soil** by using crop residues, plastic mulches, etc. and installing surface drip on tree crops and subsurface drip on row crops.

- **Reduce water use by nuisance vegetation** by clearing, thinning and/or eradicating selected riparian vegetation or phreatophytes which utilize a considerable amount of stream base flow. Phreatophytes in the western U.S. use about 1.5 times the average flow of the Colorado River.

- **Reduce crop water requirements** by applying less water than



the maximum evapotranspiration demand, especially when irrigation costs are high or water supplies are limited. You can safely allow some soil water deficit or plant water stress to occur.

- **Time the planting of crops** to match periods of high evapotranspiration with expected rainfall and carryover of stored soil moisture. Reduce soil moisture to a lower level before applying irrigation water. Apply less irrigation water than can be effectively stored in the crop root zone.

- **Limit irrigated cropland acreages** by converting portions of irrigated cropland to dryland farming in water-short areas. U.S. Department of Agriculture projections indicate that 10 to 30% of irrigated land in the nation could be converted back to dryland farming or other uses by the 21st century.



- **Select drought-resistant strains** of crops that can withstand dry periods.

- **Use data on water availability and other factors** to guide optimum management of energy, salinity, fertilizer, insects, etc., for a particular crop. Irrigated farms produce approximately 60% of the total crops harvested in the U.S. and approximately 60% of farm revenues.

SUPPLY MANAGEMENT

Consider these suggestions to augment available supply:

- **Increase water supply** by catching and retaining floodwaters for release during drought or other dry times. Convey and confine surplus runoff to groundwater recharge areas to increase water storage.

- **Increase water yield** by constructing an impermeable surface or treating soil to reduce infiltration of runoff. Collect for later use. Remove and/or manipulate vegetative cover to increase runoff, decrease water demand and control erosion on range, forested and irrigated lands.

- **Capture and retain precipitation** by collecting snow and retarding snowmelt on

certain croplands by installing snow fences, implementing selective cutting and related practices. Implement cultural and mechanical practices to decrease runoff and evaporation and thereby increase soil moisture storage.

- **Increase crop rooting depths** by breaking up hardpans and selecting crop species and varieties that are more deeply rooted to expand soil moisture extraction.

- **Add to available water supply through:**

- ✓ Inter- and intrabasin transfers which

- t water from areas with surplus water to water-short areas.

- ✓ Irrigation with moderately saline drainage waters and reclamation of wastewater effluents for irrigation.

- ✓ Support of available weather modification programs.



WATER CONSERVATION

Business, Industry & Public Facilities

Businesses, industries and local governments from coast to coast have discovered that conserving water is not only economical or good for the environment, it's good business as well. Often, even large-scale conservation measures can be implemented without a decrease in productivity. Many residential communities and commercial developments offer treated wastewater for irrigating landscapes. Similarly, golf courses irrigate with treated effluent. Electric power plants recycle water used in the cooling process. Many communities offer free water conservation kits -- containing low-flow sink aerators, water-saving showerhead and/or toilet dams -- to customers and some have adopted conservation rate structures which apply higher water rates to large water users. Local governments have also instituted building codes requiring developers to install water-saving plumbing fixtures in homes and buildings

How much water does it take to make...

◆ One 12-ounce can of soda?	16.5 gallons
◆ Forty sheets of paper?	100 gallons
◆ One ton of finished steel for an automobile?	32,000 gallons



and others offer rebates to residents who replace older model toilets with those that use less water. Even restaurants have gotten into the act by serving water to customers only on request and encouraging employees to conserve at the work site.

Typically, large quantities of water are used for industrial purposes. As a result, water conservation at large production and related facilities can pay enormous dividends. Manufacturers use less water by incorporating recycled materials into their products or by recycling water within factories. For example, producing one ton of recycled paper consumes 60,000 gallons less water than producing one ton of virgin paper. Also, implementation of reuse/recycle systems helps to decrease water and wastewater disposal costs for individual industries. In turn, consumers who purchase and use recycled products, as well as those who conserve water and energy in their daily routine, support the efforts of conscientious manufacturers and, ultimately, ensure the availability of water for all water users.



The following tips for industries, businesses and public facilities can result in substantial water savings:

- **Identify and repair leaky fixtures** and water-using equipment. Give special attention to equipment connected directly to water lines, such as processing machines, steam-using machines, washing machines, water-cooled air conditioners and furnaces.

- **Install toilet tank displacement inserts;** place flow restrictors in shower heads and faucets; and close down automatic flushes overnight.

- **Shorten rinse cycles for laundry machines** as much as possible; implement lower water levels where possible.

- **For processing, cooling and other uses,** either reuse water or use water from sources that would not adversely affect local public water supplies.

- **Install automatic flushing valves** to use as little water as possible or to cycle at longer intervals.

- **Ensure that valves and solenoids which control water flows** are shut off completely when the water-using cycle is not engaged.

- **Consider treated wastewater** for irrigation of parks, golf courses and other public facilities that use large quantities of water. In landscaping designs, include native and/or water-efficient vegetation.



•**Adjust equipment** to use the minimum amount of water required to achieve its stated purpose.

•**Check meters frequently** to determine consumption patterns and review usage patterns to identify where savings can be made.

•**Promote water conservation** at the workplace and in the community. Utilize newsletters, brochures and bulletin boards to get the message out. Place water-saving posters and literature where employees, students, patients, customers and others will see and have access to them.

•**Set a good example** by using native and/or water-efficient vegetation around public and private buildings.



Conclusion

Oklahoma is truly blessed with abundant water resources. Generous supplies are available for drinking and domestic use, industry, agriculture, power generation and countless other purposes. In its many forms, water provides the base for our vibrant agricultural industry and is the common factor upon which our large cities, small communities and rural areas continue to exist and thrive. Moreover, clean and plentiful water supplies are imperative to the health and welfare of Oklahoma's 3 million plus citizens.

How we parlay our water resources to benefit the greatest number of state citizens, for both economic development benefits and individual water needs, is of critical importance to the future growth and well-being of our state. As Oklahoma citizens, it is incumbent upon each of us to be a steward of our water resources. Conservation is the most direct way through which we can demonstrate this stewardship, so **please**.....



..... **conserve your water resources!**

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