Tool for Planning Temporary Water Supply Response in Drought Emergencies

Developed through collaboration between
the U.S. Bureau of Reclamation and
Oklahoma Water Resources Board

The purpose of this Tool is to help water resource and utility professionals meet the challenge of providing emergency water supplies to communities under the influence of severe drought.

The objective of the Tool is to assist in planning for water shortages by familiarizing users with alternative sources, treatment processes, distribution options, short term equipment solutions for treatment, and regulatory processes related to emergency situations.

A new Emergency Drought Relief Fund, enabled through HB 1923, includes $3 million for future drought mitigation and projects. While details have yet to be resolved, in the event of a gubernatorial drought declaration, expenditures will be approved through an Emergency Drought Commission consisting of the Secretary of Agriculture and Executive Directors of the OWRB and Oklahoma Conservation Commission.

Using This Tool


Click on this icon to go to other **websites** with useful information.


Click on letter buttons to go to main sections.


Click on number buttons to go to subsections.


Click on this icon to go to **documents or worksheets** included with this tool.


Click on this arrow to return to the previous page.


Click on this arrow to go to the next page.


Click on this icon to return to the main menu.



Goals for Users

- ✓ Knowledge of drought planning resources.
- ✓ An estimate of emergency water supply requirements.
- ✓ Knowledge of potential sources of emergency water.
- ✓ Knowledge of how those sources need to be treated, waste that will be generated, and how to manage that waste.
- ✓ Ideas for distribution of emergency water.
- ✓ A clear plan for navigating the regulatory process.
- ✓ Knowledge of sources of equipment.
- ✓ Strategies for involving the public.
- ✓ Knowledge of potential sources of funding.

Disclaimers

The Bureau of Reclamation and the State of Oklahoma have developed this Tool as a service to the public. The tool offers a wide range of information to meet as many needs as possible, including links to other organizational sites. Every effort has been made to provide accurate data according to available resources. However, neither the authors nor any other party involved in the preparation of the material and data available on or through this tool represent that the information provided here is in every respect complete and accurate and are not responsible for errors or omissions.

Presentation of information on commercial products does not constitute an endorsement of that product or commercial enterprise.

Do check local sources for any equipment and service needs.

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D Ancillary Equipment for New Sources
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F Distribution and Storage
G Waste Management
H Regulatory Requirements
I Commercially Available Packaged Treatment Systems
J Federal Sources for Treatment Systems
K Water Treatment Operator Requirements
L Potential Funding Sources
M Public Communications and Involvement
N Model Drought Management Plans
O Contacts for Assistance with this Tool

Preparation

A

Now is the best time to think about what to do in an emergency. The State of Oklahoma, Environmental Protection Agency (EPA), Federal Emergency Management Agency (FEMA), Centers for Disease Control (CDC), Department of Homeland Security (DHS), water industry professional organizations, and the United Nations, have produced documents to assist in preparing emergency plans for a wide range of events, including drought.

1. State Resources
2. Federal Resources
3. Professional Organizations

Preparation

State Resources

A 1

- The Oklahoma Drought Management Plan outlines membership and responsibilities as well as the sequence of state drought response actions. It also identifies drought-related capabilities of local, state, and federal entities.

- The Oklahoma Department of Emergency Management acts as the lead state coordinator in drought response with the mission of preparing for, responding to, recovering from, and mitigating against disasters and emergencies.

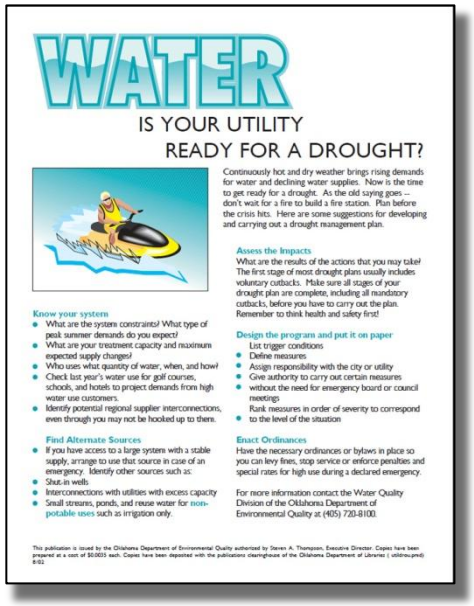
Preparation

State Resources

A 1

The Oklahoma Department of Environmental Quality (ODEQ) features the following resources:

- Templates for public water system emergency response plans
- Water Rationing Report
- Factsheet: Is Your Utility Ready for a Drought?
- Factsheet: Water Emergency Procedures
- Community Drought Impact Contact List



WATER

IS YOUR UTILITY READY FOR A DROUGHT?

Continuously hot and dry weather brings rising demands for water and declining water supplies. Now is the time to get ready for a drought. As the old saying goes -- don't wait for a fire to build a fire station. Plan before the crisis hits. Here are some suggestions for developing and carrying out a drought management plan.

Know your system

- What are the system constraints? What type of peak summer demands do you expect?
- What are your treatment capacity and maximum expected supply changes?
- Who uses what quantity of water, when, and how?
- Check last year's water use for golf courses, schools, and hotels to project demands from high water use customers.
- Identify potential regional supplier interconnections, even through you may not be hooked up to them.

Find Alternate Sources

- If you have access to a large system with a stable supply, arrange to use that source in case of an emergency. Identify other sources such as:
- Shut-in wells
- Interconnections with utilities with excess capacity
- Small streams, ponds, and reuse water for non-potable uses such as irrigation only.

Assess the Impacts

What are the results of the actions that you may take? The first stage of most drought plans usually includes voluntary cutbacks. Make sure all stages of your drought plan are complete, including all mandatory cutbacks, before you have to carry out the plan. Remember to think health and safety first!

Design the program and put it on paper

List trigger conditions

- Define measures
- Assign responsibility with the city or utility
- Give authority to carry out certain measures
- without the need for emergency board or council meetings

Rank measures in order of severity to correspond

- to the level of the situation

Enact Ordinances

Have the necessary ordinances or bylaws in place so you can levy fines, stop service or enforce penalties and special rates for high use during a declared emergency.

For more information contact the Water Quality Division of the Oklahoma Department of Environmental Quality at (405) 720-8100.

This publication is issued by the Oklahoma Department of Environmental Quality authorized by Steven A. Thompson, Executive Director. Copies have been prepared at a cost of $0.0035 each. Copies have been deposited with the publications clearinghouse of the Oklahoma Department of Libraries (oklibrary.pmd) 8/02.

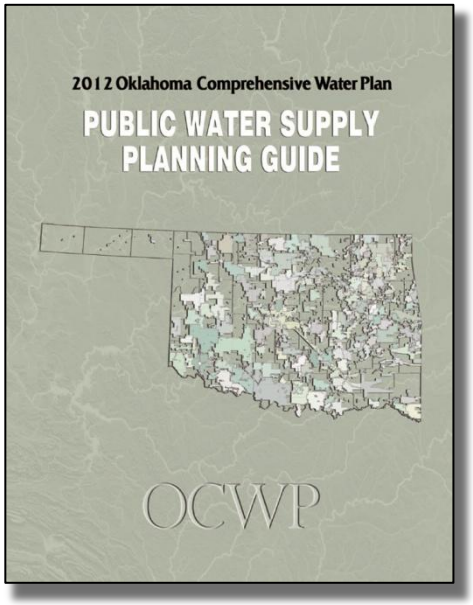
Preparation

State Resources

A 1

The Oklahoma Water Resources Board (OWRB) features the following resources:

- Drought & Water Resource Monitoring web page
  - Forecasts, Outlooks, & Indicators
  - Streamflow Conditions
  - Reservoir Storage
  - Groundwater Levels
- Oklahoma Comprehensive Water Plan web page
- Oklahoma Public Water Supply Planning Guide

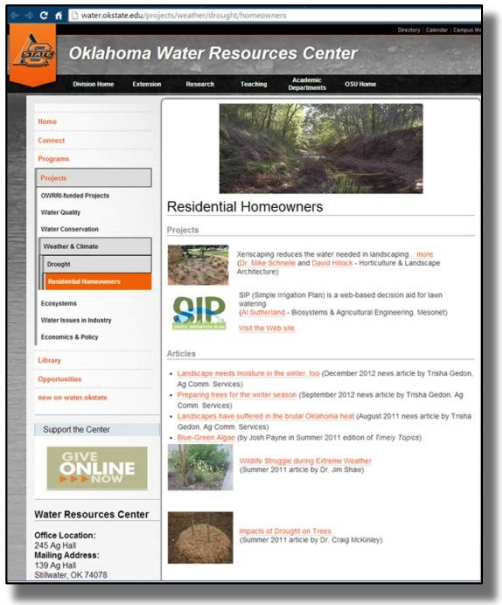


Preparation

State Resources

A 1

- The Oklahoma Water Resources Center Drought web page features the following resources:
  - Livestock (cattle) Producers drought resources page
  - Crop Producers drought resources page
  - Residential Homeowners drought resources page



Preparation

Federal Resources

A 2

- The National Drought Mitigation Center website features the Drought-Ready Communities page.

  The US Environmental Protection Agency (EPA) features the following resources:

  - Severe Drought Resources page
  - Tabletop exercise tool for Water Systems: Emergency Preparedness, Response, & Climate Resiliency (TTX Tool)

- The National Integrated Drought Information System (NIDIS) website features the US Drought Portal.
- The Bureau of Reclamation website features the Drought Program page.
- The United States Geological Survey (USGS) website features the Water Watch page.

Preparation

Professional Organizations

A 3

The American Water Works Association features the following resources:

- Drought Preparedness and Response manual.
- Water Shortage Contingency Planning Checklist.

The Water Environment Research Foundation features the following resources:

- Climate Change page.
- Resource Recovery page.
- Security & Emergency Response page.
- Water Reuse page.

Water Capacity Requirements

B

How much water do you need? Here are some considerations for narrowing in on the critical supply for an emergency.

- ✓ The minimum necessary for health and sanitation.
- ✓ The minimum necessary to keep the distribution system functioning.
- ✓ The maximum that you can get and treat reliably.

This section provides references to help define your emergency water requirement.

1 Water Capacity Requirements

2 Minimum Water Supply Recommendations

Water Capacity Requirements

B 1

Public water systems are regulated by Oklahoma Department of Environmental Quality (ODEQ) Rules and Regulations.

Oklahoma Administrative Code 252:626-19-1 requires that hydraulic analysis of the system demonstrates that (1) a minimum of 25 psi should be maintained through out the distribution system, and (2) flows are calculated to be more than one gallon per minute per service connection.

Water Capacity Requirements

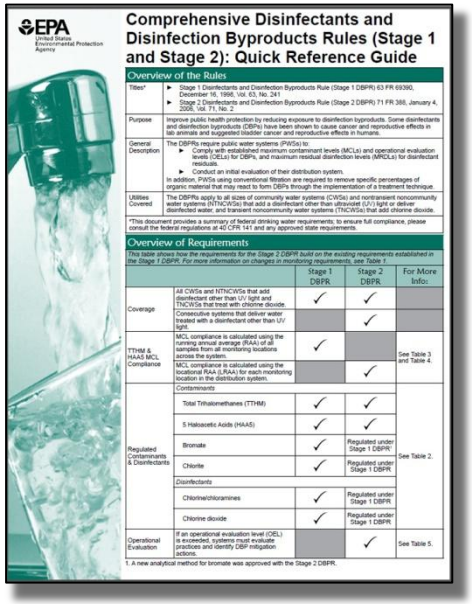
B 1

When water supply available for treatment decreases, conservation measures can assist in keeping the distribution system filled. However, water must also be kept fresh to prevent build up of disinfection by-products in the distribution system.

The EPA has provided a Quick Reference Guide for comprehensive Disinfectants and Disinfectant Byproducts Rules (Stage 1 & 2).

If levels are above the MCL further treatment to remove organic material may be necessary.

See the Water Treatment section E for more treatment recommendations.



EPA United States Environmental Protection Agency

Comprehensive Disinfectants and Disinfection Byproducts Rules (Stage 1 and Stage 2): Quick Reference Guide

Overview of the Rules

Titles*	► Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) 63 FR 69390, December 16, 1998, Vol. 63, No. 241 ► Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) 71 FR 388, January 4, 2006, Vol. 71, No. 2
Purpose	Improve public health protection by reducing exposure to disinfection byproducts. Some disinfectants and disinfection byproducts (DBPs) have been shown to cause cancer and reproductive effects in lab animals and suggested bladder cancer and reproductive effects in humans.
General Description	The DBPRs require public water systems (PWSs) to: ► Comply with established maximum contaminant levels (MCLs) and operational evaluation levels (OELs) for DBPs, and maximum residual disinfection levels (MRDLs) for disinfectant residuals. ► Conduct an initial evaluation of their distribution system. In addition, PWSs using conventional filtration are required to remove specific percentages of organic material that may react to form DBPs through the implementation of a treatment technique.
Utilities Covered	The DBPRs apply to all sizes of community water systems (CWSs) and nontransient noncommunity water systems (NTNCWSs) that add a disinfectant other than ultraviolet (UV) light or deliver disinfected water, and transient noncommunity water systems (TNCWSs) that add chlorine dioxide.

*This document provides a summary of federal drinking water requirements; to ensure full compliance, please consult the federal regulations at 40 CFR 141 and any approved state requirements.

Overview of Requirements

This table shows how the requirements for the Stage 2 DBPR build on the existing requirements established in the Stage 1 DBPR. For more information on changes in monitoring requirements, see Table 1.

		Stage 1 DBPR	Stage 2 DBPR	For More Info:
Coverage	All CWSs and NTNCWSs that add disinfectant other than UV light and TNCWSs that treat with chlorine dioxide.	✓	✓	
	Consecutive systems that deliver water treated with a disinfectant other than UV light.		✓	
TTHM & HAA5 MCL Compliance	MCL compliance is calculated using the running annual average (RAA) of all samples from all monitoring locations across the system.	✓		See Table 3 and Table 4.
	MCL compliance is calculated using the locational RAA (LRAA) for each monitoring location in the distribution system.		✓	
Regulated Contaminants & Disinfectants	*Contaminants*			See Table 2.
	Total Trihalomethanes (TTHM)	✓	✓	
	5 Haloacetic Acids (HAA5)	✓	✓	
	Bromate	✓	Regulated under Stage 1 DBPR	
	Chlorite	✓	Regulated under Stage 1 DBPR	
	Disinfectants			
	Chloramine/chloramines	✓	Regulated under Stage 1 DBPR	
	Chlorine dioxide	✓	Regulated under Stage 1 DBPR	
Operational Evaluation	If an operational evaluation level (OEL) is exceeded, systems must evaluate practices and identify DBP mitigation actions.		✓	See Table 5.

1. A new analytical method for bromate was approved with the Stage 2 DBPR.

Water Capacity Requirements

Minimum Water Supply Recommendations

B 2

- The World Health Organization's publication Emergency Water Supply, Chapter 7 provides information for establishing and protecting centralized and decentralized water supplies and recommends a minimum water supply capacity of four gallons per person per day.

- The Centers for Disease Control and Prevention (CDC) Emergency Water Supplies web page recommends storing at least one gallon per person per day and keeping a three-day supply.

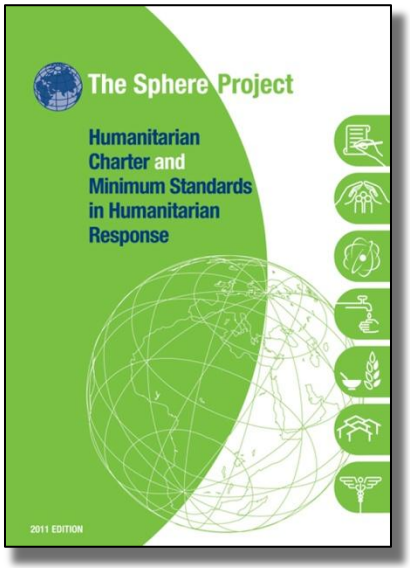
- The CDC's publication Emergency Water Supply Planning Guide for Hospitals and Health Care Facilities also recommends methods for estimating critical water supply needs.

Water Capacity Requirements

Minimum Water Supply Recommendations

B 2

- The Sphere Project Handbook provides a section on the minimum standards in water supply, sanitation, and hygiene promotion.
- Use the "Capacity" tab of the Planning Spreadsheet to calculate minimum water requirements based on recommendations from the World Health Organization, Centers for Disease Control, and Sphere Handbook.



Alternative Sources

C

When water supplies are depleted, the following alternative sources may be considered:

1. Conservation
2. Water System Partnerships
3. Additional Surface Water
4. Additional Groundwater
5. Reusing Wastewater
6. Hauling Water

Use the "Alternative Sources" Tab of the Planning Spreadsheet to inventory potential sources.

Alternative Sources

Conservation

C 1

- The OWRB's Water Conservation web page provides information on the Water for 2060 Act and Advisory Council and provides numerous links and resources.

The ODEQ's website provides water conservation fact sheets on the following topics:

- Conserving Water in the Kitchen and Laundry Room
- Conserving Water Outdoors
- Conserving Water in the Bathroom
- Water Costs Money, Don't Waste It!
- Make Every Drop Count with the Water Wise Droplets (coloring book)

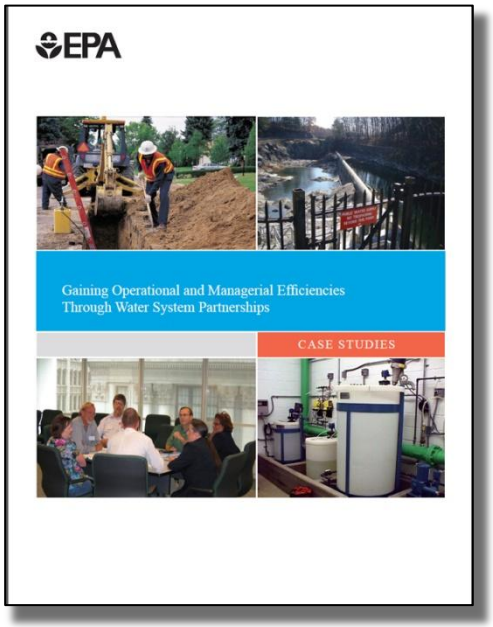
Alternative Sources

Water System Partnerships

C 2

If there are neighboring communities with a reliable water supply, it may be possible to work together to identify possibilities for an inter-connection of distribution systems.

The EPA document Gaining Operational and Managerial Efficiencies Through Water System Partnerships: Case Studies describes a variety of water utility partnerships from organizational to structural.

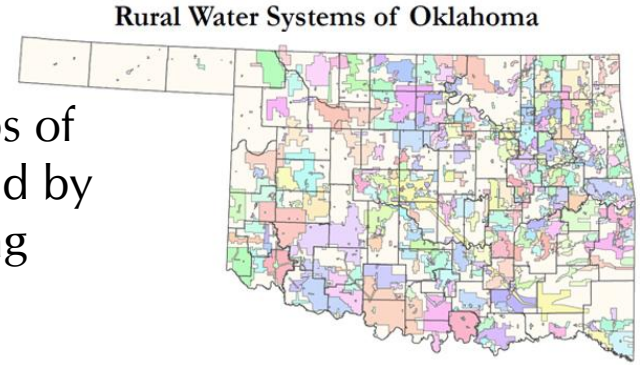


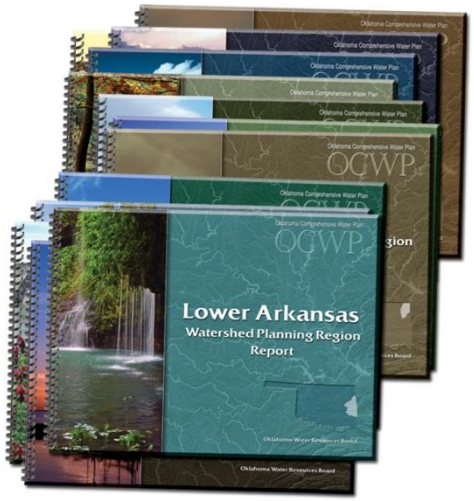
Alternative Sources

Water System Partnerships

C 2

- The OWRB provides detailed information about Rural Water Systems, including maps of their approximate boundaries statewide and by county, which may be helpful in identifying interconnection possibilities.
- Provider specific information for long-term needs can be found in the OWRB's 2012 OCWP Watershed Planning Region Reports.
- The ODEQ Public Water Supply web page has additional information.

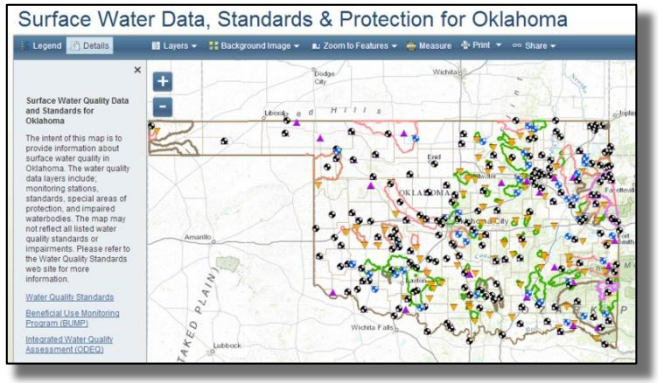




Alternative Sources
Additional Surface Water

C 3

- The OWRB website provides the following surface water resources:
  - Locating Available Water web page
  - Water Quality Monitoring web page
  - Interactive map linked directly to stream gage and surface water quality data
  - The OCWP web page, featuring the Public Water Supply Planning Guide with information on locating additional sources of water

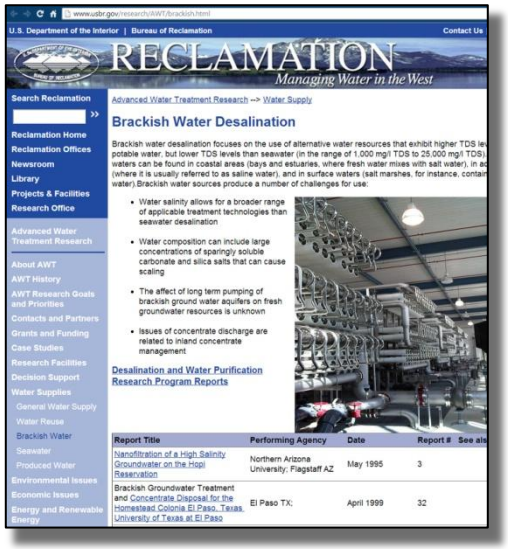


Alternative Sources
Additional Surface Water

C 3

Due to a combination of evaporative losses, decreased precipitation, and discharge of waste water, surface water may become brackish. Increased nutrient levels can result in algal blooms. Some algae produce toxic compounds that are difficult to remove in conventional treatment systems. Ultrafiltration is an excellent method for removing suspended solids, turbidity and micro-organisms.

Do not chlorinate or otherwise disinfect before ultrafiltration of brackish surface water, to prevent breaking algal cell membrane and releasing toxins.

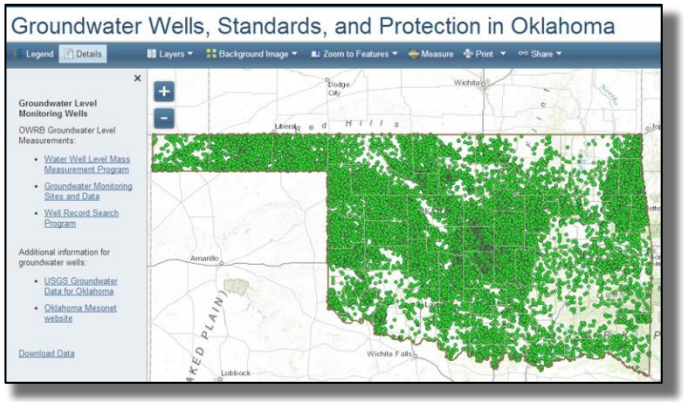


The Bureau of Reclamation's Brackish Water Desalination web page has more information and links to studies and reports.

Alternative Sources
Additional Groundwater

C 4

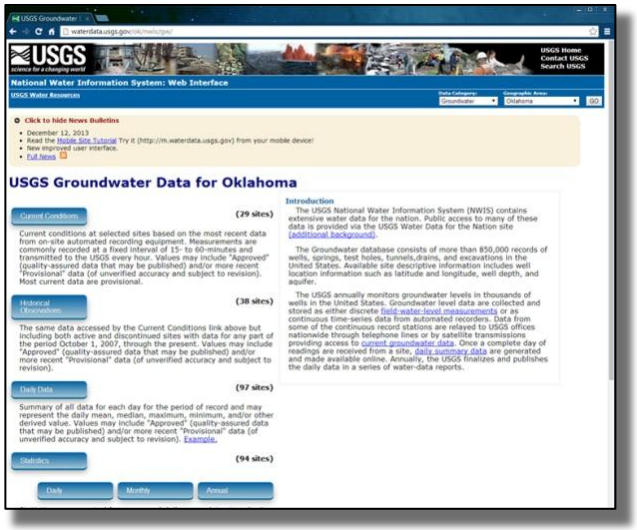
- The OWRB website provides the following groundwater resources:
  - Locating Available Water web page
  - Water Quality Monitoring web page
  - Interactive map linked directly to groundwater data, including well logs and water level monitors
  - OCWP web page, featuring the Public Water Supply Planning Guide with information on locating additional sources of water



Alternative Sources
Additional Groundwater

C 4

- The ODEQ Groundwater web page contains several groundwater quality links, including a list of maps showing levels of Total Dissolved Solids, Sulfates and Nitrates in Oklahoma's major aquifers.
- The USGS Groundwater data for Oklahoma web page provides information on current and historical water levels at select sites.



Alternative Sources
Additional Groundwater

C 4

Well Services:

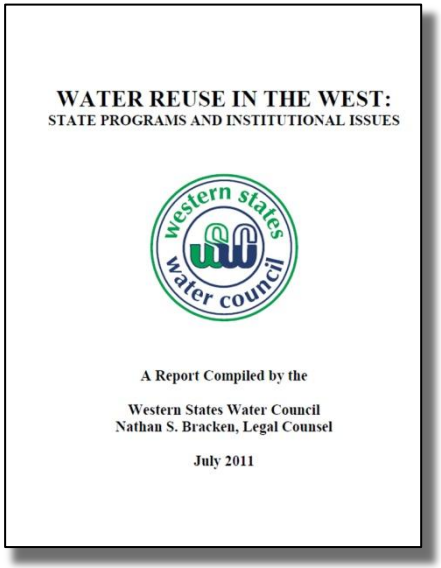
- Well jetting opens up clogged screens and can aid in restoring well productivity. Most licensed well drillers can provide this service. The OWRB licenses water well drillers in Oklahoma and provides a public search page for locating licensed drillers by activity and location.
- The Oklahoma Ground Water Association provides a membership directory and also provides links to a wealth of information concerning water well drilling in Oklahoma.

Alternative Sources

Reusing Wastewater

C 5

- The Western States Water Council report Water Reuse in the West: State Programs and Institutional Issues documents the state of water reuse in the western US. Water reuse issues for Oklahoma are discussed on page 35.
- The 2012 OCWP Supplemental Report Marginal Quality Water Issues and Recommendations is an evaluation of the potential use of treated wastewater effluent and other marginal quality water sources to meet some of Oklahoma's future water demands.



C 5

- The ODEQ has developed Rules for Operation and Maintenance of Water Reuse Systems for reclaimed water Categories 2-5 (below):

Category 2: drip irrigation on orchards or vineyards; spray or drip irrigation on sod farms, public access landscapes and public use areas/sports complexes, including unrestricted access golf courses; toilet and urinal flushing; fire protection systems; commercial closed-loop air conditioning systems; vehicle and equipment washing (excluding self-service car washes); and range cattle watering. Category 3, 4, and 5 can also be permitted as category 2 reclaimed water.

Category 3 (4 and 5 uses can also be permitted): subsurface irrigation of orchards or vineyards; restricted access landscape irrigation; irrigation of livestock pasture; concrete mixing; dust control; aggregate washing/sieving; new restricted access golf course irrigation systems; industrial cooling towers and once-through cooling systems; and restricted access irrigation of sod farms. Category 4 and 5 can also be permitted as category 3 reclaimed water.

Category 4: soil compaction and similar construction activities; and existing restricted golf course irrigation systems utilizing water that has received primary treatment in lagoon systems. Permits to construct shall not be issued for new Category 4 restricted access golf course irrigation systems pending further research and evaluation of performance data collected from existing systems. Category 5 can also be permitted as Category 4 reclaimed water.

Category 5: restricted access pasture irrigation for range cattle; restricted access irrigation of fiber, seed, forage and similar crops; and irrigation of silviculture.

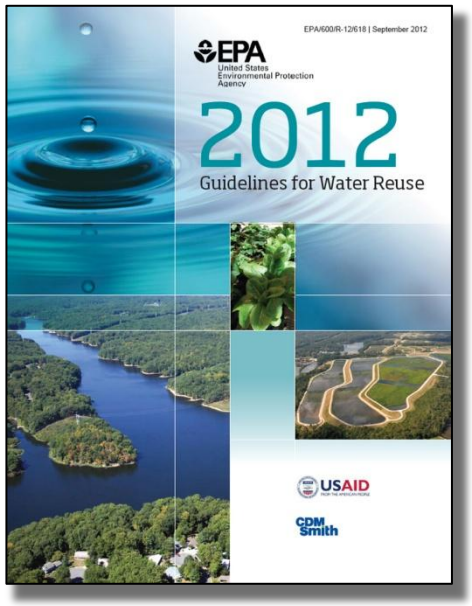
Alternative Sources

Reusing Wastewater

C 5

The EPA publication 2012 Guidelines for Water Reuse contains the following information:

- Planning and Management considerations
- Types of Reuse Applications
- State Regulatory Programs for Water Reuse
- Regional Variations in Water Reuse
- Treatment Technologies for Protecting Public and Environmental Health
- Funding Water Reuse Systems
- Public Outreach, Participation, and Consultation
- Global Experiences in Water Reuse



Alternative Sources

Reusing Wastewater

C 5

- Findings of the National Academies Press publication Water Reuse: Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater:
  - *Municipal wastewater reuse offers the potential to significantly increase the nation's total available water resources.*
  - *De facto reuse of wastewater effluent as a water supply is common in many of the nation's water systems.*
  - *Natural systems are employed in most potable water reuse systems to provide an environmental buffer. However, it cannot be demonstrated that such "natural" barriers provide any public health protection that is not also available by other engineered processes.*
  - *Reclamation facilities should develop monitoring and operational plans to respond to variability, equipment malfunctions, and operator error to ensure that reclaimed water released meets the appropriate quality standards for its use.*
- See the Bureau of Reclamation's Water Reuse web page for more information.

Alternative Sources

Reusing Wastewater

C 5

The WateReuse Research Foundation report titled Low Cost Treatment Technologies for Small-Scale Water Reclamation Plants identifies and evaluates established and innovative technologies that provide treatment of flows of less than one million gallons per day.

- *The report includes an extensive cost database, where the cost and operation data from existing small-scale wastewater treatment and water reuse facilities have been gathered and synthesized.*
- *The report concluded that natural systems (ponds plus wetlands) are the best economic alternative for small communities if inexpensive land is available and effluent water quality can satisfy the local regulations. If high water quality is desired and budget is available, non-membrane systems can be used. Membrane-based systems can be used if even higher water quality is needed and if budget allows.*

Alternative Sources

Hauling Water

C 6

Often the quickest way to provide an emergency water supply is to transport water in tankers from a nearby source and store the water in tanks and reservoirs. It is important to note that hauling water is often the most expensive alternative, but may be more expeditious for a moderate supply volume. Although Oklahoma does not specifically license water haulers, Oklahoma does require that commercial vehicles be registered based on size and weight through the Dept. of Public Safety.

- The state of Oregon provides Drinking Water Hauling Guidelines that describe types of tanker trucks that can be used and how they should be filled and cleaned.
- A source for water hauling companies in Oklahoma is Bulkwaterdelivery.com.*

**Please note that some companies on this website do not haul potable water.*

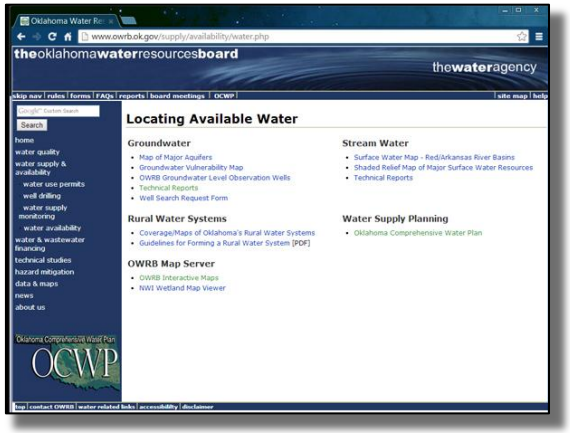
Alternative Sources

Hauling Water

C 6

The OWRB's Locating Available Water web page provides information on locating a water supply.

See section F for information on storing hauled drinking water for distribution.



Ancillary Equipment for New Sources

D

Ancillary equipment may be needed for new sources of water.

1. Intakes
2. Pumps
3. Power

Kansas State University Agricultural Experiment Station and Cooperative Extension Service Handbook for Livestock Producers and Landowners has extensive information on water sources, intake, pumping, storage, alternative power and distribution systems for livestock. The information is equally valuable for temporary, or alternative water supplies for small towns.

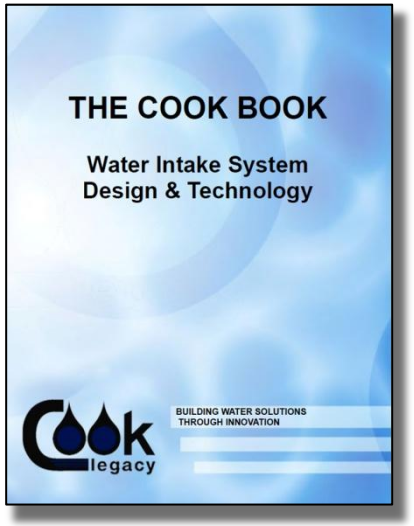
Ancillary Equipment for New Sources

Intakes

D 1

Regulations require a screened intake for new surface sources. Examples of local suppliers are listed below:

- Cook Legacy Water & Energy specializes in screen systems of all kinds. They provide The Cook Book: Water Intake System Design & Technology that is helpful in learning more about screen systems.
- Fluid Equipment in Tulsa, Oklahoma, can help with choosing a screen solution for surface water intakes.
- Hendrick Screen Company has a sales representative in Sand Springs, Oklahoma.



Ancillary Equipment for New Sources

Pumps

D 2

- Local pump suppliers can be identified on Thomasnet.com. Examples are listed below:
  - Arrow Pump & Supply
    Cushing, Stroud, Seminole, Ada, and Pawhuska, Oklahoma
  - Advanced Power, Inc
    Canton, Oklahoma
  - Bison Solar Pumps
    Balko, Oklahoma
  - Pumps of Oklahoma
    Oklahoma City, Oklahoma
  - Solar Power & Pump Co
    Elk City, Oklahoma
  - Tarby
    Claremore, Oklahoma
  - Tulsa Tool & Pump Co, Inc
    Tulsa, Oklahoma

Ancillary Equipment for New Sources

Power

D 3

It is a good idea to plan ahead for power outages during a drought. Some well pump suppliers provide solar or wind powered pumps. Examples of local suppliers are listed below:

- All Bolt Electric
  Harrah, Oklahoma
- Clifford Power Systems, Inc
  Oklahoma City and Tulsa, Oklahoma
- Oklahoma Generator
  Oklahoma City and Norman, Oklahoma
- Walters Power International
  Oklahoma City, Oklahoma

Ancillary Equipment for New Sources

Power

D 3

Alternative energy should be considered for distributed pumping systems and temporary treatment systems. The following companies have solar, wind, geothermal, and/or biogas power systems:

- Bergey Windpower Co
  Norman, Oklahoma
- Green Wind and Solar
  Norman, Oklahoma
- Harvest Solar & Wind Power
  Tulsa, Oklahoma
- Ion Solar, LLC
  Tulsa, Oklahoma
- Solar Power & Pump Co
  Elk City, Oklahoma
- Sun City Solar Energy
  Tulsa and Oklahoma City, Oklahoma
- Sunrise Alterative Energy
  Edmond, Oklahoma

The Energy Source Guide for Oklahoma also lists other companies that do not have a website.

Water Treatment

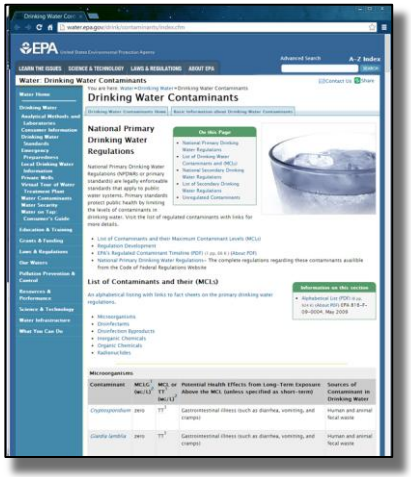
E

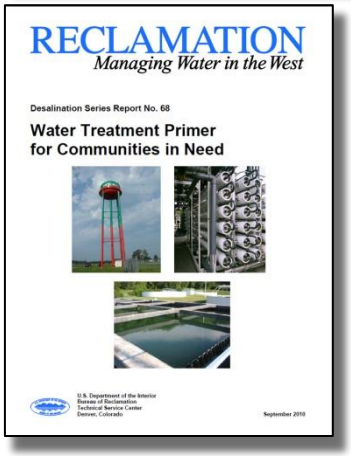
1. Drinking Water Standards
2. Water Analysis
3. Protecting Public Health

Water Treatment
Drinking Water Standards

E 1

- The minimum treatment required for potable water is determined by the ODEQ, which has adopted EPA Primary Drinking Water Standards designed to protect human health. The regulations address microorganisms, disinfectants, disinfection byproducts, inorganic and organic chemicals and radionuclides.
- Secondary water quality standards are set for cosmetic or aesthetic effects.
- The Bureau of Reclamation publication Water Treatment Primer for Communities in Need summarizes drinking water regulations, conventional and advanced treatment processes, and treatment for specific contaminants.





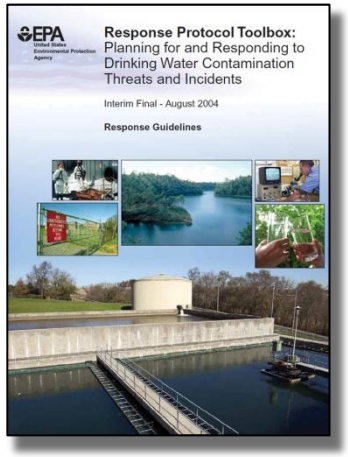
Water Treatment

Water Analysis

E 2

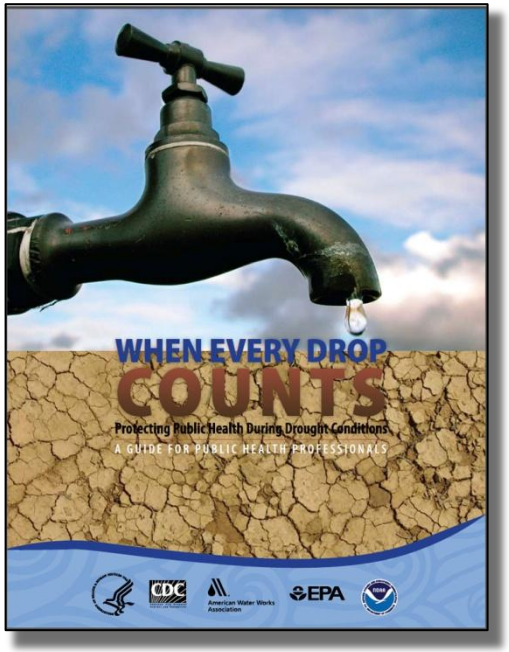
A water analysis should be performed before using a new water source. The EPA publication Response Protocol Toolbox describes EPA water source characterization protocol in chapter 3.

Record water analysis data on the Planning Spreadsheet H2OAnalysis tab. The Primary and Secondary Safe Drinking Water Standards are included on the H2OAnalysis to aid in identifying treatment goals.



E 3

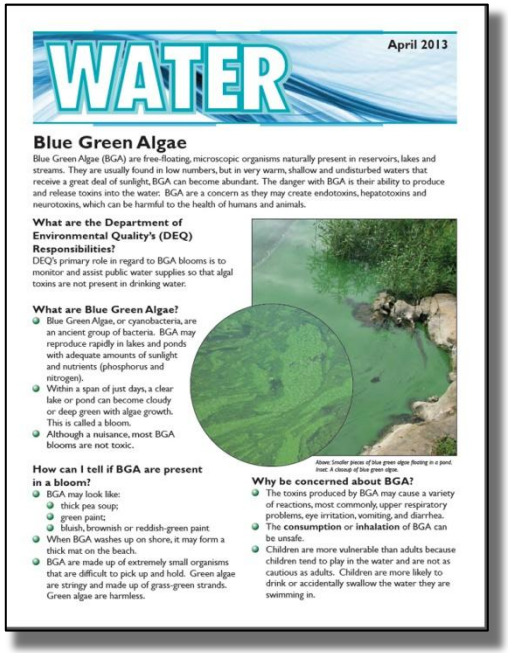
When Every Drop Counts: Protecting Public Health During Drought Conditions is a guide for public health professionals published by the Centers for Disease Control and Prevention's National Center for Environmental Health.



E 3

Cyanobacteria (blue-green algae) can become a problem in warm surface water by producing cyanotoxins that can be harmful to animals and humans. The following resources provide additional information:

- ODEQ Blue Green Algae Fact Sheet (ODEQ)
- EPA Cyanobactera Factsheet (EPA)
- Cyanotoxin Removal in Drinking Water Treatment Process and Recreational Waters (NEIWPCC)



WATER

April 2013

Blue Green Algae

Blue Green Algae (BGA) are free-floating, microscopic organisms naturally present in reservoirs, lakes and streams. They are usually found in low numbers, but in very warm, shallow and undisturbed waters that receive a great deal of sunlight, BGA can become abundant. The danger with BGA is their ability to produce and release toxins into the water. BGA are a concern as they may create endotoxins, hepatotoxins and neurotoxins, which can be harmful to the health of humans and animals.

What are the Department of Environmental Quality's (DEQ) Responsibilities?

DEQ's primary role in regard to BGA blooms is to monitor and assist public water supplies so that algal toxins are not present in drinking water.

What are Blue Green Algae?

- Blue Green Algae, or cyanobacteria, are an ancient group of bacteria. BGA may reproduce rapidly in lakes and ponds with adequate amounts of sunlight and nutrients (phosphorus and nitrogen).
- Within a span of just days, a clear lake or pond can become cloudy or deep green with algae growth. This is called a bloom.
- Although a nuisance, most BGA blooms are not toxic.

How can I tell if BGA are present in a bloom?

- BGA may look like:
  - thick pea soup;
  - green paint;
  - bluish, brownish or reddish-green paint
- When BGA washes up on shore, it may form a thick mat on the beach.
- BGA are made up of extremely small organisms that are difficult to pick up and hold. Green algae are stringy and made up of grass-green strands. Green algae are harmless.

Why be concerned about BGA?

- The toxins produced by BGA may cause a variety of reactions, most commonly, upper respiratory problems, eye irritation, vomiting, and diarrhea.
- The **consumption** or **inhalation** of BGA can be unsafe.
- Children are more vulnerable than adults because children tend to play in the water and are not as cautious as adults. Children are more likely to drink or accidentally swallow the water they are swimming in.

Distribution and Storage

F

When water supplies are depleted, distribution and storage decisions and activities must be considered:

1. Distribution Options
2. Blending and Re-mineralization
3. Temporary Water Storage
4. Disinfection of Tanks
5. Disinfection of Containers

F 1

With a reduced water supply, it can be difficult to keep the distribution system full of water with acceptable quality. The following resources and considerations pertain to distribution options.

Distribution water quality:

- The Awwa Research Foundation's State of the Science report titled Advancing the Science of Water: AwwaRF and Distribution System Water Quality is a resource for disinfectant residuals and decay; lead, copper, and corrosion; distribution system modeling; distribution system monitoring and sampling; pressure transients and intrusion; and water quality maintenance and operations.
- The North Carolina AWWA-WEA publication Distribution System Water Quality Control describes the water quality issues and control measures undertaken by the City of Raleigh, NC, during a drought in 2007.

Distribution and Storage

Distribution Options

F 1

Disinfection and pressurization protect drinking water in the distribution system from contamination. Other countries deliver non-potable water only periodically and leave the system un-pressurized the rest of the day or week. This is not an attractive option since we are used to getting potable water from our faucet. However, it may become the only option when water supply is extremely limited.

If the distribution system is designed in segments, then one segment can be filled at a time with extra disinfection residual. As a short term emergency strategy, point of use treatment systems such as carbon filter pitchers can be distributed to treat tap water for drinking and cooking.

@ Refer to EPA Environmental Technology Verification Reports for Point of Use treatment.

F 1

Public water dispensary:

- The World Health Organization's publication Environmental Health in Emergencies and Disasters: a Practical Guide provides information in chapter 7 on using water tankers, temporary water distribution stands, water containers, and facilities for personal hygiene.

Distribution and Storage

Blending and Re-mineralization

F 2

When introducing a new water quality of highly treated water to a distribution system, it is important to stabilize the water to prevent piping corrosion.

@ The World Health Organization's publication Safe Drinking-Water from Desalination provides information in chapter 6 on blending desalted water with other sources (in order to protect storage and distribution plumbing) and re-mineralization (to increase the concentration of important nutritional minerals).

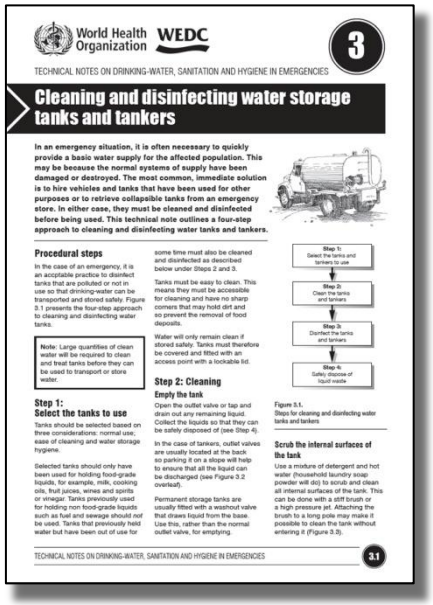
F 3

Temporary storage bladder tanks provide easily transportable water storage in a wide variety of sizes. Examples of suppliers are listed below:

- Husky Portable Containment
  Dewey, OK
- Interstate Products, Inc.
  Sarasota, FL
- Aero Tec Laboratories
  Ramsey, NJ
- Basic Concepts, Inc.
  Anderson, SC

F 4

The World Health Organization's Cleaning and disinfecting water storage tanks and tankers Technical Note includes considerations for using tanks that have been converted from another purpose, instructions for disinfecting the tank, chlorine testing to ensure disinfectant is sufficiently rinsed out, and considerations for disposal of waste liquids.



World Health Organization WEDC 3

TECHNICAL NOTES ON DRINKING-WATER, SANITATION AND HYGIENE IN EMERGENCIES

Cleaning and disinfecting water storage tanks and tankers

In an emergency situation, it is often necessary to quickly provide a basic water supply for the affected population. This may be because the normal systems of supply have been damaged or destroyed. The most common, immediate solution is to hire vehicles and tanks that have been used for other purposes or to retrieve collapsible tanks from an emergency store. In either case, they must be cleaned and disinfected before being used. This technical note outlines a four-step approach to cleaning and disinfecting water tanks and tankers.

Procedural steps

In the case of an emergency, it is an acceptable practice to disinfect tanks that are polluted or not in use so that drinking-water can be transported and stored safely. Figure 3.1 presents the four-step approach to cleaning and disinfecting water tanks.

Note: Large quantities of clean water will be required to clean and treat tanks before they can be used to transport or store water.

Step 1: Select the tanks to use

Tanks should be selected based on three considerations: normal use; ease of cleaning and water storage hygiene.

Selected tanks should only have been used for holding food-grade liquids, for example, milk, cooking oils, fruit juices, wines and spirits or vinegar. Tanks previously used for holding non food-grade liquids such as fuel and sewage should *not* be used. Tanks that previously held water but have been out of use for some time must also be cleaned and disinfected as described below under Steps 2 and 3.

Tanks must be easy to clean. This means they must be accessible for cleaning and have no sharp corners that may hold dirt and so prevent the removal of food deposits.

Water will only remain clean if stored safely. Tanks must therefore be covered and fitted with an access point with a lockable lid.

Step 2: Cleaning

Empty the tank

Open the outlet valve or tap and drain out any remaining liquid. Collect the liquids so that they can be safely disposed of (see Step 4).

In the case of tankers, outlet valves are usually located at the back so parking it on a slope will help to ensure that all the liquid can be discharged (see Figure 3.2 overleaf).

Permanent storage tanks are usually fitted with a washout valve that draws liquid from the base. Use this, rather than the normal outlet valve, for emptying.

Step 1: Select the tanks and tankers to use
Step 2: Clean the tanks and tankers
Step 3: Disinfect the tanks and tankers
Step 4: Safely dispose of liquid waste

Figure 3.1. Steps for cleaning and disinfecting water tanks and tankers

Scrub the internal surfaces of the tank

Use a mixture of detergent and hot water (household laundry soap powder will do) to scrub and clean all internal surfaces of the tank. This can be done with a stiff brush or a high pressure jet. Attaching the brush to a long pole may make it possible to clean the tank without entering it (Figure 3.3).

TECHNICAL NOTES ON DRINKING-WATER, SANITATION AND HYGIENE IN EMERGENCIES 3.1

Distribution and Storage

Disinfection of Containers

F 5

The Centers for Disease Control and Prevention provides a web page with information on cleaning and storage of water containers that includes instructions for cleaning and sanitizing water containers, properties of acceptable water containers, proper labeling and storage of water containers, and instructions for disinfecting water at home.

G

Wastewater discharges are regulated by the ODEQ Water Quality Division. Visit the General Permits web page for information on permitting. Staff listed on the Water Quality Division Contacts page are available to address program-specific questions.

1. Desalination Concentrate: Brackish Water
2. Desalination Concentrate: Land Application/Irrigation
3. Desalination Concentrate: Discharge to Treatment Plant
4. Desalination Concentrate: Deep Well Injection
5. Solid Waste Management

Waste Management

Desalination Concentrate

All water treatment desalination processes generate a concentrated waste stream. The following information should be considered:

The recovery rate, or efficiency of the system, is calculated by dividing the volume of treated water produced by the volume of water fed into the system.

Brackish water nanofiltration and reverse osmosis recovery rates range from 50% to 85% depending on the water composition and system design.

Small reverse osmosis systems have a low recovery rate of 5-7%.

The volume of concentrate is proportionate to recovery rates and water quality.

G

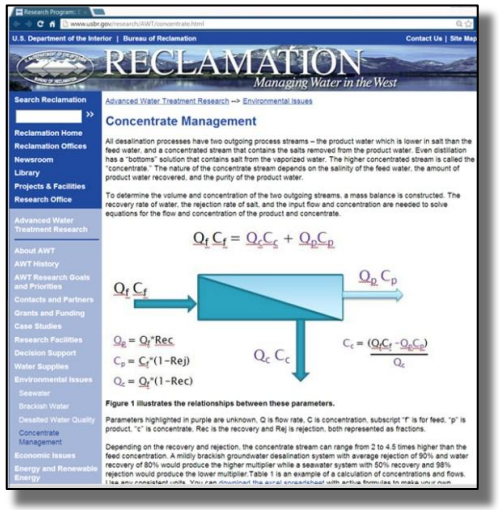
Local engineering firms can determine the best concentrate management solution for your situation. In some cases it will be best to maximize recovery (and smallest concentrate volume with maximum TDS). In other cases it will be best to minimize recovery (and increase concentrate volume with minimum TDS) so that it can be used locally for beneficial purposes.

Waste Management

Desalination Concentrate: Brackish Water

G 1

- The Bureau of Reclamation's Concentrate Management Research web page provides a list of Federally funded reports on concentrate issues and management processes.
- The Central Arizona Salinity Study: Phase II Concentrate Management provides a comparison of concentrate management solutions and costs.
- The Existing & Emerging Concentrate Minimization & Disposal Practices for Membrane Systems, published in the 2006 Florida Water Resources Journal, provides a description of concentrate management methods.



Waste Management

Desalination Concentrate: Land Application/Irrigation

G 2

- The WateReuse Foundation's Salinity Management Guide identifies liquid waste land applications, featuring information on the following topics:
  - Sodium Absorption Ratio (SAR)
  - Using Electroltye Concentration and SAR to evaluate water
- Reclamation's Water Reuse Study for Big Bear, California compares RO and NF concentrate quality to secondary municipal wastewater for irrigation water potential. This report includes analysis of SAR, conductivity, and fitness for irrigation.

Waste Management

Desalination Concentrate: Discharge to Treatment Plant

G 3

Discharge to a wastewater treatment facility may be an option depending on the composition of the concentrate and other flows into the system.

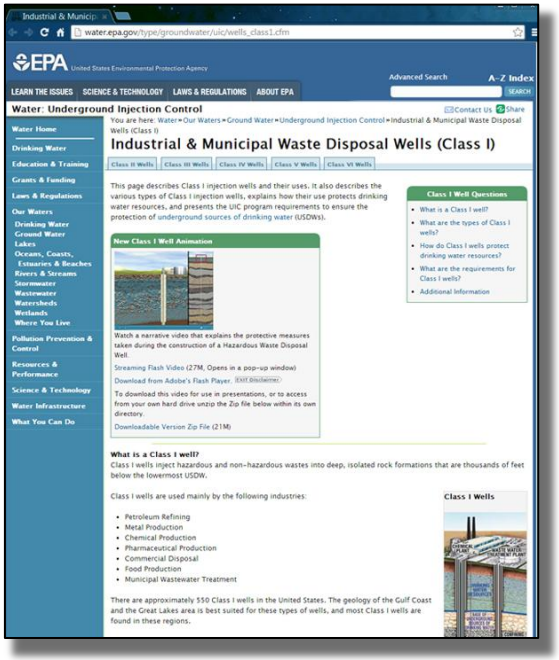
This option should be discussed with your engineer, wastewater treatment system management, and ODEQ Water Quality Division contact.

Waste Management

Desalination Concentrate: Deep Well Injection

G 4

- The EPA's Industrial & Municipal Waste Disposal Wells (Class I) web page defines Class I injection wells and their uses.
- Waste disposal by deep well injection is regulated by the ODEQ. The Land Protection Division Underground Injection Control group oversees underground injection control activities. Under Title 252, Chapter 652.



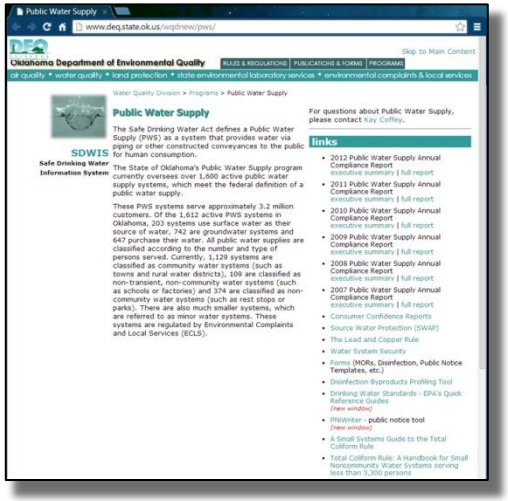
G 5

Solid waste might be generated during a drought from the existing water treatment plant if hazardous water sources contaminate the media or high water recovery precipitates solids during treatment.

@ The ODEQ Land Protection Division's Solid Waste Management section reviews permit applications for solid waste disposal.

Regulatory Requirements

- The ODEQ's Water Quality Division is responsible for regulating facilities that produce and distribute public drinking water and that treat, transport, store, and discharge wastewater.
  - The division's Public Water Supply program currently oversees over 1,600 active public water supply systems.
  - Systems serving fewer than 15 connections or 25 people are regulated by the Environmental Complaints and Local Services Division.



Commercially Available Packaged Treatment Systems[1]

I

1. Mobile/Containerized Treatment Units
2. Commercial System Sources
3. Air Stripping Equipment[2]

[1] *List of systems developed through a review of companies that sell or rent mobile treatment equipment.*

[2] *Air stripping technology could be used for any source of water that contains VOCs, but is more commonly seen in groundwater.*

Commercially Available Packaged Treatment Systems

Mobile/Containerized Treatment Units

I 1

Water treatment systems designed and built by the private industry have the capabilities to treat many types of source water:

- Brackish Surface Water
- Produced Water
- Secondary Wastewater
- Groundwater

Example: Commercial and Industrial RO Systems
Applied Membranes, Inc.

Certain mobile and containerized systems are emphasized base on their ability to treat the potential alternative water resources.

A number of companies specialize in the design and construction of mobile or containerized water treatment systems, a number of which are included in the Equipment Sources list tab in the Planning Spreadsheet.

Commercially Available Packaged Treatment Systems

Mobile/Containerized Treatment Units

System Types	Advantages and Disadvantages
Smaller Mobile Units (< 100,000 gpd)	• Highly mobile light weight truck or double axel trailer mounted units easy to transport • Smaller capacity systems
Larger Mobile Units (up to 500,000 gpd)	• Process configuration is inclusive of multiple process options allowing for the treatment of a variety of source waters • Set design configurations and processes equipped on all systems regardless of source water application
Custom Containerized Systems	• Highly customizable to water source; eliminates extraneous processes • Specific design for a set water chemistry • Mounted in 20 to 40 ft containers; requires crane and commercial transport to move containers to new locations

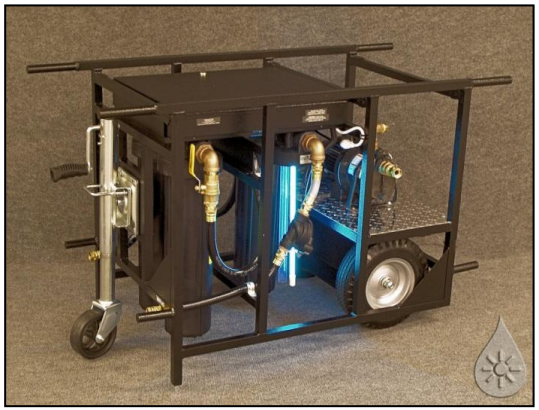
Commercially Available Packaged Treatment Systems

Mobile/Containerized Treatment Units

Portable Water Purification System example:
Outpost A system by Aqua Sun International

This system is a multi-powered (solar, grid or portable generator) water purification system capable of producing potable water from non-saline water sources.
Production: 17,280 gpd at a rate of up to 720 gph or 12 gpm.

- *Treatment process train includes filtration and UV disinfection.*
- *Filter can be substituted for lead, mercury, arsenic, and fluoride reduction filters to target specific contaminants.*
- *With a replacement parts kit the system is 58″ x 42″ x 46″ and 330 lbs.*
- *All water contact components carry a NSF Approval Rating and the ultraviolet light carries a Certificate of Analysis.*
- *Price quoted at $7,400 and availability will depend on the number of units ordered.*



Commercially Available Packaged Treatment Systems

Mobile/Containerized Treatment Units

Portable Complete Reverse Osmosis (RO) System example:
Series J RO Water Filtration System by Applied Membranes, Inc.
Designed to produce low dissolved solids water from tap or well water, these commercial RO systems use highly efficient Reverse Osmosis Membranes. Production: 11,500-28,800 gallons per day.

- *Heavy duty powder coated frame.*
- *SS High pressure components, SS Pump.*
- *Microprocessor Controlled Operation.*
- *Conservatively engineered for reliable long term performance.*
- *Factory tested to ensure trouble-free operation.*

Commercially Available Packaged Treatment Systems

Mobile/Containerized Treatment Units

Larger Mobile Water Treatment System example:
Aquamove Mobile RO Trailer by Veolia Water Solutions and Technologies
Capable of treating a variety of source waters, the 300 gpm (432,000 gpd) system can be configured as a 100-135 gpm two pass unit.

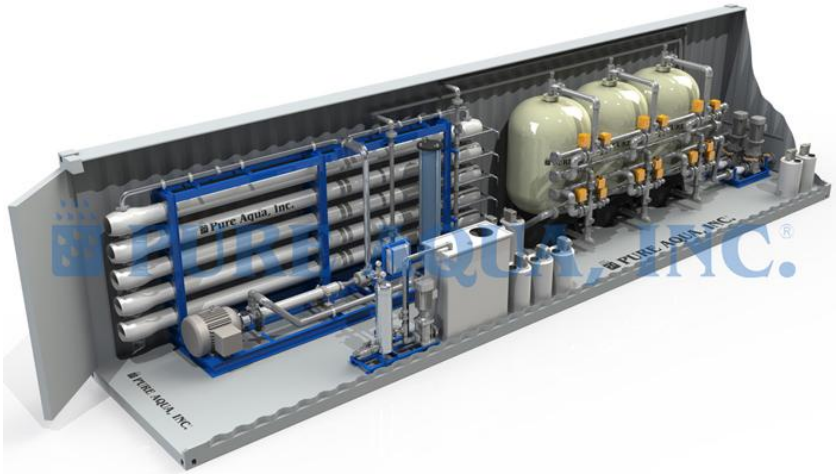
- *Treatment process: multimedia, carbon, iron removal, or softening pretreatment, depending on source water, followed by RO membrane filtration.*
- *Trailer dimensions: 53' x 8.5' x 13.5'*
- *Weight: 55,000/75,000 lbs. (shipping/operating)*
- *Requires three phase power 460V/3Ph/60Hz at 60-100 amps.*
- *Trailers are only available for lease.*
- *Trailers are available on a first come first serve basis.*
- *Trailers can be prepared and transported to a field site in 48 to 72 hours.*

Commercially Available Packaged Treatment Systems

Mobile/Containerized Treatment Units

Containerized Water Treatment System example:
Containerized RO Water Treatment System by Pure Aqua, Inc.
Customizable with various configurations for any source water application, capacities range from 30,000 gpd to 900,000 gpd.

- *Systems are generally mounted in 20 ft. containers.*
- *Containers require 460V/3Ph/60Hz power supply.*
- *Cost of the system dictated by source water.*
- *Lead time to manufacture is 8-10 weeks from receipt of order.*



Commercially Available Packaged Treatment Systems

Commercial System Sources

1 2

Several examples of mobile systems are listed below:

- Applied Membranes
- Aqua Sun
- Environmental Improvements Inc.
- First Water
- Forever Pure
- GE Water
- Lifestream Water Purification Equipment
- Noah Water
- Pall Corporation
- Pure Aqua
- RODI Systems
- Veolia
- Water Control Inc

Presentation of commercial products does not constitute an endorsement of that product or commercial enterprise.

Commercially Available Packaged Treatment Systems

Air Stripping Equipment

I 3

Air stripping technology could be used for any source of water that contains VOCs but is more commonly seen in groundwater. Air stripping is primarily used for removing volatile organics chemicals (VOCs).

Air Stripping Unit example:
STAT 180 Air Stripper Skid by Caronair
Units are either trailer mounted or skid mounted and can be used for VOC removal; equipped with either diesel or electrically powered blowers, and can accommodate gravity or pump out discharge. Flow rate up to 200 gpm.

- *Can be provided as a stand-alone treatment or part of a fully integrated treatment system.*
- *Transfer pump mounted on skid.*
- *Skid mounted with controls.*

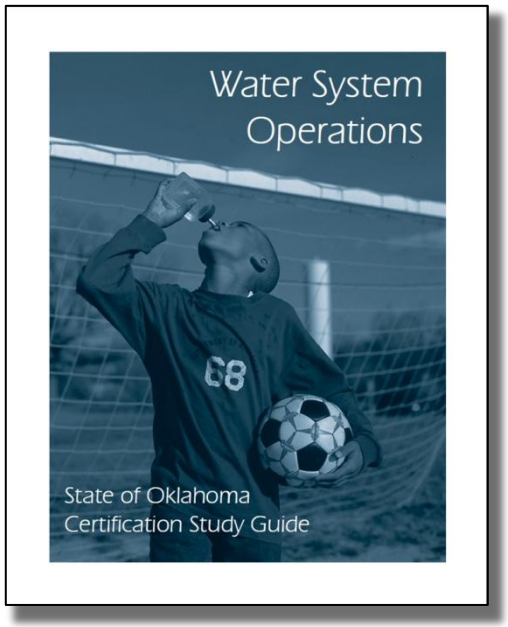
Federal Sources For Treatment Systems

Federal resources can be called into service if the President declares a state of emergency (requested by Governor).

- The Department of Defense Reserves and National Guard have access to military expeditionary water treatment equipment with capacities ranging from 5 gal/min to 100 kgal/day.

Water Treatment Operator Requirements

- The Oklahoma Department of Environmental Quality (ODEQ) regulations describe the certification process for Water and Wastewater works operators.
- A Water System Operations Certification Study Guide is also available on the ODEQ website.



Potential Funding Sources

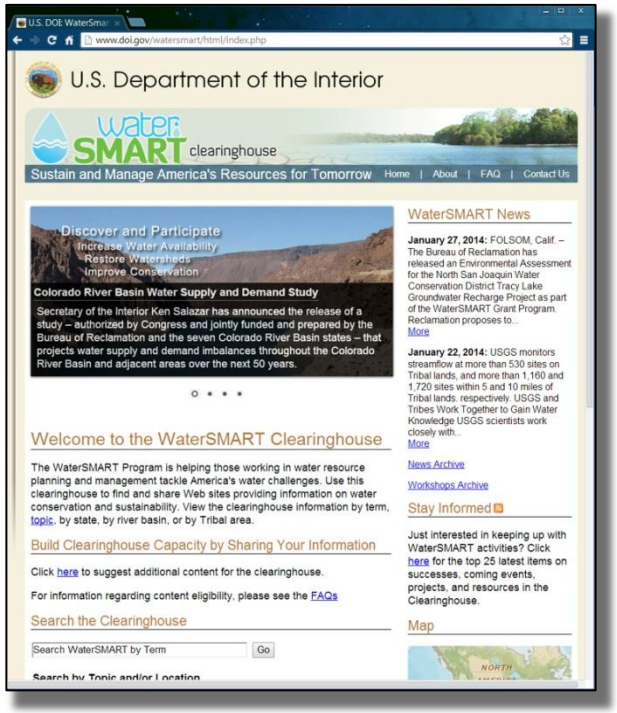
State of Oklahoma:

- OWRB Loan and Grant Programs
- Emergency Drought Relief Fund

Bureau of Reclamation, OK-TX Area Office:

- WaterSMART Program
- Title XVI Program, Water Reclamation and Reuse Program
- Reclamation Activities in Oklahoma

- USDA Farm Service Agency



Public Communication and Involvement

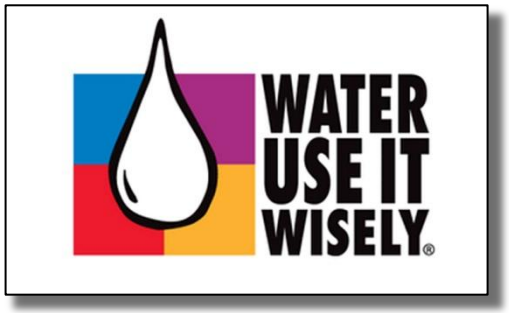
Successful conservation messages must be targeted to local communities, focusing on specific water situations. Key components of community outreach efforts should address the following topics:

- What is the source of the local water supply?
- How sufficient is the supply?
- What visible sign will indicate to the public the need to conserve?
- How will the water utility help with conservation?
- Ideas for increasing water efficiency

Public Communication and Involvement

Online public outreach resources:

- Protecting Water for People and Nature
  Global Water Program, The Nature Conservancy
- Water Use it Wisely
- Water Conservation web page
  Oklahoma Water Resources Board
- Drought Resources web page
  Oklahoma Water Resources Center
- California Water Awareness Campaign
- Elementary Water Conservation Trailhead
  Spokane Aquifer Joint Board
- Texas Conservation Education
  Texas Water Development Board



Model Drought Management Plans

Model community drought management and response plans from other states:

- South Carolina
- Colorado
- Florida Rural Water Association
- Tennessee
- Texas
- Kansas
- Various states and other sources

Contacts

Name	Organization	Role	Phone	Email
Terri Sparks	Oklahoma Water Resources Board	Technical Assistance	405-530-8800	terri.sparks@owrb.ok.gov
Collins Balcombe	US Bureau of Reclamation	Reclamation Programs	512-899-4150	cbalcombe@usbr.gov
Michelle Chapman	US Bureau of Reclamation	Technical Assistance	303-445-2264	mchapman@usbr.gov