

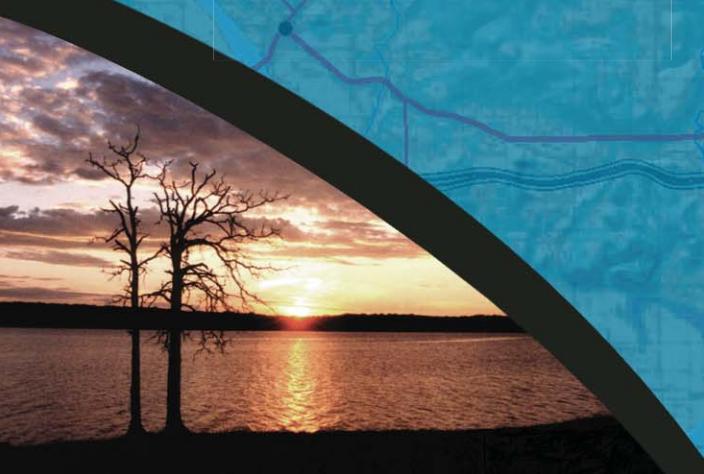
Oklahoma COMPREHENSIVE Water PLAN

2008 Status Report

The challenges of growing population and increased water demand, intense competition for water, deteriorating infrastructure, and vulnerability to drought and flood all require the formulation of innovative solutions.

As part of its broad responsibility to enhance the quality of life and general welfare, the state has the specific obligation to plan for the use of water and natural resources in a manner that will best serve the many needs of the people of Oklahoma. The Oklahoma Comprehensive Water Plan (OCWP), the state's long-range water use and management strategy, was first published in 1980 and updated in 1997. The Oklahoma Legislature, in 2006, appropriated funds to the Oklahoma Water Resources Board for the Plan's second update.

Now in its second year, the OCWP's Technical Studies phase is taking center stage as the OWRB and its planning partners begin the statewide assessment of current and future water supply needs as well as an inventory of both rural and urban water infrastructure. In addition, research has already begun on many important water policy issues, including some that dominated discussion at last year's local input meetings. Numerous studies will provide water planners with much of the information required to establish state water policy for the next 50 to 100 years. These studies are being accomplished through partnerships with various local, state, and federal agencies and organizations, as well as consultants.



The Oklahoma Water Resources Board



Oklahoma Water Resources Board Members and the water use interests they represent. Seated (left to right): Jack Keeley (municipal), Chairman Mark Nichols (irrigation), Rudy Herrmann (industry), & Lonnie Farmer (agriculture). Standing: OWRB Executive Director Duane Smith, Ed Fite (recreation), Linda Lambert (industry), Richard Sevenoaks (municipal), Ford Drummond (agriculture), Kenny Knowles (soil conservation), and Executive Secretary Mary Schooley.

Water Plan Goals

- Provide safe and dependable water supply for all Oklahomans while improving the economy and protecting the environment.
- Provide information so that water providers, policy-makers, and water users can make informed decisions concerning the use and management of Oklahoma's water resources.

Oklahoma Comprehensive Water Plan

OCWP

Innovative Water Solutions for Oklahoma

The Water Plan as a Roadmap for Oklahoma Water Management

Characterize demands & how they'll be reliably met

Identify and resolve water use conflicts

Identify information gaps & how to address them

Recommendations for water management policy

Primary resource on water for water users, planners, and the media

Enhanced management of Oklahoma's water resources to meet Oklahomans' long-term needs

Oklahoma Comprehensive Water Plan Process

Local/Regional Input Meetings

Facilitated by the Oklahoma Water Resources Research Institute (OWRRI), 42 local input meetings were held throughout Oklahoma last year; 11 regional meetings in 2008 will consolidate and prioritize local issues for subsequent policy consideration.

Planning Workshops

In 2009, stakeholder participants in 36 planning workshops will build upon sets of water issues to formulate near-future water management strategies.

Town Hall

A three-day town hall meeting will be held in 2010 to further discuss issues and strategies and reach consensus on Water Plan recommendations for consideration by the Legislature.

Feedback Meetings

Following preparation of the draft OCWP, the OWRRI will sponsor another series of 11 regional meetings to obtain feedback and solicit suggestions for implementation. Suggestions will then be communicated to the OWRB for consideration in preparing the final Water Plan.

Research

Numerous state, federal, and local partners will cooperate to study and dissect various water issues of importance to Oklahoma water use, management, and protection.

Water Supply Analysis

Cooperators will analyze existing water supplies and project future needs to identify areas likely to experience water supply shortages.

Public Water Supply Assessment

A statewide program to inventory and assess public water supply systems and related infrastructure, which will provide information about potential water supply options.

Supplemental Studies

The need for additional studies will arise to compliment previous investigations.

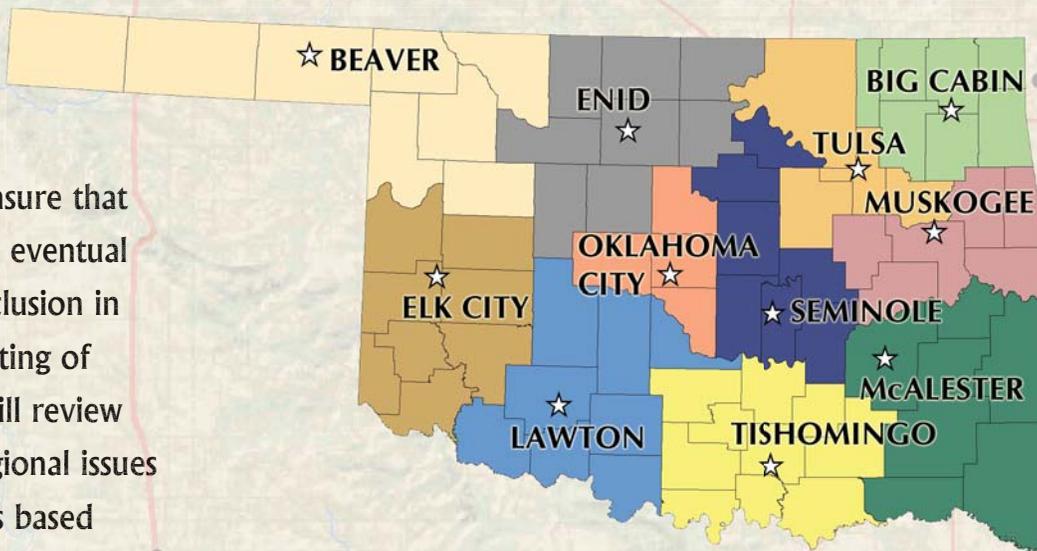


Policy Development & Public Participation

From April to November 2007, 42 Local Input Meetings were held throughout the state to gather wide-ranging public opinion on Oklahoma's pertinent water issues. Regional input meetings, the second phase of the Water Plan's public participation process, will be held during the second half of 2008 (August through October) in each of the 11 Councils of Oklahoma Governments (COG) regions. The purpose of these meetings is to ensure that the full range of Oklahoma's water issues—and eventual policy recommendations—are identified for inclusion in the final statewide plan. Regional teams, consisting of 30 representatives nominated by the public, will review findings from the listening sessions, validate regional issues and concerns, consolidate issues into categories based upon their similarity, and suggest priorities for further consideration in the planning process. Meetings will be open to the public.

2008 Regional Input Meetings*

Aug. 7 - Big Cabin	Oct. 2 - Tishomingo
Aug. 12 - Elk City	Oct. 9 - Tulsa
Aug. 21 - McAlester	Oct. 23 - Muskogee
Sept. 11 - Beaver	Nov. 6 - Oklahoma City
Sept. 18 - Lawton	Nov. 13 - Seminole
Sept. 25 - Enid	<i>*tentative schedule</i>



For more information about OCWP Regional Input Meetings, go to <http://environ.okstate.edu/owrri/waterplan/regions.asp>.

Issues Frequently Mentioned by Citizen Participants

- Stabilizing lake levels
- Prioritizing water uses
- Recreational and aesthetic benefits of water and its importance to economic development
- Water reuse and reservoir development
- Conjunctive management of stream and groundwater
- Water conservation and incentives
- Water quality protection for public water supplies
- Impacts of oil/gas industry and agriculture on groundwater
- Maximizing natural water treatment and storage through wetlands and riparian areas
- Instream flow protection
- Increased funding for water/wastewater treatment, collection, and distribution systems
- Regionalization of water supply systems
- Local control of water resources
- Protection of water rights by landowners
- Metering irrigation use
- Sale of water to Texas
- Resolving conflicts between large cities and rural water systems
- State and tribal water ownership issues
- Unified "water portal" for educators and the public
- Researching aquifer storage and sustainable withdrawals
- Monitoring and gaging groundwater wells
- Impacts of climate change
- Unfunded mandates

Technical Studies & Research

Supporting the Water Plan are technical and engineering assessments performed primarily by Camp Dresser & McKee, Inc. (CDM), the lead engineering firm contracted by the U.S. Army Corps of Engineers through a cooperative agreement with the OWRB, as well as research studies accomplished by various state and federal agencies and universities. Studies are already underway to provide planners with information required to lay the groundwork for an effective and innovative water policy for Oklahoma's future.

OCWP Technical Approach

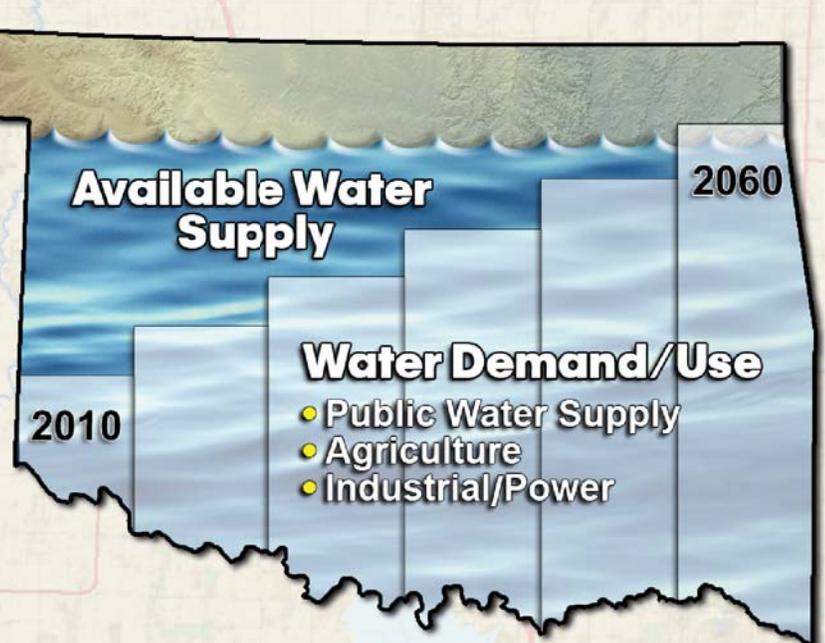
- Project future water needs by county and type of water use.
- Assess water supply availability during both droughts and wet periods.
- Identify areas where attention and resources are needed to address current and future shortages.
- Meet future water needs through balanced water supply management.
- Analyze and prioritize infrastructure needs and solutions.

Statewide Water Supply and Demand Analysis

The OCWP Statewide Supply and Demand Analysis will be performed to obtain forecasts of water demand and supply availability through 2060. Utilizing a variety of demographic, economic, and related data for each county in Oklahoma, consumptive water demands will be calculated for municipal & industrial (M&I), self-supplied industrial (including oil and gas production), and agricultural (irrigation/livestock) water use. M&I demands and future water supply alternatives will be determined down to the provider level. Projected demands will be evaluated in light of current and future water supplies to identify areas of potential surplus and shortfall. In those areas where water supply "gaps" are anticipated, modeling and other water management tools will be employed to identify potential solutions to address local water needs.

The supply and demand analysis will be performed based upon current law. Building upon recommendations offered in the original 1980 OCWP and 1995 update, as well as early public comment on the current update, planners will also consider additional water use factors, such as environmental and recreational in-stream requirements, reservoir operations and lake level concerns, and the hydrologic interaction between stream and groundwater.

Comparing future demand or need for water to availability is a critical aspect of water planning. Water supply is largely controlled by climate, sources (reservoirs, infrastructure, etc.), and quality, while demand is driven by demographics and economic factors.



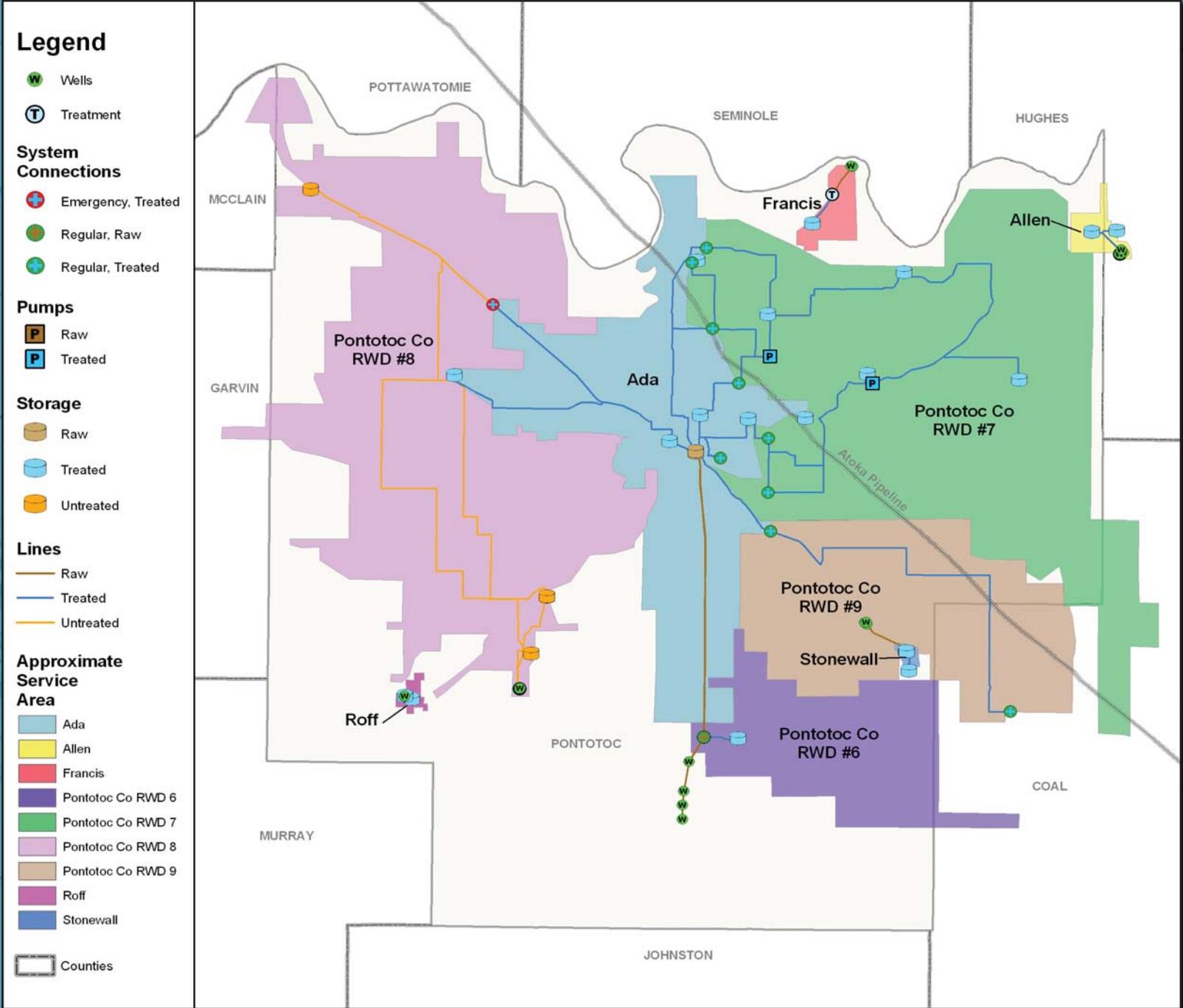
Public Water Supply and Infrastructure Survey

To address Oklahoma's future water infrastructure needs, an important objective of the Water Plan is to gather information on the condition and future reliability of public water systems, including raw water supplies, down to the individual water provider level. Water supply and management opportunities will be more easily identified through the comprehensive and detailed collection of existing treatment/distribution infrastructure, service area population and demands, and both current and planned sources of water supply.

An important objective of the Water Plan is to gather information on the condition and future reliability of public water systems . . . down to the individual water provider level.

Pontotoc County Pilot Mapping Project

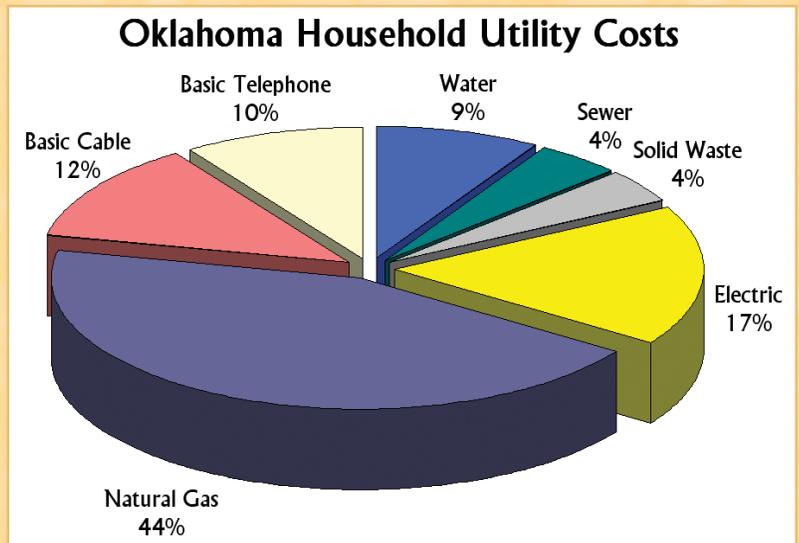
In the spring of 2008, contractors conducted a pilot mapping project to collect data associated with key water supply infrastructure components in Pontotoc County. Results of the project will be used to demonstrate the costs/benefits of a statewide mapping program as well as refine data collection and mapping procedures.



The Cost of Water

Water, the only "utility" that the typical human cannot live without, comprises less than 9 percent (\$21.83) of the average Oklahoman's monthly bill. The total estimated average monthly cost for utilities (including natural gas, electric, sewer, solid waste, basic cable, telephone, and water) paid by the average Oklahoma family is \$252.27. The total average monthly residential water rate increase since 1993 is only \$3.15.

Cost of water is based on usage of 5,920 gallons per month. Data (2006) obtained from the Oklahoma Municipal League and Oklahoma Corporation Commission.



Research Studies

The OWRB, in conjunction with various state, federal, and local water planning partners, has initiated more than a dozen research projects that will answer many important water management questions and provide necessary data for decisions in the water planning process. Many of these studies also serve to accomplish early implementation of Water Plan initiatives.

Oklahoma Water Resources Research Institute

- Utilizing Lake Tenkiller as a case study, a statewide water pricing support model will be developed to estimate both monetary and opportunity costs of a representative water system.
- Complementing the ongoing Arbuckle-Simpson Hydrology Study, researchers will employ ground penetrating radar (GPR) and resistivity data to characterize the aquifer's fractures and major faults.
- Researchers will investigate mechanisms through which phosphorus, a major pollutant, is transported in the subsurface to surface waters.
- The usefulness of remote sensing methods and satellite imagery in water use monitoring, especially concerning irrigation, will be evaluated.
- A study will address ways to incorporate non-consumptive uses of water, including environmental/instream flows that sustain aquatic animals and plants, in statewide water demand projections.
- A methodology will be developed to assist rural water systems in planning and updating their water supply infrastructure.

U.S. Army Corps of Engineers

Through its Planning Assistance to the States (PAS) program, the Corps and OWRB are cooperating in various water planning projects to investigate future water supply alternatives for growing communities in Oklahoma, including Bartlesville and Bristow. A related ongoing study in western Oklahoma is researching potential construction of a reservoir near Mangum to provide the region with water supply and recreational benefits.

U.S. Geological Survey

Comprehensive planning for water resources management, development, and use in Oklahoma requires an informed description of trends in base and total flow. Currently there is no analysis of long-term base and total flow trends for streams in the major watersheds of Oklahoma. USGS researchers will analyze flow data collected at streamflow-gaging stations in Oklahoma to construct a trend analysis to determine when and where base and total flow has changed in Oklahoma and interpret causes for significant flow trends. Researchers will also use recent streamflow data to update summaries of streamflow statistics in Oklahoma. Useful information describing gaging station streamflow data includes: mean annual and monthly flow, low- and high-flow frequency statistics, peak-flow statistics, and annual flow-duration statistics.

Oklahoma Climatological Survey

The OCS will evaluate the potential impacts of climate change on water resources and management in Oklahoma, both on a seasonal and regional scale.

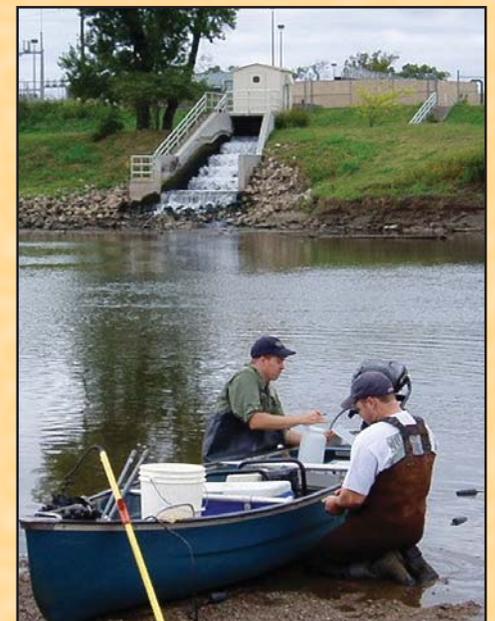
Statewide Surface Water Quality Trend Analysis

To develop a more complete picture of Oklahoma's water resources, the OWRB will bring together other state, federal, local, and academic water quality experts to conduct the first-ever comprehensive analysis of general surface water quality trends.

Utilizing all available data resources, including 10 years worth of information gathered from the OWRB's Beneficial Use Monitoring Program (BUMP), trend analyses will incorporate such parameters as nutrients, minerals, sediments, and bacteria.

While this continuously updated compendium of data will greatly enhance Oklahoma's overall water quality management program, it will also provide critically important information concerning the future allocation of surface water supplies.

For more information on OWRB water quality monitoring programs, go to www.owrb.ok.gov/quality/monitoring/monitoring.php.



OWRB staff collect biological data below a wastewater treatment plant near Ponca City.

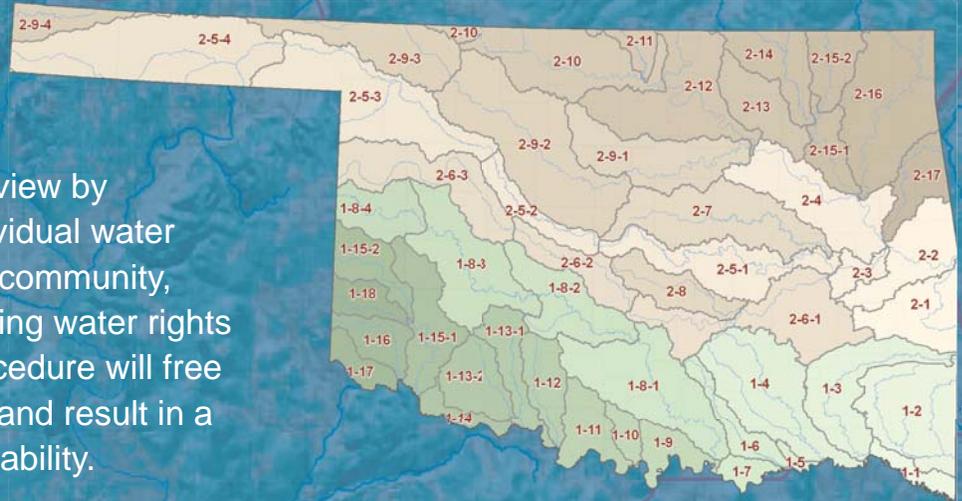
Improving Water Rights Administration

Development of the Water Plan relies upon accurate assessment and efficient allocation of surface and groundwater resources, supported by sound science and technology. Therefore, in addition to assorted Water Plan studies, the OWRB is addressing several enhancements to its water use permitting processes.

First, staff are working to modernize the OWRB's antiquated water rights administration system, which will result in a new, more efficient database and related software applications, including the integration of Geographic Information System (GIS) technology and document imaging procedures. State funds and matching grant money from the U.S. Bureau of Reclamation are being used to underwrite the modernization project.

In addition, through comprehensive statewide review by stream system of surface water permits and individual water usage, consultation with Oklahoma's water user community, and formal proceedings, OWRB staff are identifying water rights suitable for cancellation due to nonuse. This procedure will free up water for other prospective state water users and result in a more accurate accounting of water use and availability.

OWRB Stream Systems



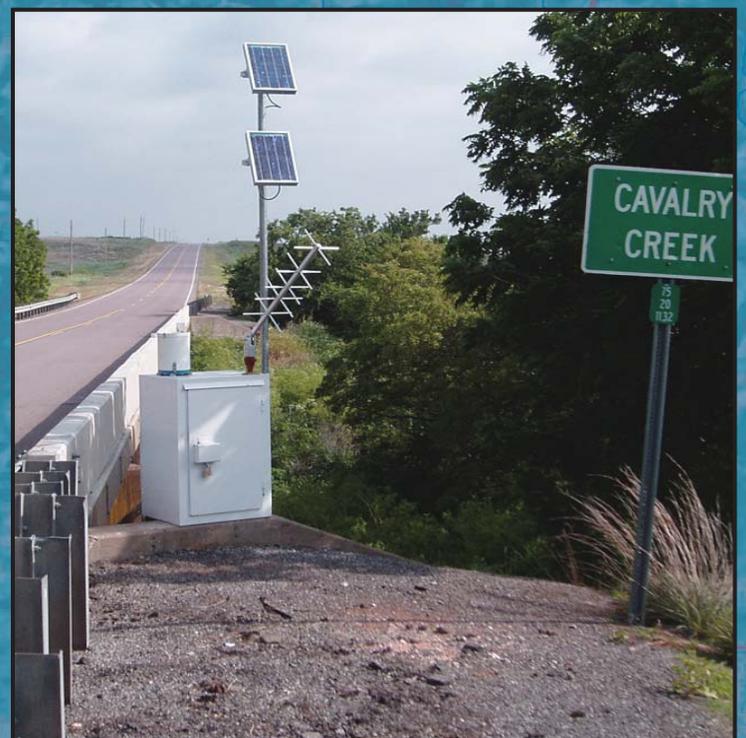
The Importance of Water Resources Data

Increasingly, government leaders, special interest groups, and the public are demanding objective solutions to Oklahoma's water issues and problems. More than ever before, today's water management decisions must be reasonable, feasible, and justifiable. The continued expansion of the tools and resources (stream and groundwater gages and related equipment) required to collect, maintain, interpret, and disseminate adequate water resources data is crucial to such determinations. As a result, Water Plan initiatives will encourage state water agencies to leverage emerging and more innovative technologies to maximize the usefulness of water information.

Real-Time Stream Gages



Real-time stream and lake gages operated and maintained by the OWRB, U.S. Geological Survey, and U.S. Army Corps of Engineers provide assorted water data to hydrologists and researchers. Typically, information is recorded at intervals from every few minutes to one hour; stored onsite, and then transmitted via satellite, telephone, or radio.



Stream gage at Cavalry Creek. Stream gages provide critically important data that enhance water quality/quantity management and flood prediction, but operating costs and increasing budgetary concerns are threatening the state's existing gaging network.

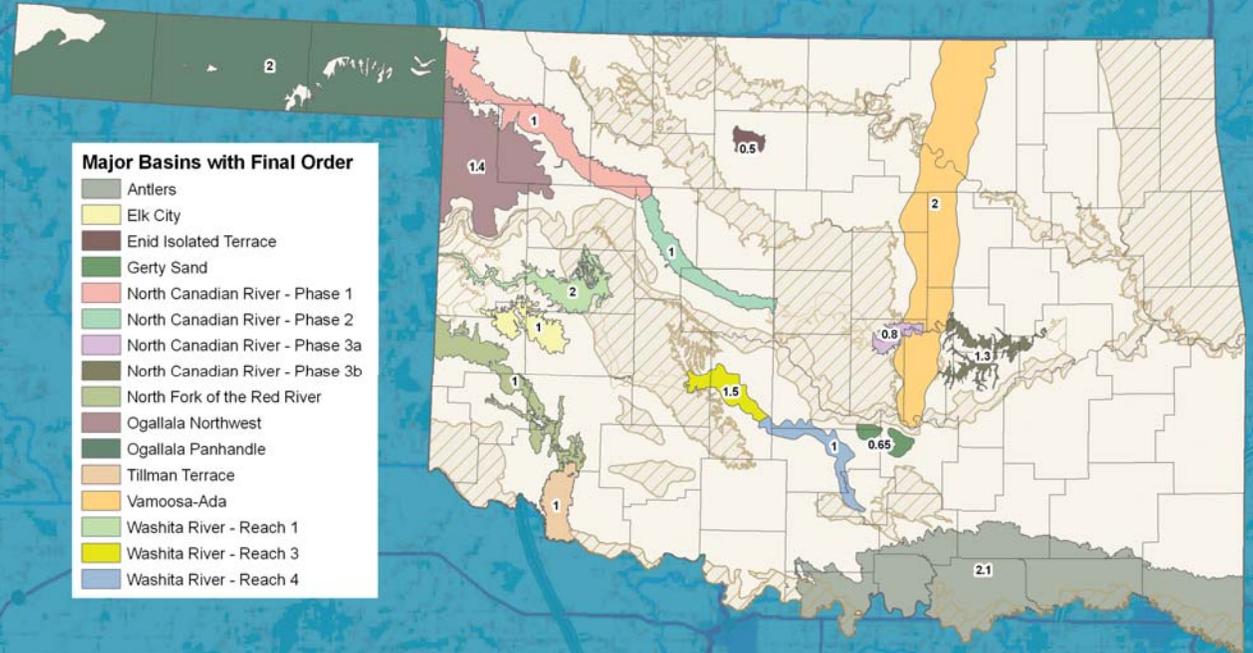
Groundwater Studies Are Vital to Water Rights Allocation

While considered private property, Oklahoma groundwaters are subject to reasonable regulation by the OWRB. State law requires the OWRB to conduct hydrologic studies of the state's aquifers (termed "groundwater basins" upon each study's completion) and to determine amounts of water that may be withdrawn by permitted users. For unstudied aquifers, "temporary" permits are granted to users allotting two acre-feet of water per acre of land per year. In studied groundwater basins, results of hydrologic investigations and related considerations are used to determine the maximum annual yield and a subsequent specific "equal proportionate share" of water allowed for use from the basin through the issuance of "regular" permits.

For example, referring to the map at right, which delineates basin boundaries and equal proportionate shares (in acre-feet of water per acre of land per year), for a basin with an EPS of 1 af/acre/yr, an applicant requesting a permit for 100 acre-ft would

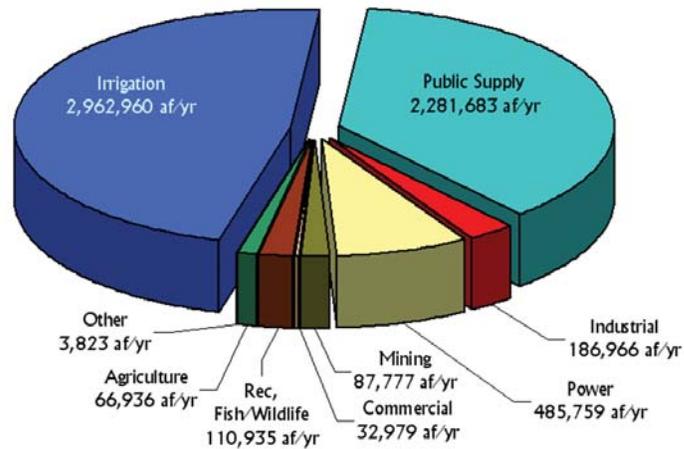
need to dedicate 100 acres of land to its use. For a basin with an EPS of 2 af/acre/yr, an applicant requesting a permit for 100 acre-ft would be required to dedicate only 50 acres of land.

Equal proportionate shares have yet to be determined on many major and minor groundwater basins in the state. (A "major" basin contains wells yielding an average of at least 50 gallons per minute (gpm) from a bedrock aquifer or at least 150 gpm from an alluvial aquifer. A "minor" basin has lesser average yields basinwide.) Approximately half of the groundwater permitted in Oklahoma comes from aquifers upon which no OWRB hydrologic study has been performed and on which insufficient data exists about available water in storage. In addition to the daily water management considerations, it is vital to the Water Plan, especially to the determination of current and future sources of water supply as well as demand, that hydrologic studies be completed and updated on a regular basis.

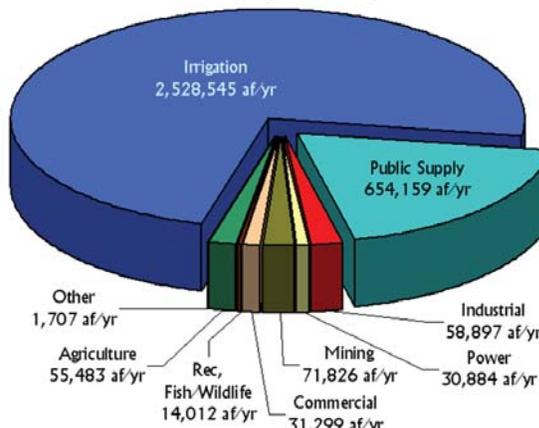


Permitted Water Use

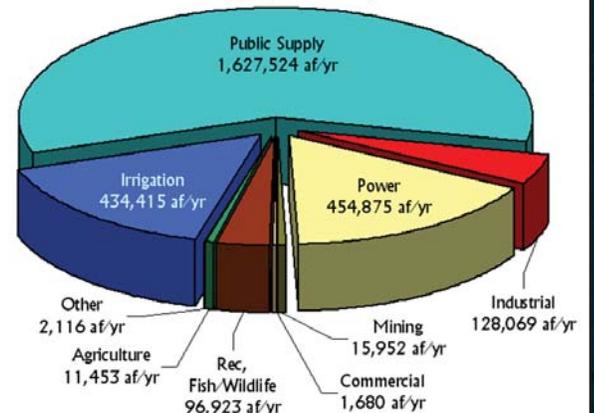
OWRB Water Rights Summary
Total Permitted Water Use
Total = 6,219,820 acre-feet/year



OWRB Water Rights Summary
Total Permitted Groundwater Use
Total = 3,446,813 acre-feet/year



OWRB Water Rights Summary
Total Permitted Stream Water Use
Total = 2,773,007 acre-feet/year



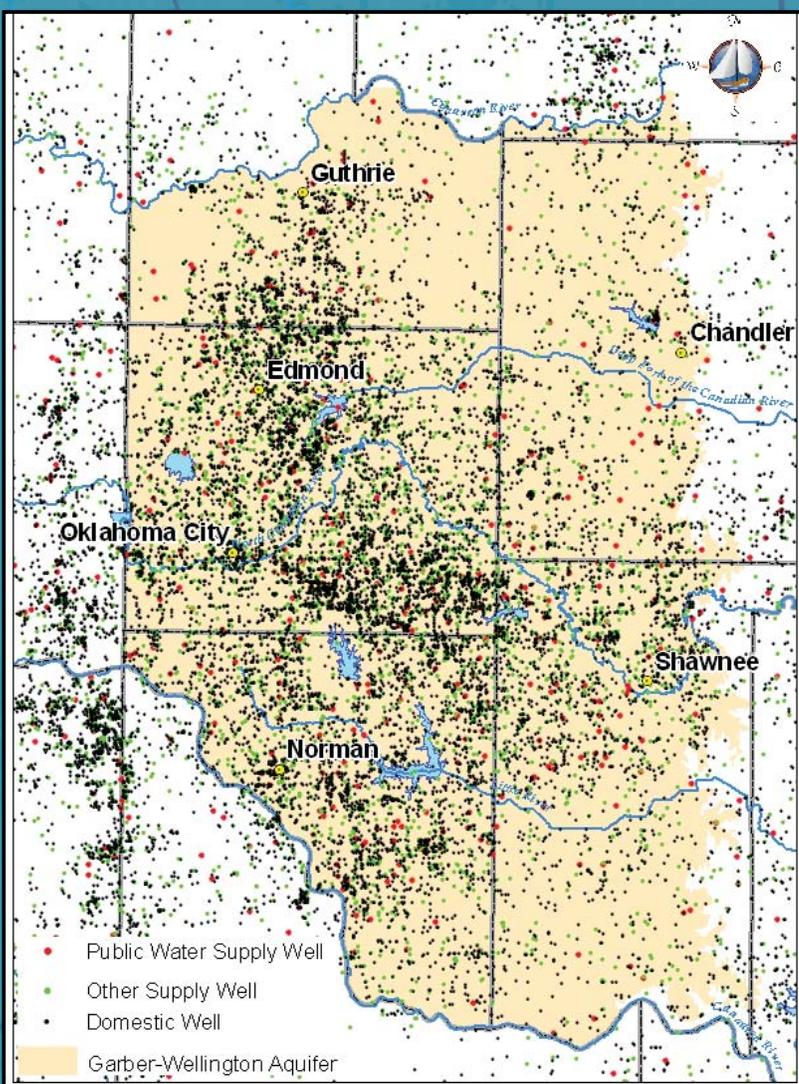
Arbuckle-Simpson Hydrology Study

Now in the final year of the Arbuckle-Simpson Hydrology Study, investigators are focusing on various management options that will protect the region's streamflow. Currently underway are several research efforts to evaluate the impacts of proposed water-use strategies on streamflow. These efforts include an instream flow study to assess instream flow requirements of selected fishes and analysis of tree-ring data to identify the occurrence and frequency of droughts.

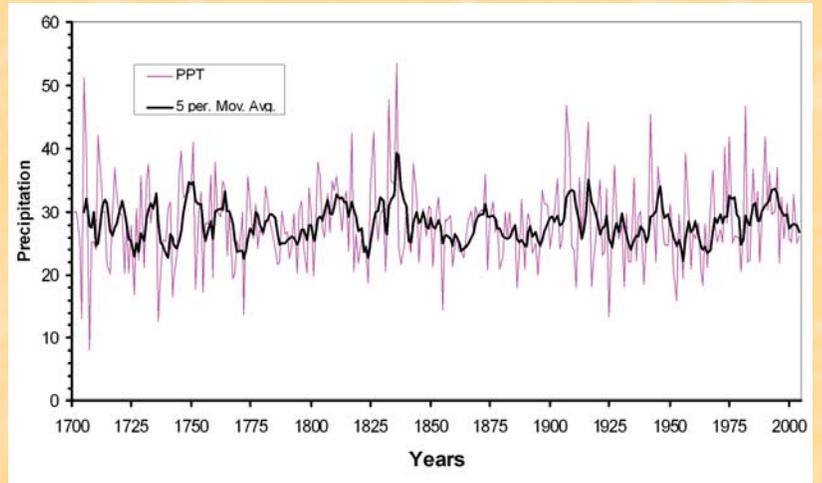
Finally, computer simulations with groundwater and rainfall-runoff models will be conducted to predict the consequences of various groundwater withdrawal scenarios on streamflow. OWRB plans to meet with various stakeholders to present initial results of the simulations and to solicit input on various management options.

Right: Arbuckle-Simpson and Garber-Wellington aquifers.

Below: A close-up look at the Garber-Wellington aquifer region shows reported domestic, public supply, and other wells.



Tree Ring Analysis in the Arbuckle-Simpson Study



Dr. Aondover Tarhule (OU) developed a 300-year tree-ring chronology based on ring width indices developed from Post Oak (*Quercus stellata*) trees. Using the chronology and instrumental climatic records, Dr. Tarhule reconstructed precipitation, temperature, and streamflow for the Arbuckle-Simpson aquifer. The reconstructed series suggests that during the past 300 years, multi-decadal wet and dry periods have been rare in south-central Oklahoma and that the period of recorded rainfall during the last century may be very similar to previous centuries. The chart above shows the reconstructed precipitation in inches for the 300-year time period.

Garber-Wellington Aquifer Study

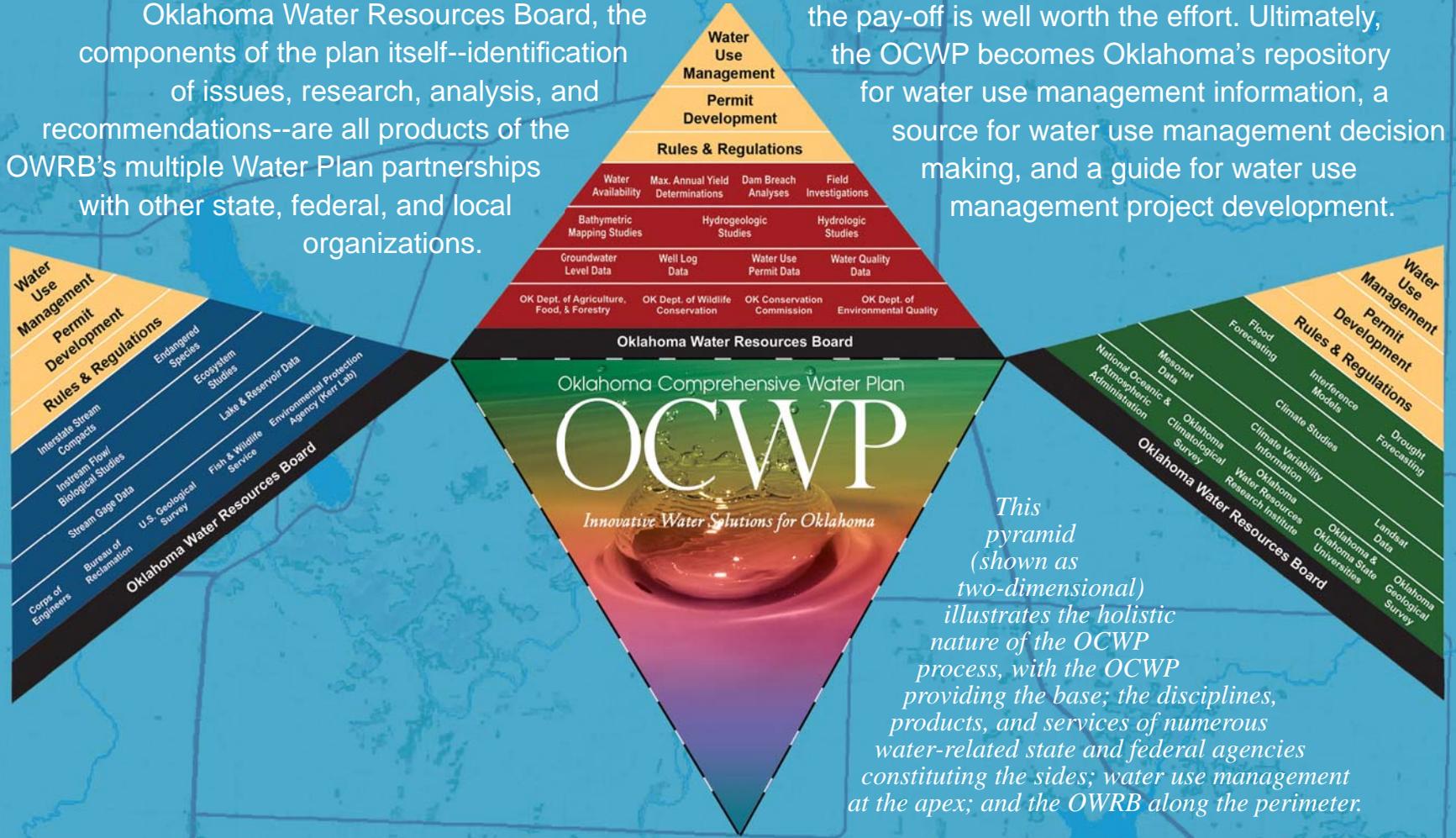
With the Arbuckle-Simpson Hydrology Study nearing completion, the OWRB is turning its focus towards the Garber-Wellington aquifer in central Oklahoma. Also known as the Central Oklahoma aquifer, the Garber-Wellington is a major source of municipal, industrial, commercial, agricultural, and domestic water supply. With a population of approximately 1 million, which is expected to increase 30 percent by 2060, the region needs to have sufficient water supplies into the future.

The primary purpose of the study is to obtain the necessary hydrologic information to develop a water management plan that will ensure sufficient good quality water to support a growing population and economy, even during protracted periods of drought and changing climatic conditions. Coordinated by the OWRB and the Association of Central Oklahoma Governments (ACOG), the study will be conducted by a multi-agency/organization study team. The U.S. Geological Survey (USGS) will be key in developing a groundwater flow model that will be used to evaluate the allocation of water rights and to simulate management options.

The Holistic Nature of the OCWP Process

While the responsibility for organizing, assembling, and updating a statewide Comprehensive Water Plan belongs to the Oklahoma Water Resources Board, the components of the plan itself--identification of issues, research, analysis, and recommendations--are all products of the OWRB's multiple Water Plan partnerships with other state, federal, and local organizations.

Clearly, developing a sound Water Plan is an enormous undertaking that requires the inclusion of all available resources across the state, but the pay-off is well worth the effort. Ultimately, the OCWP becomes Oklahoma's repository for water use management information, a source for water use management decision making, and a guide for water use management project development.



This pyramid (shown as two-dimensional) illustrates the holistic nature of the OCWP process, with the OCWP providing the base; the disciplines, products, and services of numerous water-related state and federal agencies constituting the sides; water use management at the apex; and the OWRB along the perimeter.

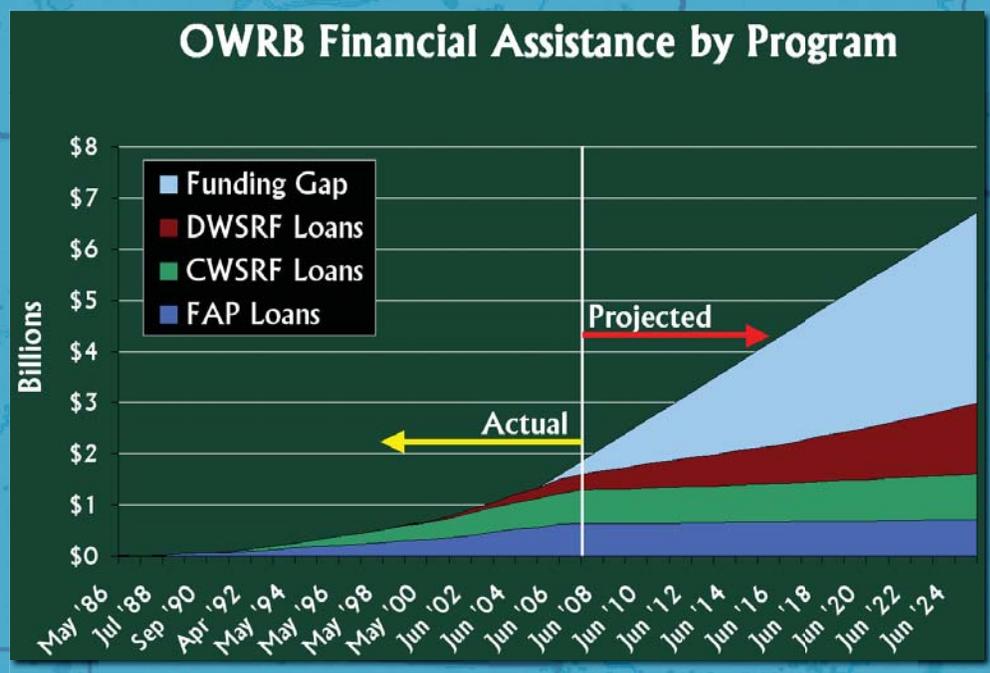
Water Plan Implementation Through the FAP

The Statewide Water Development Revolving Fund, currently responsible for more than \$1.7 billion in state water/wastewater financing, will provide the essential mechanism to implement long-term water supply strategies that arise from the OCWP process. However, federal money for water infrastructure has fallen 70% since 1980 and nearly 50% in the past six years.

the dwindling Revolving Fund so that it can remain a viable tool for Oklahoma's water future. The OWRB and Corps of Engineers are investigating opportunities through the state's existing SRF programs to expedite the planning, prioritization, and implementation of community water resource projects in Oklahoma.

The Clean Water and Drinking Water State Revolving Funds, administered by the U.S. Environmental Protection Agency and managed by individual states, have been particularly hard-hit. SRF loans, which provide about 70% of Oklahoma's water and sewer infrastructure financing, play a vital role in community water quality improvement.

In light of an anticipated \$5.4 billion water/wastewater infrastructure funding gap in Oklahoma over the next 20 years, the OWRB continues to explore new avenues to replenish



"It never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."

John Steinbeck

"The Water Resources Coalition called the OCWP procedure 'a model that should be considered on a national scale for proper water planning' and 'an excellent example of what the new trend line should be... the future in water resources planning.'"

"... Even a good plan is only a tool; its effectiveness is measured through its implementation."

"... Oklahoma has brought about a paradigm shift through which states, rather than the federal government, set their particular water planning priorities ..."

Population growth trends in metropolitan areas, as well as continuing urban sprawl into rural areas, will continue to place considerable demands on the use, availability, and quality of water throughout Oklahoma. Climate change, drought episodes, environmental regulations, legal considerations, and water requirements for economic development, agriculture, and recreation will result in greater stress on state waters and water managers.



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OPINION

You can't drink a water plan

By Duane Smith

How important is a water plan? Georgia never got around to developing one and is consequently dealing with a critical water supply shortage and federal court case over waters shared with neighboring states in the drought-ravaged Southeast. In his novel "East of Eden," John Steinbeck posited "it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."

Fortunately, Oklahoma has had a water plan since 1980 and we are updating this plan to fortify ourselves against future water crises. On March 11, during testimony to the Congressional Subcommittee on Water Resources and the Environment, the Oklahoma Water Resources Board received high-profile support for our ongoing Oklahoma Comprehensive Water Plan update. The Water Resources Coalition called the OCWP procedure "a model that should be considered on a national scale for proper water planning" and "an excellent example of what the new trend line should be ... the future in water resources planning."

This affirmation of our planning process follows last November's reauthorization of the Water Resources Development Act, which included \$6.5 million for the OCWP and more than \$53 million for 18 important water projects in Oklahoma. Crucial to passage of this landmark water



Duane Smith

legislation, the first such bill since 2000, was the support of Oklahoma Sen. Jim Inhofe, ranking member of the Senate Environment and Public Works Committee.

What has made our plan enviable is our innovative two-pronged approach: open and inclusive policy development complemented by technical work using state, federal and local partnerships. This process ensures broad public input, comprehensive analysis and realistic management strategies as we investigate future water supply opportunities.

We also are actively seeking planning assistance and funding that we can maximize through cost-sharing initiatives. In working closely with leadership at the Corps of Engineers, Oklahoma has brought about a paradigm shift through which states, rather than the federal government, set their particular water planning priorities, and then use the expertise and experience of our federal partners to make projects a reality.

Unfortunately, Oklahoma has no dedicated source of funding to match available federal monies and implement projects identified in our Water Plan. Even a good plan is only a tool; its effectiveness is measured through its implementation. The water board urges the Legislature to remove the existing cap and expiration date on gross production tax revenues, thus enabling the state to fund long-term water planning projects, because water — like energy and education — is a cornerstone for this state's growth.

As it was so appropriately stated in the February 2008 issue of Texas Monthly magazine, "The good news is that Texas has an incredibly detailed plan for how to deal with the looming shortfalls in every one of its major urban areas. The problem is that you can't drink a plan."

Smith is executive director of the Oklahoma Water Resources Board.

Oklahoma **COMPREHENSIVE** **Water** **PLAN**



Evaporation: The process by which water becomes a vapor at a temperature below the boiling point.

Transpiration: The process by which water vapor escapes from plants, principally the leaves, and enters the atmosphere.

Condensation: The changing of water vapor into liquid water.

Precipitation: Any form of water, such as hail, rain, mist, sleet, or snow, that falls to the earth's surface.

Runoff: Rainfall or melted snow that flows across the earth's surface and eventually runs into streams.

Infiltration: The downward entry of water from the surface into the subsurface.

Groundwater Flow: The movement of water through openings in sediments and rock beneath the earth's surface.

Aquifer: A rock formation that is capable of holding and yielding significant amounts of groundwater.

