



WATER ISSUES

IN ARKANSAS

An Unfinished Story...

SUMMARY REPORT



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WINTHROP ROCKEFELLER FOUNDATION
JUNE 2008



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FOUNDATION

A Study Conducted for the Winthrop Rockefeller Foundation



FTN Associates, Ltd.
Little Rock, Arkansas
June 2008

Cover photo credits (clockwise from upper left):

Gunner Pool in the Ozark National Forest, AETN

Dwight Lasker with USGS collects water samples at Gunner Pool, AETN

Little Red River, Arkansas Parks & Tourism

Irrigation at Rohwer Research Station, U of A System Division of Agriculture

Bayou DeView, The Nature Conservancy

Lake Maumelle, AETN

Autumn in the Arkansas Ozarks, AETN

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WATER ISSUES IN ARKANSAS: *An Unfinished Story*

The Winthrop Rockefeller Foundation commissioned *Water Issues in Arkansas* to present a comprehensive view of the subject from the multiple perspectives of government, industry, agriculture, business, utilities, nonprofit organizations, private citizens and the public. The report provides a set of policy options to help resolve the water issues identified in this study and to move toward achieving sustainable water resources in Arkansas. This summary report draws from a larger companion report that can be accessed from the DVD located in the pocket sleeve at the front of this report. The companion report also includes a detailed reference list, literature review, and data from interviews and a public telephone survey of Arkansans.

WINTHROP ROCKEFELLER FOUNDATION

In 1974, the trustees of Governor Winthrop Rockefeller's estate endowed the Winthrop Rockefeller Foundation with the task of continuing the work of the Rockwin Fund. Winthrop Rockefeller established the Rockwin Fund in 1954 and, from 1956 until his death in 1973, annually funded projects and programs designed to improve quality of life in Arkansas.

The Winthrop Rockefeller Foundation is a private, nonprofit organization dedicated to improving the lives of Arkansans by funding programs and projects to promote education, economic development, and economic, racial, and social justice. During the past 34 years, the Foundation has awarded more than \$121 million in grants.

ACKNOWLEDGEMENTS

This study could not have been completed without the support and assistance of Dr. Dennis Ford, Jim Shirrell, Jay Fredrich and Dr. Jarvis Harper at FTN Associates; the staff at the University of Arkansas at Little Rock Institute for Economic Advancement, and more than 75 individuals who shared their time and experience through personal interviews.

Bill Rahn, Dr. Sybil Hampton and Dr. Sherece West at the Winthrop Rockefeller Foundation, along with members of the study's Advisory Committee, provided guidance, direction and many helpful comments.

All conclusions, interpretations and recommendations made or identified in the report are those of the authors, and not of the Winthrop Rockefeller Foundation.

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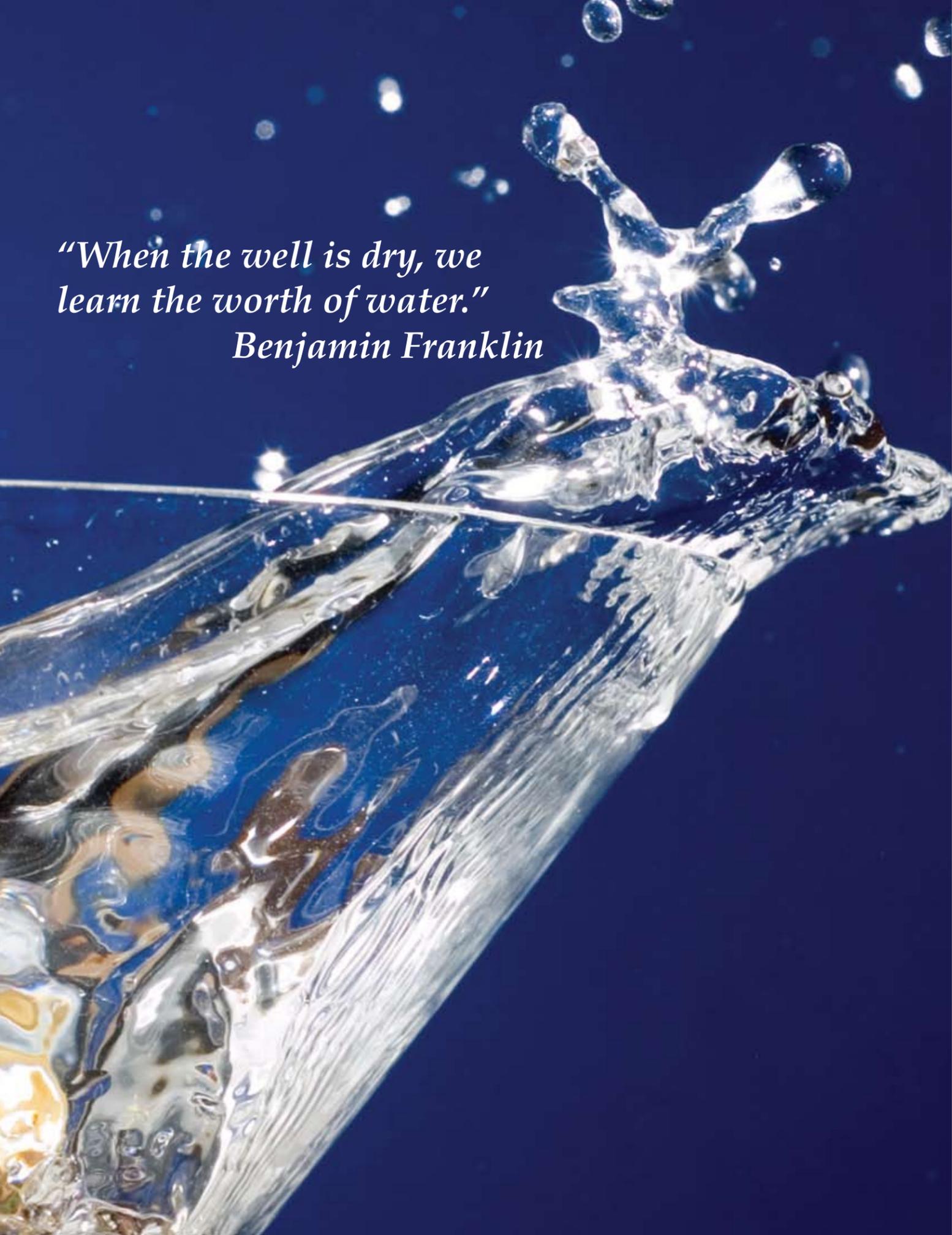
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*“When the well is dry, we
learn the worth of water.”
Benjamin Franklin*

executive summary

Arkansas – a state with rich supplies of surface water in rivers, streams, lakes, reservoirs, and wetlands in addition to large amounts of sub-surface groundwater. These water resources have propelled the state’s economy through recreation, navigation, power generation, manufacturing, and agriculture.

Water will continue to be essential for a robust economy, public health, and quality of life in Arkansas. But Arkansas is at a critical juncture in water management. Decisions we make now can move us toward crisis or sustainability.

This report highlights trends, desirable goals, policy options, and tools that will help Arkansans make informed choices. Our conclusions and proposals are based on documented facts about the state’s water resources, a survey of 400 Arkansans, and interviews with more than 75 representatives of public, business, agricultural, nonprofit, and academic organizations.

Facts and Trends

From 1980 to 2005, these trends emerged:

- *Water quality problems are increasingly caused by non-point source pollution, including storm runoff from communities, construction sites, agriculture and dirt roads; and pollution from malfunctioning septic systems*
- *Climate change is contributing to changes in the occurrence of droughts and floods*
- *Groundwater levels are dropping. This is the water below the surface that*

flows through layers of soil and rock and emerges in springs, streams, lakes, or wells

- *Use of groundwater and surface water for irrigation and public water supplies has increased*
- *Litigation, rather than collaboration, has become the most common approach to resolving water issues*
- *Poorly planned development is contributing to flooding and inadequate water supply*
- *Water infrastructure needs repair and replacement*

High Priority Issues

Public officials, government employees, educators, commercial and agribusiness representatives, and private citizens overwhelmingly agree that water is vital to the state’s long-term growth and prosperity and yet there is a widespread lack of knowledge or understanding about our water resources.

In addition to this lack of understanding, our surveys and interviews identified these high priority issues:

- *Water pollution*
- *Groundwater depletion*
- *Flooding*
- *Water shortages*
- *Inadequate water distribution*
- *Lack of stewardship*
- *Inadequate laws and regulations*
- *Inadequate funding*
- *Inadequate planning*
- *Ineffective leadership*
- *Ineffective management*

Desired Outcomes

We believe most Arkansans would support the need to work toward specific goals or outcomes that:

- Maintain an adequate supply of safe drinking water
- Provide enough good-quality water to support the state economy and sustain a healthy environment
- Protect life and property from damage caused by flooding
- Recognize the value of water and its contribution to the overall quality of life in Arkansas
- Provide stewardship of water, protecting the rights of all Arkansans to use water resources
- Manage water comprehensively to sustain groundwater and surface water for future generations
- Manage water resources efficiently through a participatory process

“We need a global approach to this from all sides. We need to educate people, we need the scientists to create new technologies, we need the engineers to create the networks, we need every human being to be aware of how precious water is and save it. Everybody has to be involved in a very firm and assertive way.”

Isabel Allende, Author

Can Anything Be Done?

Citizens and leaders in Arkansas must be proactive and collaborative in identifying and implementing water management strategies. This report offers examples of

policy options within eight broad water policy areas that could be used to help assure a sustainable, safe and abundant water supply.

• Economic Incentives and Markets

- Determine the true value or cost of water, taking into account government subsidies, unintended consequences and alternative uses
- Create voluntary and economic incentives, such as tax credits for the installation of water conservation equipment by commercial or residential users
- Promote private-public alliances that enable public agencies to outsource certain activities to private companies for more efficient water management
- Review federal funding opportunities that are untapped because of failure to satisfy requirements for local matching funds



• Integrated Surface/Groundwater Management

- Manage groundwater and surface water quantity and quality through one agency with clear lines of authority
- Revisit water allocation in federal water projects, such as U.S. Army Corps of Engineers reservoirs
- Develop regional water management districts based on surface water, groundwater and precipitation patterns, rather than county boundaries



- Create and protect “soaking zones” where water can soak into the ground and storage areas where surplus water can be captured during high-flow periods
- Enact enforceable water-withdrawal regulations
- Move water from where it is to where it is needed by revising criteria for setting water use priorities
- Encourage water conservation, reuse and recycling in the commercial, municipal, agricultural and household sectors



• Integrated Point/Non-Point Source Management

- Manage water quality through one agency with authority over all types of water pollution
- Make water quality data readily available through a centralized public data storage system
- Spotlight water quality benefits by identifying and publicizing the monetary value of best-management practices
- Authorize “pollutant trading practices” through which an industrial or municipal wastewater discharger pays for programs to reduce pollutant loads from other sources



• Water Laws and Regulations

- Establish a Vision 2025 Committee to develop a model for sustainable water resources by the year 2025 that could guide the development of a comprehensive water code or state water plan

- Establish a Comprehensive State Water Code Commission to determine the need for an integrated set of laws governing water
- Revise the existing Arkansas water plan to make it consistent with the 2025 vision for sustainable water resources
- Convene a Water Summit with broad, diverse participation to discuss laws and regulations, revisions to the Arkansas water plan and water projects that integrate social, economic and environmental goals

• Participatory Process

- Separate facts from perceptions by documenting the opinions of different population segments about water resource issues
- Promote Water Watch or other voluntary programs to encourage public involvement, in the same way the Arkansas Game and Fish Commission assigns Stream Teams to promote stewardship of streams used for fishing
- Work to build trust among stakeholders and community groups that may be polarized on water issues



• Leaders and Champions

- Provide water leadership training on socioeconomic and cultural approaches for watershed management



- Identify community leaders and champions and provide training/ education on water resource issues
- **Public Awareness and Outreach**
 - Provide a definitive source of public information about water in Arkansas
 - Declare a “Decade of Water” in Arkansas
 - Engage existing organizations in the effort to raise awareness of water resource issues (professional, trade, civic organizations)
 - Educate the kids with materials and lesson plans for primary, secondary and post-secondary schools
 - Promote an ethic of water stewardship
- **Adaptive Management**
 - Improve water monitoring networks to develop an accurate picture of water availability in Arkansas
 - Supplement this monitoring information with data gathered through volunteer Water Watch programs
 - Identify, track and assess performance measures to determine if the state is moving toward sustainable water resources

A companion report to this summary provides a comprehensive discussion of these and additional policy options, including pros and cons of each. The companion report can be accessed from the DVD inserted in the pocket at the front of this summary, or it may be downloaded from the Winthrop Rockefeller Foundation website at www.wrfoundation.org.

A Call to Action

By raising awareness of issues and options for reaching solutions, this report seeks to encourage greater civic engagement to protect our water resources.

There are leaders and champions in our communities. Public interest and volunteerism are rapidly increasing. Everything is poised for success. When we address water issues, we also address social, economic and other environmental issues. Sustainable management of water resources could also move Arkansas toward economic and social sustainability over the next 25 years. The question is which paths and options will Arkansans choose?

Some say Arkansas is a water-rich state. Others say we will soon appreciate the value of water as groundwater in the Delta region is depleted and wells run dry. Arkansans are at a critical juncture in water management. The decisions we make can move us either toward crisis or sustainability (see Figure 1 on page 6). Issues affecting the quantity and quality of water in Arkansas include:

- *Uncontrolled growth and sprawl*
- *Lack of planning*
- *Short-sighted use*
- *Poor stewardship*
- *Greed*
- *Piecemeal laws and regulations*
- *Lack of understanding*

Everyone contributes to the problems – business, industry, agriculture, government agencies, nonprofit organizations and the public. The 1970s Pogo comic strip said it best: “We have met the enemy and he is us.”

This is a story about water issues in Arkansas over the past 25 years and what can be done to sustain the state’s water resources.

Says who? Arkansans, that’s who. More specifically, people we interviewed for this study and those who participated in a random statewide telephone survey.

Water has often proved a contentious issue in Arkansas. Some conflicts have endured for decades (groundwater depletion in the Delta), while others have emerged more recently (the Lake Maumelle and Illinois River watershed disputes). Why do these conflicts surface? Is water really that important? What factors contribute to these problems? What can we do to solve or resolve them? The purpose of this study is to answer such questions.

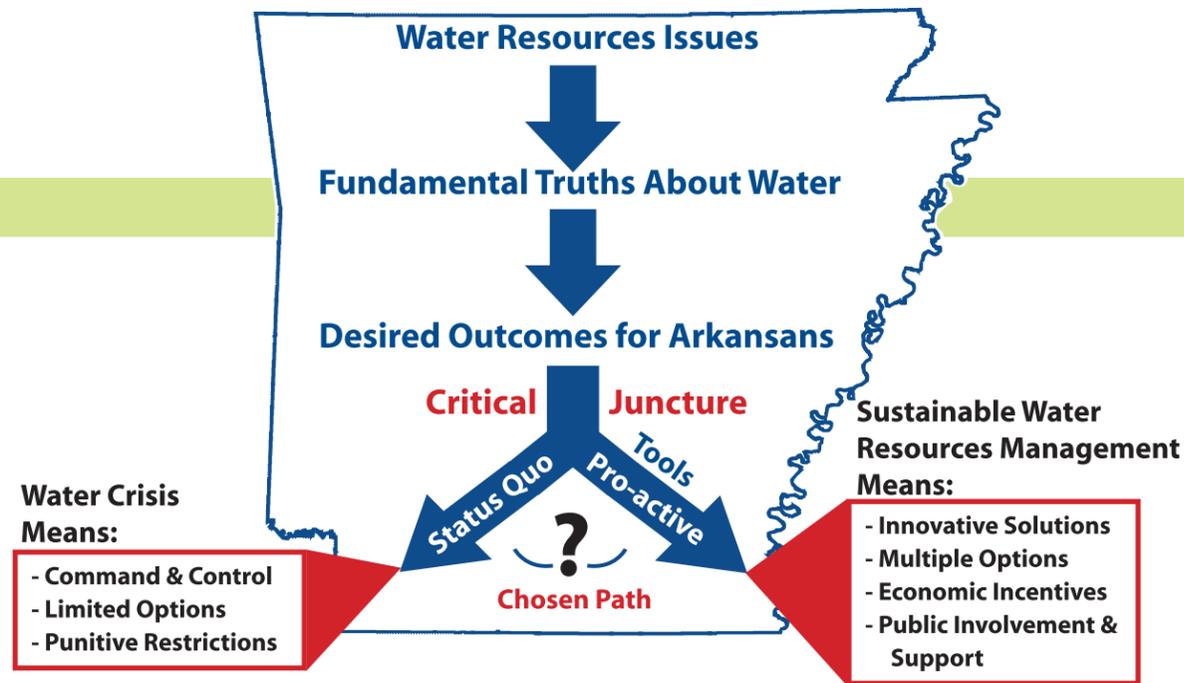
Throughout its 34-year history, the Winthrop Rockefeller Foundation has maintained an awareness of the importance of a safe and abundant water supply in Arkansas. This report reflects the Foundation’s interest in gaining a comprehensive perspective on water issues in Arkansas from myriad sectors: government, corporations, agriculture, academia, institutions and private citizens. Water directly affects the state’s economic development. Industry and agriculture can exist only with the assurance of adequate water quantity and quality. Access to a safe and abundant water supply is critical to ensuring our public health and quality of life.

Purpose

This summary – drawn from a larger, companion report – provides insights about water issues in Arkansas as well as various policy options that can help sustain a safe, abundant water supply for future generations while also understanding current needs for water use. Discussion of these issues, some of which are identified in the opening paragraph of this introduction, begins in the section of this report titled “Views on Water.”



Figure 1— How Water Issues Flow Through This Report



This report identifies policy options to assure a safe, sustainable supply of water for future generations of Arkansans.

Many of the policy options for achieving sustainability described in this summary report were derived from personal interviews and a statewide telephone survey of Arkansas residents or from successful models developed in other states. A discussion of what these options can do is found in the section of this report titled “Can Anything Be Done?”

The lengthier companion report from which this summary is drawn provides more details about both water issues and policy options for achieving sustainability. The companion report is available on the DVD inside the front cover of this report, or can be downloaded from

the Winthrop Rockefeller Foundation website, www.wrfoundation.org. The companion report also contains a review of pertinent articles and reports about water issues in Arkansas over the past 25 years, results of the personal interviews and random telephone surveys conducted for this study, U.S. Census Bureau statistics on water use, and the pros and cons of employing the various options.

A Story of Arkansas Water

This summary report begins with background information about 25 years of water use and management in Arkansas followed by a presentation of interview and survey results that indicate what Arkansas residents consider priority issues. Conflicting positions are discussed along with a set of tools for resolving disputes – all within the context of what is scientifically known about water. Some say we already have a water crisis; others say we still have time to avert a crisis. The story is unfinished because the people of Arkansas will ultimately decide the next steps along a path to either crisis or sustainability.

Arkansas water resources - a primer

Surface Water

Arkansas’ surface water includes streams, lakes, reservoirs, rivers, wetlands and their associated watersheds. Because all land feeds some body of water, everyone lives and works in a watershed. Most people live downstream from someone else in a watershed. The watershed for a large system of connected water bodies is often called a basin. Figure 2 maps the four basins of Arkansas’ major river systems and of the Delta.

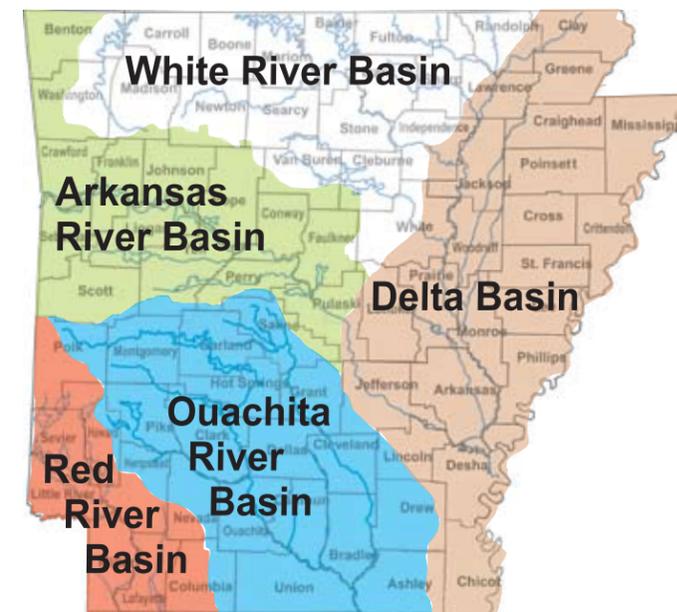
The level of the water table fluctuates, depending on how much water seeps into the ground and how much flows out or is withdrawn. Factors affecting the water table include rainfall; how much ground is covered by impervious surfaces such as buildings and concrete; and how much the land is watered or irrigated. Also, if the water table is deeper than a surface-water resource, water can seep into the ground from streams, lakes and reservoirs.

Groundwater

Arkansas also has important groundwater resources. Groundwater is water that has seeped into the earth. At some depth below the surface, water saturates soil or rock. The top of a saturated zone is called the water table (see Figure 3 on page 8).

Groundwater occupies the saturated zone below the water table. Groundwater flows through underground layers of soil and rock until it surfaces as a spring or as seepage into a stream or lake, or until it is pumped from a well. The elevation of the ground surface and how readily the underground geology conducts water

Figure 2— River Basins in Arkansas



affects the flow path of groundwater. Some geologic layers act as barriers while others allow groundwater to pass through easily.

Aquifers are water-saturated geologic layers of underground rock, sand or gravel that conduct water easily enough for a well to remove useful quantities. Figure 3 shows the two types of aquifers. A confined aquifer lies sandwiched between two relatively impervious geologic layers that don't readily conduct water. An unconfined aquifer has a relatively impervious geologic layer underneath, but not on top. The water table represents the upper boundary of an unconfined aquifer. Most confined aquifers receive water from a portion of the geologic layer that is

unconfined. Geologists characterize and name geologic layers, which also is the name applied to their associated aquifers.

Twelve major aquifers supply water in Arkansas. The two largest, and most-often discussed, are the Mississippi River Alluvial Aquifer (usually called the Alluvial Aquifer) and the Sparta/Memphis Sand Aquifer (usually called the Sparta Aquifer). The Alluvial Aquifer, which is largely unconfined, lies beneath the Delta area of east Arkansas. Its primary use is irrigation. The Sparta Aquifer, a confined aquifer in southern and eastern parts of the state, is primarily used for public and private water supply and industrial use.

This summary emerged from government reports, scientific articles, U.S. Census statistics, and trade-journal and newspaper accounts about changes in Arkansas' environmental and economic conditions, water law and water resources management over the last 25 years.

The drought of 1980-1981 raised concerns about water shortages in Arkansas, including the impact on crop irrigation. By 1981, groundwater levels in the agriculture-dependent Delta counties had dropped from 20 to 30 feet below the surface to more than 40 to 50 feet deep. Some farmers' wells were drying up.

Also in 1981, the Arkansas legislature established a Water Code Study Commission to review the adequacy of the piecemeal laws and regulations governing water management related to agriculture, industry, communities and the environment. The commission worked through 1982 to develop a proposal for a comprehensive state water code encompassing an integrated set of laws and regulations governing water-use rights. The 1983 legislature, however, rejected the proposal.

Concerns raised about the proposed water code included the inadequacy of statewide regulations to address local concerns, interference with property rights and the lack of readily available alternative water sources if restrictions were applied to current uses. In the years since the Water Code Study Commission developed its proposal, water use and management in Arkansas have seen multiple changes.

Water withdrawals in Arkansas increased by 55 percent between 1980 and 2000.

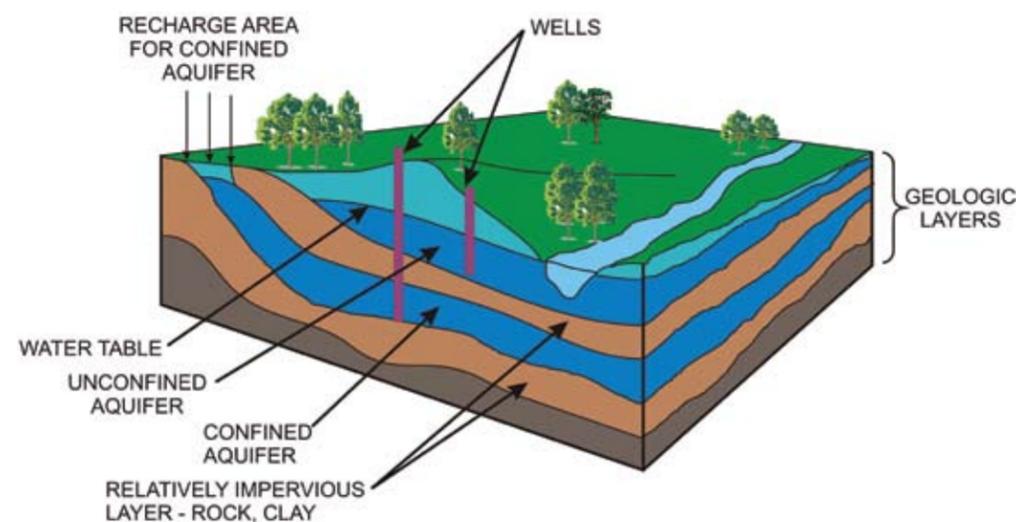
Water Use

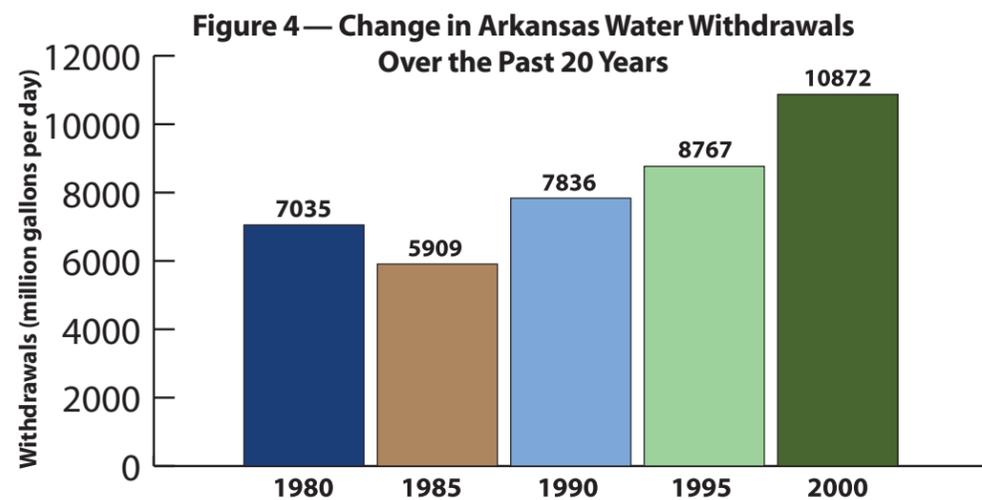
Water withdrawals represent one way of tracking water use. While withdrawals have leveled off nationally since about 1990, they continue to rise in Arkansas, affecting both surface water and groundwater (see Figure 4 on page 10). Withdrawals in 2000 were 55 percent higher than in 1980. Even so, withdrawals for some key use categories decreased over this 20-year period. Water withdrawals for industrial use and for aquaculture fell by 43 percent and 53 percent, respectively, between 1980 and 2000 (see Figure 5 on page 11). Both sectors enjoyed growth during this period but required lower withdrawals by implementing more efficient methods.

Increased withdrawals for public water supply (Figure 5) as well as for thermoelectric power generation and irrigation (see Figure 6 on page 12) explain the significant percentage rise in total withdrawals since 1980.

In this 20-year span, withdrawals for public water supply increased by 66 percent, from 253 million gallons per day to 421 million gallons per day (Figure 5). The percentage of Arkansas residents who receive their water from public utilities also rose, from 74 percent in 1980 to 85 percent in 2000. Most of these public-use

Figure 3— Elements of Arkansas Groundwater





water withdrawals (60 percent in 1980 and 70 percent in 2000) came from surface water, primarily reservoirs.

Higher public-use withdrawals can be attributed, in part, to the approximately 20 percent increase in Arkansas' population between 1980 and 2000 (Table 1). But some Arkansans draw their water from private wells or similar systems, so a larger population alone does not explain the higher withdrawals.

Per-capita water use has emerged as a telling factor. In 1980, the average use of public water supplies in Arkansas was 161 gallons per day, per person. In 2000, usage had risen to an average of 181 gallons per day, per person. (One estimate establishes 13 gallons per day as the minimum amount of water needed for personal use.) This increase in per capita water

use may be associated with improvement in the standard of living in Arkansas. U.S. Census figures show that per-capita income more than doubled between 1980 and 2000 (Table 1).

Water withdrawals for thermoelectric power generation in Arkansas (gas, coal, and nuclear power plants) showed a modest increase between 1980 and 2000 (see Figure 6 on page 12).

Withdrawals for irrigation, by comparison, nearly doubled in the 20-year span (Figure 6). Likewise, irrigated cropland doubled, in both acreage and in percent. The 2 million acres of irrigated cropland in 1982 (representing 20 percent of total cropland) increased to about 4 million acres in 2003 (representing 43 percent of total cropland). Irrigation accounted for 73 percent of Arkansas total water withdrawals in

Table 1 — Demographic Changes in Arkansas over the Past 25 Years

	1980-82		2000-04	
	Rural	Urban	Rural	Urban
Arkansas Population	1,094,847	1,191,510	1,153,483	1,625,671
Per Capita Income	\$10,451**	\$12,938**	\$22,574	\$28,145
Poverty Rate	22%	16%	18%	15%

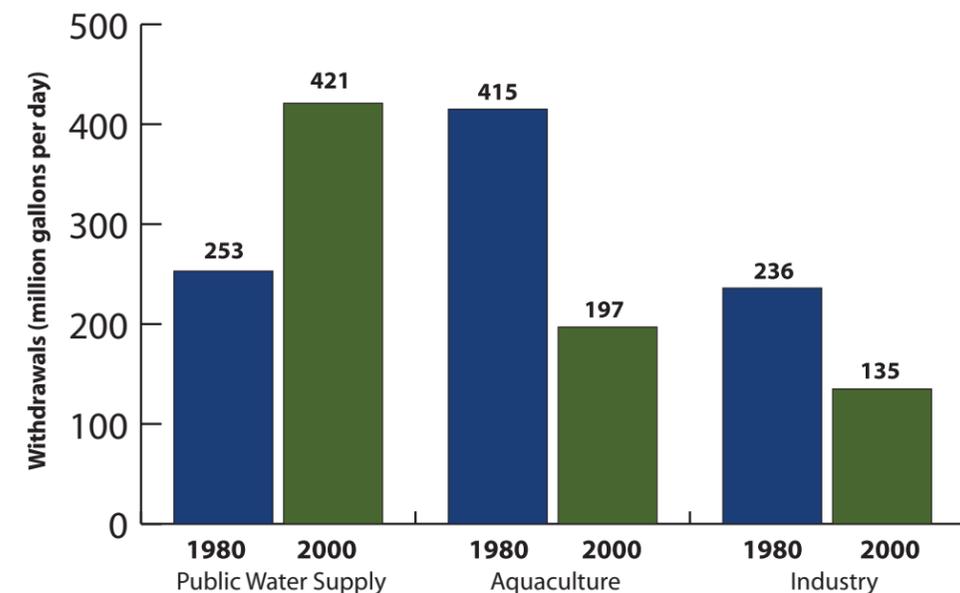
** Income adjusted for 2000 inflation.

2000 (see Figure 7 on page 13). The U.S. Geological Survey reported that more than 80 percent of irrigation withdrawals in 2000 derived from groundwater, of which more than 95 percent came from the Alluvial Aquifer. In other words, the majority of the increase in state water withdrawals between 1980 and 2000 can be tracked to withdrawals from the Alluvial Aquifer for irrigation.

Declining groundwater levels in both the Alluvial and Sparta aquifers have prompted

growing concern. The issue is not only the extra expense of pumping water from deeper wells, but also the reduced capacity of the aquifers to store and transmit water and the potential for underlying salt water to seep up and contaminate the aquifer. Scientific studies indicate that, without a decrease in groundwater withdrawals, parts of the Alluvial Aquifer will be unable to supply good quality water by 2015 and the Sparta Aquifer will be similarly affected by about 2030.

Figure 5 — Changes in Water Withdrawals from 1980 to 2000, for Public Water Supply, Industry, and Aquaculture Use Categories



Water Management

State law authorizes the Arkansas Natural Resources Commission (ANRC) to develop and update the Arkansas Water Plan, which serves as a framework for how state water laws are implemented, regulated and evaluated for effectiveness. The first published plan dates to 1975. In response to the work of the Water Code Study Commission in 1981-1982, the 1985 legislature directed the ANRC's predecessor (the Arkansas Soil and Water Conservation Commission) to update the Arkansas Water Plan. Updates to the plan made between 1986 and 1989 led to publication of an Arkansas Water Plan Executive Summary in 1990. In 2000, the Governor's Water Resources Task Force reviewed the Arkansas Water Plan and

determined that it did not adequately address current water concerns, and was in need of revision. No funds have been committed for the revision.

Delta aquifer water levels have continued to decline while withdrawals for irrigation nearly doubled between 1980 and 2000.

Although the ANRC has primary responsibility for Arkansas' water quantity and the Arkansas Department

Figure 6— Changes in Water Withdrawals from 1980 to 2000, for Thermoelectric Power Generation and Irrigation Use Categories

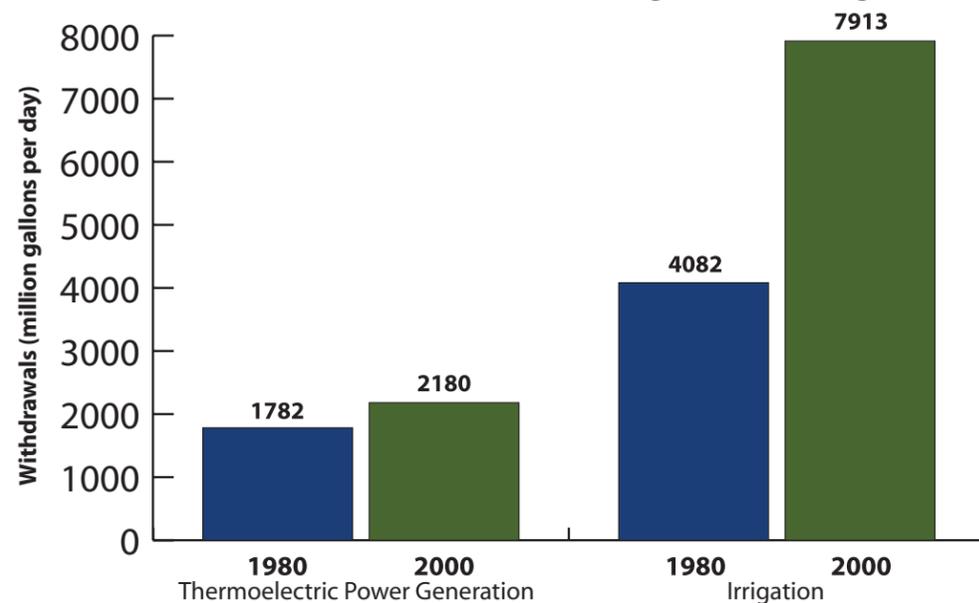
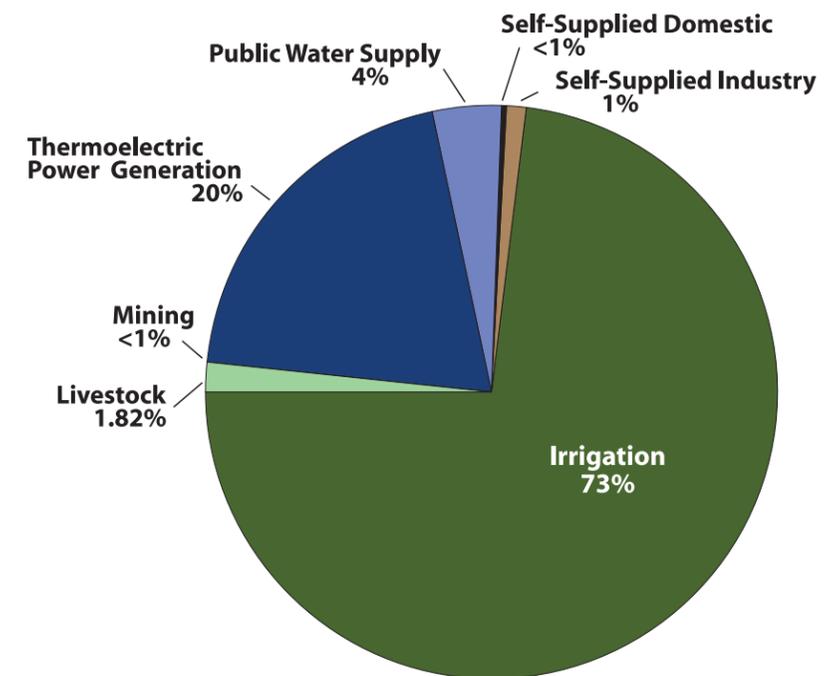


Figure 7— 2000 Arkansas Water Withdrawals



of Environmental Quality monitors water quality, numerous other state agencies and commissions include water resources management as part of their mission. These include the Arkansas Department of Health, Arkansas Natural Heritage Commission and the Arkansas Game and Fish Commission. Unfortunately, one agency's actions can conflict with those of another. This happens, for example, when one agency views water as a resource to be used and managed while another agency is charged with protecting water from certain uses encouraged by the first agency.

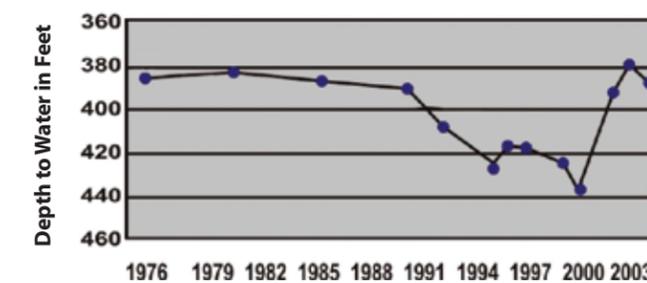
Water Quantity

New regulations, laws and practices have affected the management of water quantity in Arkansas over the past quarter century. Minimum flows to protect fish, wildlife, and other uses have been established for many Arkansas rivers. Policies have been put in place to regulate the allocation of surface water during times of shortage, with basin-specific allocation plans still pending. State laws enacted in 1991, 1999 and 2004 encourage protection of the Alluvial and Sparta aquifers in designated Critical Groundwater Areas of eastern and southern Arkansas. As a result, groundwater levels in the Sparta

Union County – An Early Success Story for Sparta Aquifer Recovery

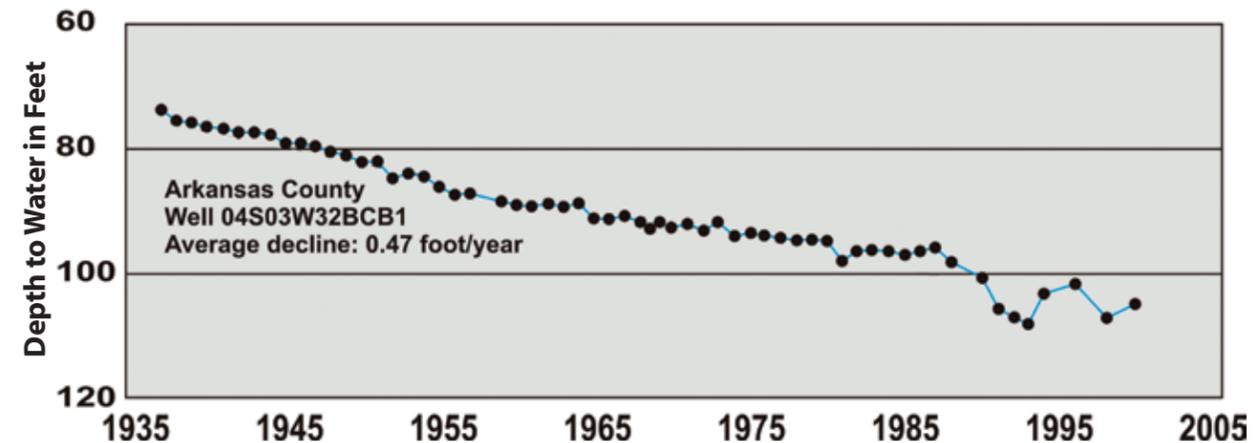
In 1996, the Arkansas Natural Resources Commission declared Union County and four other South Arkansas counties as the state's first Critical Groundwater Area. The Sparta Aquifer water levels in these five counties had dropped below the critical level established by the commission. Both the state agency and the U.S. Geological Survey assessed the groundwater problem in Union County as the worst of the lot. Most of the groundwater pumped from the Sparta Aquifer served industrial users crucial to the local economy. Once Union County was designated a Critical Groundwater Area, county officials intensified a public awareness campaign and, working with county stakeholders including large-volume industrial water users, supported legislation that authorized formation of the Union County Water Conservation Board. The legislation empowered the board to act with unprecedented authority over groundwater. Shortly after its formation in June 1999, the board applied a conservation fee for groundwater withdrawals from the Sparta Aquifer. The money raised from this fee, coupled with revenue from a temporary county sales tax and private contributions, funded ninety percent of the planning, design and construction of a \$65 million project to provide Ouachita River water to Union County's three largest industrial Sparta Aquifer groundwater users. Between 2004 and 2005 all three users converted from Sparta Aquifer water to Ouachita River water. The success of this project accounts in large part for the rising water levels of the Sparta Aquifer in Union County after years of steady decline (See Chart below).

Recent Recovery of Sparta Aquifer in Union County near El Dorado after Groundwater Conservation Project



(graph courtesy of Arkansas Natural Resources Commission)

Figure 8— Declining Alluvial Aquifer Over the Past 70 Years



Aquifer are stable or rising in Union County (see page 15). In addition, more farmers employ conservation practices (such as irrigation water runoff recovery systems) for irrigating their rice fields. Still, groundwater levels continue to fall in several eastern Arkansas counties (Figure 8).

Water Quality

Broader program focus, modified standards and new state laws have widened the scope of water-quality management in Arkansas over the past 25 years. More comprehensive approaches are being used to gauge how all pollution sources in a watershed affect water quality. These approaches consider and measure point-

source discharges from industrial and municipal wastewater facilities as well as pollutant loads from non-point sources – including storm runoff from communities, construction sites, agriculture, and dirt roads, as well as seepage from malfunctioning septic systems. Water quality standards also have been tailored to reflect the natural characteristics of regions such as the Ozarks, Ouachitas and the Arkansas River Valley. State legislation passed in 2003 and 2004 targeted specific watersheds affected by nutrient pollution and directed land owners in these areas to employ practices that reduce the amount of nitrogen and phosphorus associated with fertilizers and manure that can drain into surface water and groundwater.

“Among these treasures of our land is water—fast becoming our most valuable, most prized, most critical resource. A blessing where properly used.”

Dwight Eisenhower

Information collected during a telephone survey and personal interviews form the basis for the comprehensive perspective on water resources in Arkansas summarized in this report. The University of Arkansas at Little Rock Institute for Economic Advancement Survey / Business Research Group selected at random more than 400 adult Arkansas residents for a May 2006 telephone survey on water issues of importance to them. Additionally, more than 75 representatives of government agencies, cities and counties, business and agricultural interests, non-governmental organizations, and academia agreed to personal interviews. They answered 10 open-ended questions, including inquiries about problems associated with water use and possible solutions.

Arkansas residents interviewed for this study identified high-priority issues, chief among them a lack of understanding about water resources.

Everyone interviewed in person, as well as more than 96 percent of the telephone-survey respondents, agreed that water is vital to Arkansas’ long-term growth and prosperity. From this general consensus, they proceeded to name high-priority

Table 2—High-Priority Water Issues For Arkansans

* Lack of Understanding About Water Resources
* Water Pollution
* Groundwater Depletion
* Flooding
* Water Shortages
* Inadequate Water Distribution
* Lack of Stewardship
* Adequacy of Laws and Regulations
* Inadequate Funding
* Inadequate Planning
* Ineffective Leadership
* Ineffective Management

water issues for Arkansas. See Table 2 for a list of these issues. A discussion of each follows.

Lack of Understanding About Water Resources

Few people know enough about the multi-faceted topic of water in Arkansas. This came up in each personal interview and the telephone-survey respondents echoed the sentiment. Public officials, government employees, educators, commercial and agribusiness representatives and private citizens all concur that knowledge and understanding are lacking.

Many raised concerns that were based on perceptions, rather than facts and science. Perceived problems are important,

however, because they suggest people may make decisions about water issues without knowing the facts. Misperceptions will remain an issue as long as getting a clear grasp of all facets of water resources eludes us.

Water Pollution

Nearly all respondents identified water pollution as a priority issue. They mentioned point-source pollution from municipal and industrial wastewater discharge, as well as nonpoint-source pollution generated by agricultural runoff, and stormwater runoff from commercial and industrial sites, real estate development, mining activities and other land uses. Most respondents acknowledged the significant progress made in treating and controlling point-source pollution over the past 25 years. They linked most current water-quality issues to non-point sources.

Groundwater Depletion

Likewise, a great majority of respondents cited groundwater depletion of both the

Alluvial Aquifer and the Sparta Aquifer. Some said the depletion of these aquifers is already a crisis.

The depletion of the Alluvial Aquifer in the Delta has led to the drilling of irrigation wells into the Sparta Aquifer, which previously served primarily as a source of municipal water. Respondents raised concerns about pumping the Sparta Aquifer for agricultural irrigation, potentially jeopardizing the ability of municipalities to rely on this groundwater supply of drinking water for their citizens (Figure 9).

The need for a sustainable source of drinking water versus the need for irrigation water exemplifies one of many conflicts associated with the use of water in Arkansas. Lacking a substitute for water to meet these demands or a change in demand, such disputes will continue.

Flooding

The ebb and flow of water includes cycles of flooding and drought. Respondents raised both

flooding and water shortages as priority water issues for Arkansas. Many believed commercial and residential development have contributed to both problems. Increasing the number of buildings and amount of paved area in a watershed increases the likelihood of flooding because buildings and pavement prevent water from soaking into the ground. Rain runs off roads, parking lots and rooftops too fast for streams to handle. They overflow and flood the area.

Water Shortages

These same rapidly developing areas also are prone to water shortages. Respondents linked water shortages to an increased demand that exceeds the capacity of existing infrastructure (i.e., municipal water mains and pipes) to deliver the water in some communities (e.g., the Bentonville and Rogers areas of Northwest Arkansas).

Inadequate Water Distribution

Floods and periods of drought both bring Arkansas' inadequate water distribution to the surface. We lack the storage capacity to capture floodwaters for future use. In times of shortage, we lack the ability to transport water from where it might be available to where it is most needed.

Lack of Stewardship

Many respondents cited the need for a stewardship ethic as opposed to an ownership mentality they say is prevalent in Arkansas (i.e., "I own the land, I own the water."). In addition, many respondents said conflicts are increasing due, in part,

Lack of understanding about water was identified as the highest priority issue by almost everyone.

to a polarity on water issues with an unwillingness to seek middle ground being the norm rather than the exception.

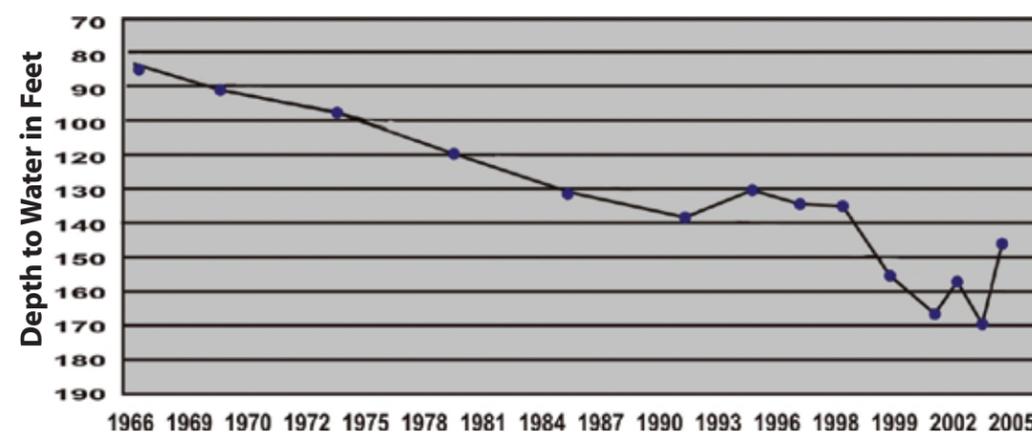
One respondent with 30 years of professional experience said polarization over water issues among individuals, groups and organizations is more intense than ever. Those with disagreements seem to prefer turning these issues over to the courts rather than working toward a solution agreeable to both. In fact, several individuals declined to be interviewed for this study because of ongoing legal action, or fear of litigation, arising from water issues.

Adequacy of Laws & Regulations

Respondents had differing perspectives on this issue. Some maintained adequate laws exist but are insufficiently enforced, while others declared existing statutes and regulations as clearly inadequate.

Although the adequacy of existing rules was in dispute, respondents generally agreed on the need for a review of existing laws and regulations and a more comprehensive water code. Given polarized views, however, the respondents

Figure 9— Decline in the Sparta Aquifer near DeWitt Over the Past 40 Years



voiced skepticism about the possibility of enacting a comprehensive set of water laws.

An ownership mentality contributes to polarization and conflict on water issues.

Inadequate Funding

Respondents expressed nearly uniform agreement on the need for more money to address water issues. They listed numerous activities that required funding: replacing aging infrastructure such as drinking water and sewer lines in both urban and rural areas; building new water-treatment facilities; constructing additional water storage and/or distribution systems; monitoring water quantity and quality in lakes, streams, and groundwater; developing educational and instructional material on water issues; and restoring impaired water bodies and watersheds. Most respondents said they had no idea how much money was needed, but there were estimates of up to \$3 billion.

Inadequate Planning

Many respondents labeled the existing Arkansas Water Plan, which has not been updated since 1990, as inadequate and antiquated. Over the past 16 years, other states and agencies have enacted regulations and approaches that promoted more comprehensive management of water resources. As mentioned earlier in this report, the Governor's Water Resources Task Force determined in 2000 that the existing plan failed to adequately address current water concerns.

A comprehensive water plan requires an all-inclusive set of laws (i.e., water codes that consider the entire water cycle and the effects on the environment, society, and economy in making decisions about water use). The alternative is the continued use of ineffective, inefficient and piecemeal approaches in addressing water issues.

Ineffective Leadership

Many personal interview respondents and more than half of the telephone-survey respondents indicated that either local and/or state government leaders have failed to place an appropriate emphasis on water in Arkansas or that they (respondents) "don't know" if government leaders are giving water issues enough attention. Sixty-two percent of the random-survey respondents assigned the responsibility for fixing water problems to local and state governments.

Telephone-survey results also indicated a need for greater public education about various water resources initiatives and activities, both ongoing or in the planning stages.

Ineffective Management

Most respondents believed Arkansas lacks effective water management. They gave several examples: the management of surface water and groundwater as if they are two independent sources, disputes between municipalities and regional water authorities, and the last-resort consideration (if considered at all) of conservation, reuse and recycling. They also noted that conflicts arising among

multiple uses (e.g., recreation, water supply, hydropower generation, and fish and wildlife protection) occur in many water bodies.

Respondents said litigation is usually the first choice for resolving water-use conflicts, rather than giving collaboration and cooperation a try. In addition, many respondents indicated that Arkansas has no "champion" for water.

Management responsibilities for sustaining water quantity and water quality remain apportioned among multiple agencies, with fuzzy lines of authority and responsibility.

fundamental truths

“Water is the basis of life and the blue arteries of the earth! Everything in the non-marine environment depends on freshwater to survive.”

Sandra Postel
Director, Global Water Policy Project

We believe some fundamental truths apply as a starting point for discussing water in Arkansas as well as for understanding some of the characters in this water story. These principles represent our synthesis of survey- and interview-respondent comments, a review of articles and reports, and from a framework and guidelines for sustainable water resources management. Table 3 lists these fundamental truths, which are summarized below.

We arrived at seven fundamental truths to help us better understand water and water issues in Arkansas.

Water is essential for life.

The human body consists of about 70 percent water. Plants and other animals obviously need water to live. In addition, their survival may depend on specific amounts of water at critical times of the year. Therefore, all life forms require consideration when resolving water issues. Humans are part of, not apart from, aquatic and terrestrial ecosystems.

Water is a renewable, but finite, resource.

Although a water-rich state, Arkansas does not have an infinite water supply. Fortunately, water is a renewable resource, meaning it can be withdrawn from lakes, streams and aquifers for use, treated, and

Table 3— Fundamental Truths About Arkansas Water

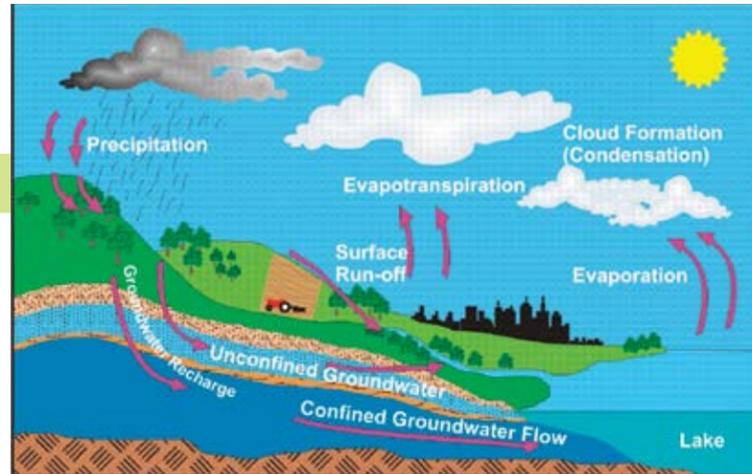
* Water is essential for life.
* Water is a renewable, but finite, resource.
* Surface water, groundwater, and precipitation are tightly linked.
* Water has no substitutes for most uses.
* Water runs downhill.
* No one owns the water in Arkansas.
* Water has social, economic, and environmental value, and touches every sector of our lives.

eventually returned to a stream or reservoir for repeated withdrawal and re-use. Such non-consumptive uses include industrial cooling, hydroelectric power generation, navigation and recreation. Consumptive uses exist as well. Water can be incorporated into industrial and manufactured products, or agricultural crops, which are then sold. Eventually, this water may return to the environment (as products are used or food is consumed), but the return might not be within the state where the water was withdrawn and might not occur for years. Water is a renewable, but not infinite, resource.

Surface water, groundwater and precipitation are tightly linked.

We tend to think of surface water, groundwater and precipitation as independent of each other rather than interrelated parts of the hydrologic cycle. Precipitation (rain or snow) falls onto the land and either runs off the

Figure 10—Hydrologic Cycle Links Precipitation, Surface Water and Groundwater



land into streams, rivers, lakes and reservoirs to form surface water or soaks into the ground to form and renew groundwater aquifers (Figure 10). In between rainstorms, groundwater serves as a primary source for surface water as it seeps out of the ground into stream channels or lakebeds. Some of the surface water evaporates and returns to the atmosphere. In addition, trees, shrubs, plants and grasses pull water from the ground and transpire it back into the atmosphere from where it can return as precipitation. This illustrates the connection between surface water, groundwater and precipitation. Affecting any one affects the other two.

Water has no substitutes for most uses.

Unlike other resources, such as energy sources, water has no substitutes for most uses. We can generate electricity by burning coal, oil, or natural gas; by hydropower or wind generation, and by solar energy or other sources. However, water has no substitute for many commercial, industrial, and agricultural uses. Nothing can replace water in

growing crops. The same holds true for many other products and processes.

No one owns water in Arkansas – just the right to use the water.

Water runs downhill.

Water moves primarily with the force of gravity either pulling it into the ground or channeling it downstream from a higher to lower elevation (Figure 10). Most people live downstream from someone else, and are affected by what happens upstream.

No one owns the water in Arkansas.

Arkansas abides by a doctrine of reasonable riparian use similar to most Eastern states. This means that landowners (private, state, or federal) who own property next to a stream or lake, the ground under any surface water, or land over any groundwater have the right to reasonably use the water, but they do not own the water. This is not

semantics. No one owns surface water, groundwater or precipitation in Arkansas, only the right to use these resources under a specific set of conditions and circumstances.

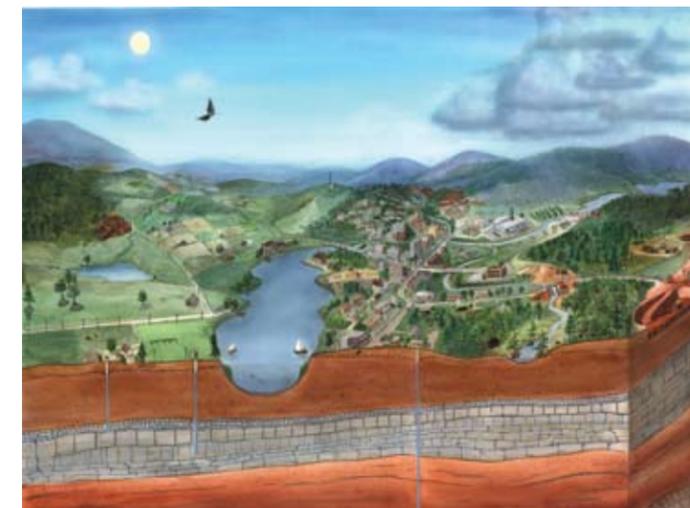
Water has social, economic and environmental value, and touches every sector of our lives.

Because water is essential to life, it affects every aspect of our social and economic fabric (Figure 11). Water is much more than a part of the physical environment. Many businesses, industries and agricultural enterprises count on water for survival. We rely on water for recreational activities (boating, fishing, swimming) and social amenities (enjoying a sunset over a lake, hearing the roar of a waterfall, enjoying the serenity of a flowing stream). Resolving water issues, therefore, requires that we consider their environmental, economic and social impact.

Water is essential, not only as part the physical environment, but also a key component of our social and economic life.

Now that we have a set of fundamental truths for use in evaluating our options, the next step is to do as Stephen Covey suggests: “Begin with the end in mind.” Can Arkansans agree on a set of desired outcomes for water? Is there a happy ending to our water story?

Figure 11—Multiple Uses of Surface Water and Groundwater



desired outcomes

Responses to the telephone survey and personal interviews suggest a set of desired outcomes for water we believe that most Arkansans would support. These are listed and briefly described below.

Maintain an adequate supply of safe, good-quality drinking water.

Where water is available, every resident should enjoy a safe, good-quality supply for drinking. Some parts of the state lack adequate water, but in those areas where supplies are sufficient, water should be safe to drink.

Provide enough good-quality water to support the state economy and sustain a healthy environment.

Business, industry and agriculture require sufficient good-quality water to provide jobs and bolster the economy of Arkansas. Similarly, Arkansans need this resource for continued enjoyment of a healthy environment (fish, wildlife, forests, wetlands, etc.). As stated earlier in this report, our economic and social systems are a part of, not apart from, ecological

systems. Therefore, ensuring enough safe, good-quality water to support and sustain all living organisms is part of the formula for a successful state economy.

Protect life and property from damages caused by flooding.

Streams and rivers flood periodically, and Arkansans deserve protection from loss of life and property where such safeguards are environmentally and economically feasible. Some areas, however, must flood to preserve wetlands and habitat for fish and wildlife. Adequate protection does not imply that all areas will be secure from the effects of flooding.

Recognize the value of water and its contribution to the overall quality of life in Arkansas.

Because state and federal subsidies cover parts of the cost of providing water, the market value (what people are willing to pay for water) is murky in most instances. Development of the bottled-water market has helped give us a better understanding of the economic value of water.

In legislation for funding the McClellan-Kerr Arkansas Waterway Navigation System (completed in 1971), Sen. Robert Kerr of Oklahoma declared that the day would come when a barrel of water exceeded the value of a barrel of oil. Today, 20-ounce bottles of water frequently sell for at least \$1. That is equivalent to more than \$6 a gallon — more than the price for a gallon of gas. However, water has more than a monetary value, because it is integral to our quality of life.

Serve as good stewards of water, protecting the rights of all Arkansans to use water resources.

Because no one owns the water in Arkansas, we should share the duty of good water stewardship. Virtually everyone lives downstream from someone else. What I do on my property will affect the water for others downstream, for better or worse. While we have individual property rights, we also have collective stewardship obligations associated with those rights. Good stewardship is not optional; it is mandatory in a democratic society.

Manage water comprehensively to sustain groundwater and surface water for generations to come.

As stated in the section titled “Fundamental Truths,” surface water, groundwater and precipitation are tightly linked. We can’t manage one without affecting the other two. Managing surface water and groundwater together can ensure that neither resource is depleted and that both will be available in adequate supplies for future generations.

Manage water resources efficiently through a participatory process.

Economics focuses on the efficient allocation of scarce resources among alternative, competing ends. Water, as a finite resource, has become scarce in some areas of the state. Managing water calls for efficient approaches, perhaps using economic tools and instruments. Stakeholders who represent the competing uses for water in Arkansas should participate in the process so everyone has a say.

can anything be done?

“We need a global approach to this from all sides. We need to educate people, we need the scientists to create new technologies, we need the engineers to create the networks, we need every human being to be aware of how precious water is and save it. Everybody has to be involved in a very firm and assertive way.”

Isabel Allende
Author

Respondents interviewed in person or by telephone for this report proposed many ideas for addressing water resources issues. Some suggested increasing the scope or extent of existing efforts. Others proposed tools or policies that other

Arkansans identified various policy options to help resolve water resources issues and move toward desired outcomes.

states or settings utilize. This section separates these tools and policy options into eight themes, many of which overlap

and interact (Figure 12). Each theme, summarized below, presents tools or options for use in successfully addressing water issues in Arkansas. The companion report to this summary provides a more comprehensive list of tools and options, along with the pros and cons of implementing them.

Improving the quantity and quality of our water resources provides multiple benefits. For example, stream restoration not only improves the environment, but also generates design, construction and maintenance jobs, creates income through ecotourism or recreational industries, and contributes to a better quality of life in a given community. Not everyone will agree with all the ideas presented below. The key is to initiate a civil discussion of these tools and options, considering their advantages and limitations.

Figure 12—General Themes for Addressing Arkansas Water Issues





Economic Incentives and Markets

Many economic incentives and tools are available for use in water resources management, but may not be used by water resources managers because they aren't aware of or haven't considered these ideas in the context of water management. Here are some examples:

Determine the Value of Water – The price users pay for water reflects only part of the total cost associated with providing the water; government subsidies pay the rest. This makes it difficult to determine the actual value of water. A complete accounting must factor in the cost of unintended consequences and value of alternate uses. Understanding water's full cost and value would contribute to more effective and efficient use and to developing potential markets for water.

Create Voluntary and Economic Incentives – Economic incentives ideally decrease water use so additional water resources don't need to be developed. For example, a number of states provide tax credits to residential or commercial users who install water-conservation equipment. Federal agencies pay individuals and organizations to protect water resources under the Wetland Reserve Program and other projects. Several European countries switched from a "polluter-pays" system to a "polluter-paid-for-not-polluting" system as a cost-effective way to reduce nonpoint-source pollution.

Conservation, restoration and stewardship programs for surface waters and watersheds benefit the environment, the economy and overall quality of life.

Promote Private-Public Alliances – Public agencies can outsource activities to private-sector companies for more effective and efficient outcomes. For example, some smaller water utilities delegate billing, new construction and/or maintenance of water lines to private firms that can perform these tasks more cost-effectively. This approach can maintain the strengths of the public sector while shoring up weaknesses with private-sector assistance.

Leverage and Legislate Needed Funds – Most existing federal programs require matching funds from the organizations requesting the federal funds. For example, the Environmental Protection Agency's Section 319 fund for managing nonpoint-pollution sources require a 40 percent match from non-federal sources to obtain the other 60 percent of the funds needed to complete the projects (such as installing grassed buffer strips to control soil erosion).

In many cases these organizations cannot come up with matching funds, so the appropriated money in these federal programs cannot be fully used. A task force appointed for the purpose could review existing federal programs and their matching requirements and estimate the matching funds needed to fully use the appropriated federal dollars. Nonprofit and private-sector organizations could use this information to leverage existing funds and determine how much money the Arkansas legislature might appropriate to make the match.



Integrated Surface/ Groundwater Management

Survey respondents identified groundwater depletion as one of the highest-priority water issues for Arkansas. In addition, one of our fundamental truths declares that surface water, groundwater and precipitation cannot be managed independently because these three elements are inseparably linked in the hydrologic cycle. For example, declining groundwater levels in eastern Arkansas have resulted in less surface water in streams because groundwater seepage supplies a large part of the flow in these streams. Projects to capture rainwater for agricultural use can also reduce water available for eastern Arkansas streams. This theme deals primarily with water-quantity management. Read on for a discussion of tools proposed for moving toward integrated water resources management.

Implement Water Management Through One Agency – A single, unified agency with authority over groundwater and surface water quantity and quality could have clear lines of authority and responsibility. Some respondents called for a "water czar" to ensure a comprehensive approach coupled with the authority to make and enforce needed changes. Others voiced concern about a "water czar" wielding too much power without appropriate checks and balances.

Revisit Water Allocation in Federal Water Projects – Only an act of Congress can change the allocation of water stored in Corps of Engineer reservoirs. The allocation of many of these reservoirs was established in the 1940s and 1950s. Revisiting these allocations given existing needs for water in Arkansas could prove necessary.

Develop Regional Water Management Districts – Water-management regions can be redefined based on surface water, groundwater and precipitation patterns, rather than county boundaries. These new regions wouldn't necessarily correspond to watersheds because groundwater does not follow watershed boundaries.

Protect "Soaking Zones" and Create Storage Areas – "Soaking Zones" encompass areas where water can soak into the ground to replenish aquifers. Texas and other surrounding states have established protected soaking zones

for aquifer maintenance. New major reservoir projects appear unlikely, but small-scale off-channel storage projects could capture surplus water during high-flow periods for use during low-flow periods.

Enact Enforceable Regulations – For the most part, water-withdrawal regulations, particularly groundwater withdrawal rules, are voluntary and nearly unenforceable. Some survey respondents suggested making the rules mandatory and subject to penalties as an effective means of water resources management. Other respondents favored economic incentives and volunteer approaches over regulations.

Move Water From Where It Is to Where It Is Needed – Arkansas could move toward the efficient transfer of water from areas with a surplus to areas with a shortage by adopting new or revised criteria for prioritizing water use and transfer. The new criteria could encourage use of economic tools such as water trading (e.g., a municipal wastewater utility contributing money to develop a grey water distribution system to reduce wastewater volume instead of paying more to expand the treatment facility) and water markets (e.g., municipalities paying farmers to reduce irrigation water use to ensure sustainability of municipal water supply) for cost-effective redistribution of water from areas or uses with surplus to those experiencing water shortage.

Encourage Water Conservation, Reuse, and Recycling – Farmers irrigating crops, catfish farmers and various industries employ conservation practices to reduce water use. More can follow their example by practicing conservation, recycling and re-use across the board at the commercial, municipal and household level.

Integrated Point/Nonpoint Source Management

Survey respondents also ranked water pollution as a high-priority issue for water in Arkansas. Current management of point-source industrial and municipal wastewater discharges differs from methods applied to nonpoint sources of pollution, even though their combined loads affect water resources. Permit systems typically regulate point-source and municipal stormwater discharges while education and voluntary practices help control nonpoint sources, such as agricultural runoff.

Implement Water Management Through One Agency – As suggested on page 31, integrated management of water quality issues may be improved by placing the responsibility for management of all aspects of state water (e.g., surface water and groundwater, quantity and quality) under a single agency.

Make Water Quality Data Readily Available – Several agencies and groups collect data on the quality of surface water and groundwater, but the



state lacks a central repository for this information. Organizations, agencies and groups that need this information would benefit from a centralized public data storage and retrieval system.

Spotlight Water Quality Benefits – We have a good idea of what it costs to treat water to meet water-quality standards, but we rarely hear about the monetary value of best-management practices, water treatment and water-quality management. Understanding benefits and costs not only will help with decision-making, but also help win public acceptance of those decisions.

A comprehensive, integrated approach is needed to resolve water issues. Piecemeal approaches got us where we are.

Pollutant Trading –The 1990 Clean Air Act Amendments authorized trading of air-pollution credits as a management tool. Some states have adopted a similar system of water-pollution trading as a way to establish economic markets that improve water quality. Under such a system, an industrial or municipal wastewater discharger could pay for programs to reduce pollutant loads from other sources (point or nonpoint)

in the watershed in lieu of modifying its treatment process. This approach achieves the goal of reducing total pollutant loads in the watershed, usually at a lower price than modifying the paying discharger's treatment process.

Water Laws and Regulations

Many Arkansans believe the development and adoption of a comprehensive set of laws and regulations governing surface water and groundwater use would benefit Arkansas' water resources. Piecemeal approaches got us where we are. A comprehensive, integrated approach could resolve water issues.



Vision 2025 – The governor could establish a Vision 2025 Committee to develop a model for sustainable water resources in the year 2025. This, in turn, could guide the development of a comprehensive water code or state water plan.

Comprehensive State Water Code Commission – The governor could appoint a Comprehensive State Water Code Commission, similar to the one created in 1981, to research and determine the need for an integrated set of laws governing water issues. Some survey respondents, however, believed the current laws and regulations are adequate.

Plan 2025 – In conjunction with a Comprehensive State Water Code Commission, the Arkansas Natural Resources Commission could partner

with other agencies and institutions to revise the existing Arkansas water plan and make it consistent with the vision for 2025 and any legislatively enacted water code. This document would describe the implementation of state laws and regulations. The 2001 Governor's Water Resource Task Force Report recommended a revision of the existing Arkansas water plan.

Water Summit – Representatives from all sectors could gather to brainstorm, discuss and debate the appropriate format for, and elements of a comprehensive set of laws and regulations pertaining to water, and of revisions to the Arkansas water plan. A water summit could show participants how water projects can integrate social, economic, and environmental concerns, provide multiple benefits and improve the overall quality of life in Arkansas.

A participatory process may take more time, but it will produce better long-term results.

Participatory Process

Nearly all the telephone-survey respondents indicated an interest in water and water resources, and expressed their opinions on myriad issues. The desire among respondents to participate in making decisions about water issues

affecting them emerged as an underlying theme during the survey.

Document Community Beliefs – We make decisions based on what we think is true through a set of mental models. But, sometimes, what we believe isn't true. Instead, it is perception. However, until we actually review what we think is true and compare it with the facts, we will find it difficult to change our beliefs and actions. A project that identifies what different population segments believe is true about various water resources issues could be useful in separating perceptions from facts.

Promote Water Watch or Similar Public Participation Programs – The Arkansas Game and Fish Commission assigns Stream Teams to promote stewardship of streams and stream fisheries within Arkansas. The state could consider similar volunteer efforts for all waterbodies of Arkansas, looking to Water Watch programs in Kentucky and Alabama as examples.

Build Trust – People work and participate with those they trust. Building trust helps achieve consensus when contentious issues arise. Determining how trust is built among different groups and organizations could help community leaders and others understand the current lack of trust and polarization among community groups on water issues, and begin building the trust needed to resolve their differences.



Leaders and Champions

A national study on water resources management identified three factors that have to be in place before most water issues are addressed. They are crisis, leadership and money – in that order. Unfortunately, many water resources issues reach the crisis stage before they are addressed. Leaders come forward in times of crisis. By this time, though, it is too late to implement many potentially viable solutions, even though their long-term benefits significantly outweigh short-term costs. Good leadership can sometimes avert crises and provide the time needed to put more cost-effective, benefit-rich solutions to work.

Leaders help avert crises, and then carry out innovative options with long-term benefits.

Provide Water Leadership Training

– Several institutions in Arkansas work with watershed organizations to provide training on technical approaches for watershed management. Watershed management, however, remains fundamentally a social activity – interacting with people to get things done in the watershed. A watershed leadership forum could help organizations support local leaders and champions for water issues in Arkansas.

Identify Community Leaders and Champions

– Arkansas communities offer programs to identify leaders and champions and provide them with educational training. Their education could cover information about water resources, infusing new leaders and champions throughout Arkansas with knowledge and understanding about the relationship between water issues and the long-term growth and prosperity of their communities.

Public Awareness and Outreach

Almost all survey respondents and people interviewed agreed that all sectors of society – elected officials, government officials, private business, industrial and agricultural interests, institutions, academics and private citizens – lacked sufficient awareness and understanding of water resources issues. Little effort has been made to provide the information they need about water in Arkansas. The respondents identified tools to improve public awareness and outreach, as discussed below.

Provide a Definitive Information Source on Water in Arkansas

– Non-technical individuals have no place to go for information about the multiple facets of water in Arkansas. An engaging and comprehensive electronic encyclopedia on water in Arkansas could provide a basic reference tool for developing educational materials for different target audiences.



Declare a “Decade of Water” in Arkansas

– The governor could designate the next 10 years as the “Decade of Water” in Arkansas. Activities could include development and distribution by state agencies of promotional material on the importance of water to economic and community development, to human and ecological health, to recreation and tourism, and to the aesthetic beauty of the Natural State. An Office of Water Information could cultivate public awareness and ensure promotional messages delivered by state agencies are coordinated, collaborative and consistent.

Engage Existing Organizations – Trade, professional and other civil-society institutions and organizations could use their existing educational and communication networks to raise awareness of water resources issues among their constituencies.

Educate the Kids – Primary, secondary, and post-secondary educational institutions need educational material, lesson plans and other information related to water resources issues.

Promote Stewardship – The ethics of water stewardship could become part of the educational information, materials and programs provided not only to the public, but also to private business, industry, agriculture and government agencies. Stewardship is defined as the responsible

management of resources that are not owned, but held in trust.

Adaptive Management

The water resources issues facing Arkansas did not surface overnight, nor will they be resolved quickly. Change is the only constant in our lives. As the physical, social, and economic environment changes, some solutions to and resolutions of current issues will no longer be appropriate. Mid-course corrections or new approaches will be needed. Adaptive management is a continuous cycle of: monitor => assess => evaluate => adapt, if needed => monitor => assess.... Read on for discussion of several options that promote adaptive management.



The companion report to this summary includes information about other tools, along with the pros and cons of applying them.

Improve Water Monitoring Networks – An adage in business is “What matters gets measured.” We currently cannot develop

an accurate picture of water availability and use for Arkansas because the data doesn’t exist. Designing, implementing and funding an effective water-quantity and water-quality monitoring network could help provide information needed for effective water-management decisions.

Identify, Track and Assess Performance Measures

– A revised and comprehensive water plan could identify explicit goals and strategies, socioeconomic indicators and water indicators to determine if the state is moving toward sustainable water resources. Other states have developed indicators that possibly could be modified and adapted for Arkansas.

Use “Water Watch” Programs Data – The volunteer programs discussed earlier could supplement the fixed monitoring network supported by government agencies. Judicious location of additional sites could significantly increase the data available for assessing the performance of management and regulatory practices and raise public participation in water resources management within Arkansas.

Integrated Themes

It’s easier to see some parts of the water cycle than others; surface-water lakes and streams are more visible than groundwater. Some parts only occur occasionally, such as rainstorms. However, sustaining every part is critical for water to continually cycle through our economy, society and environment. Similarly, it is critical to address each of the themes identified in this report if Arkansas is to avert a water crisis and move toward sustainable water resources.



how does the story end?

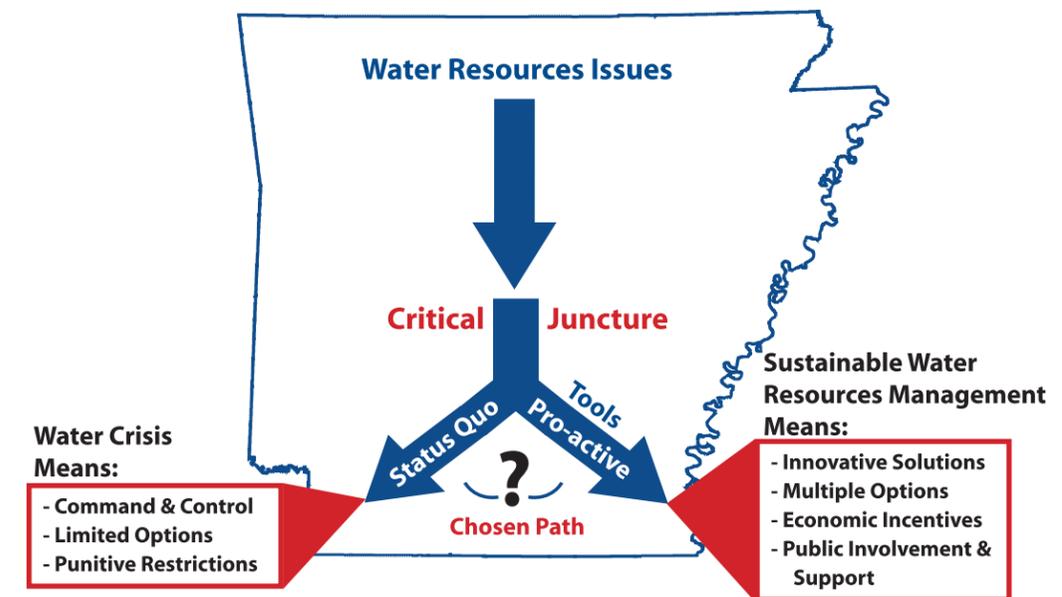
“The problem with water, though, is that the shortfalls don’t show up until the very end. You can go on pumping unsustainably until the day you run out. Then all you have is the recharge flow, which comes from precipitation. This is not decades away, this is years away.”

Lester Brown
Worldwatch Institute

Arkansas is at a critical juncture in water management. This summary has tried to tell the story of changes that have occurred over the past 25 years, identify the leading water-management issues, highlight fundamental truths about Arkansas water, propose desired outcomes, or the “happy ending,” that we assume most Arkansans would support and discuss some of the options to help us achieve these outcomes.

Most of the knowledge needed to address issues identified by the respondents interviewed for this study already exists.

There are leaders and champions in our communities. Public interest and volunteerism are rapidly increasing. Everything is poised for success. Water integrates environmental, economic and social concerns. When we address water issues, we also address social, economic and other environmental issues. Sustainable management of water resources could also move Arkansas toward economic and social sustainability over the next 25 years. The question is, which paths and options will Arkansans choose to continue this story?



about the authors

Kent Thornton, PhD, is a systems ecologist with FTN Associates, Ltd. His area of expertise is sustainable water resources management. FTN Associates, Ltd. is an engineering and environmental consulting firm with offices in Little Rock and Fayetteville, Baton Rouge, Louisiana, and Jackson, Mississippi. The firm's slogan is "We know H2O."

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WATER ISSUES IN ARKANSAS ADVISORY COMMITTEE

The study benefited greatly from the expertise of a diverse group of individuals serving in an advisory capacity. While the advisory committee's input helped guide the research, the conclusions and set of options put forward in this report are not necessarily those of the individual committee members.

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