

MISSOURI DEPARTMENT OF NATURAL RESOURCES



Missouri Water Resources Law

1998

Annual
Report



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Missouri Department of Natural Resources

Division of Geology and Land Survey

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Cover photo: Daut Mill in Ozark County. Photo by Jim Vandike.

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Missouri Water Resource Law

Sections 640.400 to 640.435 shall be known and may be cited as the “Missouri Water Resources Law,” in recognition of the significance of the conservation, development and appropriate use of water resources of Missouri.

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INTRODUCTION

This is the 1998 Annual Report for the Missouri Water Resources Law, as required in Section 640.426, RSMo. It provides an overview of the activities that the Missouri Department of Natural Resources (DNR) performs to meet the objectives of the law.

The report focuses upon the accomplishments of individual programs and relates program activities to those sections of the law that are addressed. The report

follows the same organizational structure as the law, beginning with Water Quality and Quantity. Each section starts with text from the law, followed by a brief discussion of how the department satisfies the requirements of the law. Through an accumulation of information from different programs throughout the department, each section emphasizes the progress that has been made in implementing the Water Resources Law.

Types of Water Systems

Public Water System— Provides water to at least 25 people at least 60 days a year or has at least 15 service connections. Public water systems can be publicly owned or privately owned. There are two types of public water systems, community and non-community.

Community Water System— Has at least 15 service connections used by year-around residents or regularly serves at least 25 residents year-around.

Non-community Water System— Serves an average of at least 25 persons at least 60 days a year.

Private Water System— Serves less than 25 people or has less than 15 service connections; for example, a private well serving a family.

WATER QUALITY AND QUANTITY

RSMo 640.400—The department shall ensure that the quality and quantity of the water resources of the state are maintained at the highest level practicable to support present and future beneficial uses. The department shall inventory, monitor and protect the available water resources in order to maintain water quality, protect the public health, safety and general economic welfare.

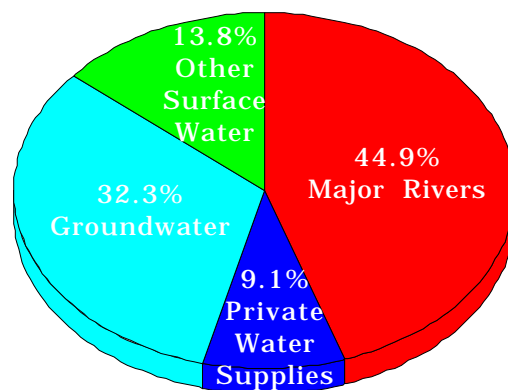
PUBLIC DRINKING WATER SYSTEMS

The Department of Natural Resources (DNR) regulates approximately 1,420 community and 1,270 non-community public water systems in Missouri that serve most of the state's population. Since drinking water can be a principal agent in the transmission of communicable diseases, these systems must be routinely inspected and samples from each system must be frequently analyzed. Regulation is carried out under the authority of the Missouri Safe Drinking Water Law. Without this protection, the incidence of water borne illnesses in the state could increase.

Drinking water quality is routinely monitored by the department, in cooperation with the Department of Health. The results provide early detection of potential

health problems. Sampling plans are developed that match the degree of contamination threat from a source or system to the type of contaminant and frequency of testing needed. Quality assurance and quality control plans for sample collection and analysis are developed for each contaminant group. To avert public health crises related to drinking water, the data are reported to the public water systems and regional office staff within a short period of time.

WHERE DOES MISSOURI'S DRINKING WATER COME FROM?



Raw water sources vary in quality and quantity from one area of the state to another. To produce finished water of satisfactory quality and quantity on a consistent basis, treatment plants must be designed specifically for the raw water sources. Department staff review engineering plans and reports for the construction or

renovation of public drinking water systems to ensure that essential sanitary standards are met. Construction permits are issued as appropriate. Department staff assure that all public water systems are properly operated and maintained and that they operate under a state permit. The permit outlines how the public water system should be operated to be in compliance with the law and regulations.

WASTEWATERDISCHARGES

Many agencies and organizations are closely associated with water quality issues, however, DNR is the agency responsible for maintaining and improving water quality in Missouri's streams, lakes and groundwater. It is also the agency responsible for enforcing the Missouri Clean Water Law.

Missouri water quality standards are rules made by the Missouri Clean Water Commission. The standards list the classified waters of the state, their beneficial uses, and the allowable concentrations of various pollutants.

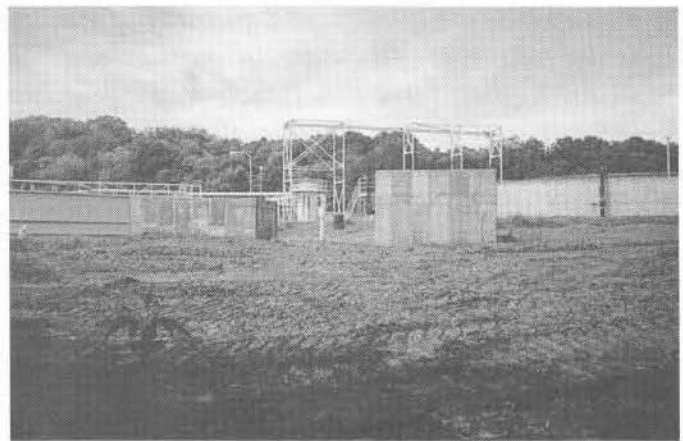
The department requires all point source discharges of contaminants (other than from single family residences and stormwater discharges) to obtain a water pollution control permit and comply with its terms.

Permits cover point-source discharges such as treated sewage from towns, subdivisions or businesses, industrial wastewater discharges, and runoff from large concentrated animal feeding operations (CAFOs), mines, quarries and chemical storage areas. The permits limit the amount of pollutants that can be discharged so that water quality standards set for streams, lakes, and groundwater are not violated.

Letters of Approval (LOA) are available for smaller animal feeding operations

(CAFOs). The letters ensure that properly designed facilities are constructed for holding animal wastes.

The Department of Natural Resources administers a program that distributes grants or low-interest loans for the construction of wastewater treatment facilities. The funds for this program come from the state and the U.S. Environmental Protection Agency. In 1997, this loan program dispensed loans valued at \$70 million, providing almost a \$25 million savings to participating communities.



Construction of Kansas City's Todd Creek Wastewater Facility was funded through DNR's Loan Program. Photo from DNR's KCRO.

The loan program has been in effect since 1990 and requires that most of the burden of funding falls on cities. From 1972 to 1992, a state-federal grant program funded up to 90 percent of the construction costs of wastewater treatment facilities, which helped meet the needs of both expanding populations and replacement of aging facilities. Today, there is concern about the ability of the present funding system to continue to meet construction needs.

Enforcement actions related to water pollution are sometimes necessary. During 1997, there were about 295 active cases involving violations of the Clean Water Law

or regulations. Of these, 88 cases were resolved, and the facilities returned to compliance during the year. These settlements included collection by DNR and the attorney general's office of more than \$300,000 for environmental damages and penalties.

NON-POINTSOURCE POLLUTION

Non-point source pollution (NPS) is defined as contamination caused by diffuse sources that are not regulated as point sources. This type of pollution is normally associated with agricultural, silvicultural and urban runoff, and runoff from construction activities. It results in human-made or human-induced alteration of the chemical, physical, biological or radiological integrity of the water. In practical terms, non-point source pollution does not result from a discharge at a specific single location (such as a pipe), but generally results from land runoff, precipitation, atmospheric deposition or percolation. In simpler terms, it is pollution which enters waterways by over-land flow or infiltration, as opposed to through conveyances such as pipes or channels.

By the early 1970s, many streams and lakes across the land had become open conduits for the nation's sewage and industrial wastes. With passage of the federal Water Pollution Control Act of 1972 (P.L. 92-500), Congress set in motion a massive clean-up. Throughout the following decades, hundreds of waste treatment facilities were constructed. Previously polluted streams and lakes became cleaner and aquatic life began to reappear. However, 24 years and billions of dollars later, we have not yet completely achieved the goals of water that is clean enough for swimming, recreational uses, and protection of aquatic life. Only

about half of today's pollutants come from pipes or point sources. The remainder are from non-point sources.

The State of Missouri operates a non-point source management plan designed to address these non-point sources. The goals and objectives of the Missouri non-point source efforts are to prevent further non-point source pollution in the waters of Missouri and to restore those segments presently not meeting or only partially attaining their designated beneficial uses.

Specific goals are:

- Enhance public awareness of solutions to non-point source pollution, and prevention of NPS pollution through education and outreach efforts such as Lakes of Missouri Volunteers, Stream Team Volunteer Monitors, and teacher training in water quality education.
- Support training and certification programs for those in the agricultural chemical industry who provide direct assistance and advice to agricultural producers and other sectors. For example, the National Agronomy Society recognizes Certified Crop Advisors who give advice to farmers in regard to farm chemical use. Efforts should help ensure the advisors' professionalism, environmental awareness, and that they provide accurate, informed assistance.
- Support development and presentation of training for citizens initiating and participating in watershed restoration projects.
- Maintain leadership and support for the Missouri Water Quality Coordinating Committee to continue to provide a forum for enhancing understanding, promoting implementing, and sharing nonpoint source information by local, state, and federal agencies and nongovernmental entities involved in water quality issues. Utilize this and other forums to

generate greater participation and build new alliances with the private sector.

- Support adoption of conservation practices that protect environmental quality without removing land from production, except in special cases (such as in small drinking water reservoir watersheds or for wellhead protection).
- Work with federal and state agencies such as the NRCS and the FSA (USDA) to maximize targeting federal and state resources toward watersheds of high non-point source priority, and to promote selection of management practices effective in reducing or preventing non-point source pollution and in improving stream and riparian habitat.
- Work with forestry and agricultural industry organizations to involve their memberships in non-point source pollution abatement activities and promote awareness through information and education efforts; for example, agricultural chemical dealers and sales representatives who take extension courses for continuing education units (CEUs).
- Promote innovative and cost-effective technologies that offer more effective or less expensive control measures, such as through “field days” and demonstrations.
- Provide technical assistance, cost-share assistance for innovative practices, promotional assistance and monitoring support for agricultural non-point source Special Area Land Treatment watershed projects implemented by staff of the Soil and Water Districts Commission.
- Support, technically and financially, implementation of non-point source watershed projects and demonstrations, particularly for those water bodies supplying water for drinking.
- Support, financially, demonstrations and technical assistance, on a regional or watershed basis, of practices such as

whole farm planning, integrated crop management, reduced nitrogen applications, pest scouting, riparian corridor reestablishment, appropriate animal waste management, and other practices and systems, which may be expected to contribute to environmentally sound farm management.

- Expand capabilities in geographic information systems for use in watershed assessments and prioritization.
- Actively seek new partnerships in the private sector, for example the Missouri Corn Growers Association is actively involved in water quality monitoring, and other commodity groups are becoming involved as partners.

The department currently is revising the Non-point Source Management Plan, which focuses the state and federal activities that are directed toward non-point source pollution and directs federal funds toward eligible management practices.

Letters of Approval or permits are offered for animal feeding operations (CAFOs) smaller than 1,000 animal units. The voluntary program was developed two decades ago and has been operated by the department as a free service to agricultural producers.

In 1995, DNR entered into an agreement with the Department of Agriculture to operate an agricultural loan program. Under this program, DNR will loan funds to the Agricultural and Small Business Development Authority (ASBDA). The ASBDA will use the funds to finance, at subsidized interest rates, animal waste facilities for producers. The loans are limited to animal feeding operations of less than 1,000 animal units. Producers' repayments are used by ASBDA to repay the loan from DNR. The department has committed \$10,000,000 to these loans. Another \$10,000,000 is available if the program is successful.

SOIL AND WATER CONSERVATION

Soil is a fragile natural resource capable of sustaining human life. All living things depend on the soil for food. Everything we eat, and most of what we wear come from the soil.

Today, farmers work soils intensively to produce food for a growing population. In Missouri, agriculture is one of the largest industries. Of the 44 million acres in the state, more than half (27 million) are devoted to agricultural production. Sometimes, however, agricultural production can contribute to erosion.

Erosion is a process where wind and water move crop-producing soil off the land. This topsoil often collects in ditches, along roadsides or ends up in our lakes, rivers and streams. To prevent this, many landowners employ various soil conservation practices on their farms. Controlling and preventing erosion on Missouri's farms helps ensure production and keeps food plentiful and prices reasonable for future generations.

Missouri is now a leader in soil conservation, but in the past the state had the second highest rate of soil erosion in the nation. In 1984, 1988, and again in 1996, Missourians voted for a one-tenth-of-one-percent sales tax to support soil and water conservation efforts and state parks. The tax money added a unique twist to an already strong mix of federal, state and local players working to save our soil.

Each county has a soil and water conservation district formed by a vote of eligible landowners in the county. These landowners also elect the board of supervisors to oversee the operations of the district. The supervisors work with the landowners and encourage them to participate in the district's voluntary programs. They work together to make decisions on the best treatments for the land.

The local districts work with the Missouri Soil and Water Districts Commission and the federal Natural Resources Conservation Service (NRCS) to administer the state soil and water conservation programs. The Commission sets the policy for the use of the tax money and administers it through DNR's Soil and Water Conservation Program. More than 75 percent of expenditures have gone back on the land. NRCS offers technical expertise to landowners on the best treatment or preventive measures for their land. Other cooperators include University Extension and the Missouri Departments of Agriculture and Conservation.

Missouri is now first in the nation in the rate of reducing soil erosion. But almost 5 million acres of agricultural land still need treatment. The Commission's work and goal for the coming years is outlined in its Plan for the Future.

The goal is to treat 95 percent of all agricultural land in the state by the year 2006. Through the programs that have been set up to do that, participants also will address agricultural run-off and water quality issues, and provide the state with a second benefit on its investment.

One way to do that is through the Special Area Land Treatment (SALT) Program. This program brings landowners in watersheds together to help solve soil erosion and water quality problems. Keeping soil and agricultural chemicals out of rivers and streams and on the land contributes to agricultural productivity and water quality.

PILOT AGRICULTURAL NON-POINT SOURCE (AGNPS) SPECIAL AREA LAND TREATMENT (SALT) PROJECTS

Currently, the SALT program is being expanded to address nonpoint source pollution issues associated with runoff from production agriculture. The SALT program

is a voluntary approach to natural resource management and conservation. A project grant is made available to local Soil and Water Conservation Districts to provide general support for the project, technical assistance, and information and education activities in the watershed. Financial assistance is available to landowners to encourage the adoption and implementation of best management practices. SALT projects are coordinated with the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA), and their Environmental Quality Incentive Program (EQIP), so that the same acreage does not have two projects at the same time.

The intent of the pilot AgNPS SALT projects is to provide a basic level of resources to make significant contributions to the control and reduction of nonpoint source water pollution from agricultural runoff. The concept is based on numerous partners contributing to the project and various tools utilized to accomplish project goals. Through joint efforts, limited resources and funding can be used in a cost-effective manner.

There are twelve pilot AgNPS SALT projects located in 19 counties throughout the state. SALT watersheds do not follow county boundaries, so there are five projects that overlap into more than one county. The twelve pilot projects are located in the following counties: Harrison, Grundy, Daviess, DeKalb, Clinton, Ray, Carroll, Chariton, Randolph, Howard, Saline, Boone, Osage, Bates, Laclede, Greene, Newton, Barry, and Stoddard.

Some of the water quality issues being addressed in the pilot projects include: Sedimentation, nitrification (by nitrogen and phosphorus), chemical contamination from pesticides and herbicides, loss of aquatic habitat, streambank erosion, fecal

coliform/bacteria from animal wastes, and karst groundwater contamination. Often, SALT projects provide a springboard for landowners to address additional natural resource problems. Landowners working together in this way can address additional resource goals, such as improved water quality and improved pasture management, along with erosion treatment and control.

Two programs that help landowners carry out these objectives are the cost-share and loan interest-share programs. The cost-share program funds up to 75 percent of the cost of installing conservation practices on agricultural land. The loan interest-share program refunds a portion of the interest on loans for purchasing conservation equipment.

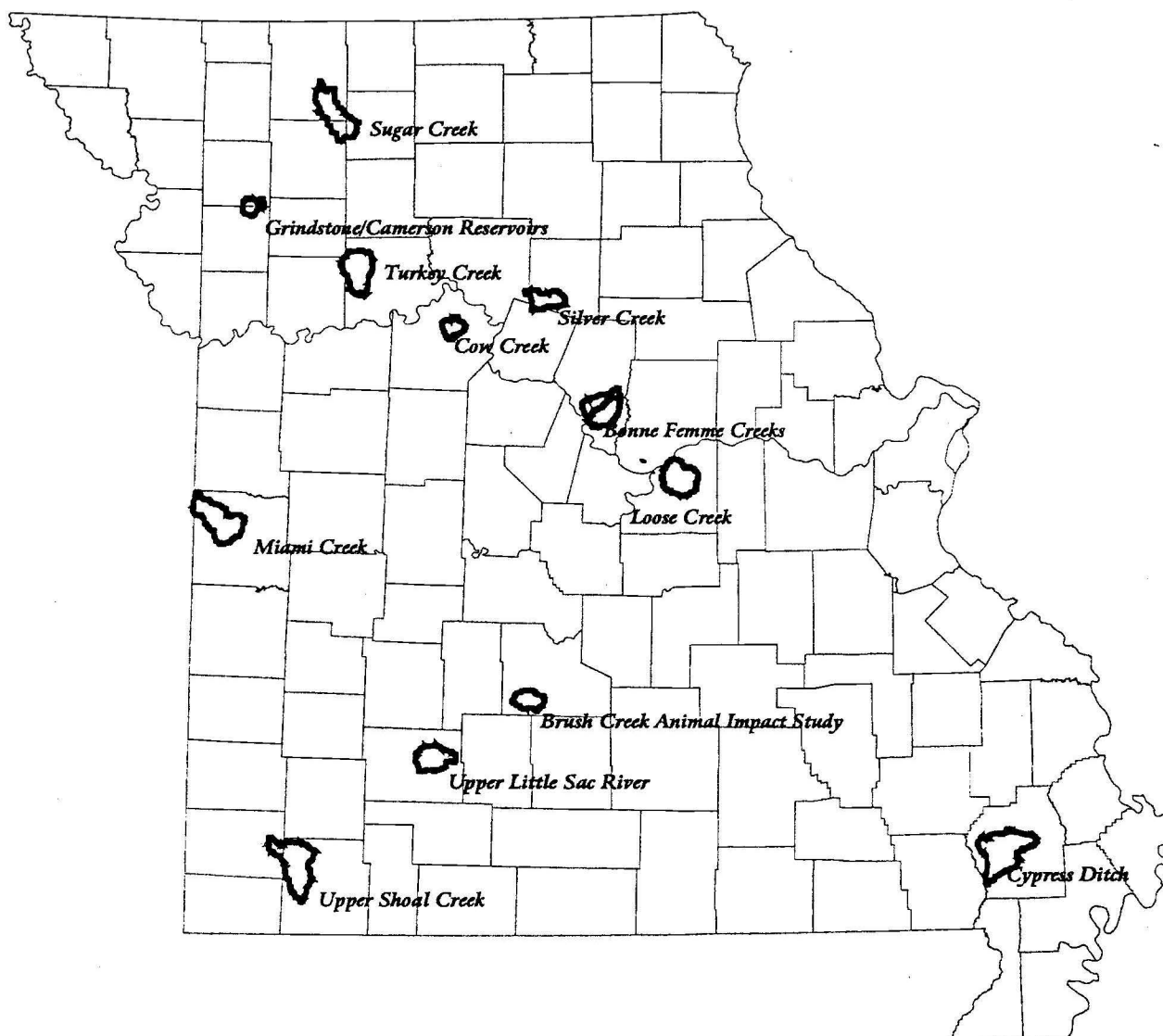
The commission considers local soil and water conservation districts to be the delivery system for its conservation programs. As such, a major point of the Plan for the Future is to strengthen the role of the local districts. Districts receive grants to provide technical assistance for landowners and other operational costs.

Finally, the Commission plans to assist in the completion of the first generation soil survey of Missouri by the year 2002.

Through this program, the state has installed nearly 100,000 conservation practices, saving more than 125 million tons of soil on about 1.2 million acres of cropland. Missouri is a leader in soil conservation as a result of soil and water conservation districts' work and the voluntary commitment of Missouri farmers. These soil successes will pay off for the state's water quality as well.

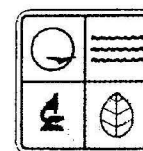
Through this program, the state has installed nearly 100,000 conservation practices, saving more than 135 million tons of soil on about 1.7 million acres of cropland.

Pilot Agricultural Non-Point SALT Projects



 Pilot AgNPS SALT
 County

Data layer created from maps provided to the Soil and Water Conservation Program from the District Offices.



Map created
by
Soil and Water Conservation Program
Missouri Division of Environmental Quality
Missouri Department of Natural Resources
December 1997

HAZARDOUS WASTES

The department regulates hazardous waste to protect human health and the environment and to ensure that any contamination is remediated as quickly as possible. The department oversees groundwater and surface water monitoring at hazardous waste sites within the state. As part of this oversight, hazardous waste facilities are required to determine the impact of past and present waste management practices on water quality. This includes determining the extent of contamination, the distribution of contamination and potential effect on other waters or water users. If contamination is found to pose a threat, the department will ensure remedial actions are taken.

Groundwater and surface water monitoring activities, and any subsequent remediation, can occur at four different types of sites:

- 1) Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal facilities (TSDs),
- 2) Superfund cleanup sites,
- 3) Voluntary cleanup sites, and
- 4) Leaking underground storage tank facilities.

The department may require RCRA TSD facilities whose practices might affect large bodies of surface water in Missouri to have a surface water monitoring program. Currently, nine RCRA TSD facilities in Missouri are monitoring surface water for various contaminants. These facilities are required to report to the department at least once per year. The results of the monitoring are examined and tracked by the department.

In accordance with state regulation, a TSD facility that is subject to federal groundwater monitoring requirements must conduct groundwater monitoring on a regular basis until released from such obligation by

the department. Currently, 46 TSD sites are conducting groundwater monitoring in Missouri. Of these 46 sites, 25 are actively remediating groundwater contamination to improve the quality of water that may ultimately migrate to surface water bodies or drinking water sources.

Each TSD facility must submit an annual groundwater monitoring report to the department for an official evaluation. The evaluation includes determination of contamination data trends and the extent of contamination resulting from TSD facility operation. All groundwater monitoring data from RCRA TSDs in Missouri is entered into a database where it can be tracked and evaluated.

There are additional RCRA facilities and Superfund sites in Missouri owned by the federal government. These sites, generally operated by the U.S. Department of Defense and Department of Energy, are also required to monitor groundwater for contamination. The Department of Natural Resources evaluates and tracks contamination data provided by these facilities in an annual report. There are 15 federal facilities currently required to monitor groundwater in Missouri. Of these 15 facilities, two facilities are actively remediating contaminated groundwater and three additional facilities are in the final design phase of remedial actions to be taken.

Additional hazardous waste sites fall under the "Superfund" law and its amendments. Superfund includes the authority to initiate surface and groundwater investigations and subsequent remedial actions. The Department of Natural Resources performs site assessments on potential Superfund sites and from these assessments, determines the degree of surface and groundwater investigations that will be required.

Currently, 54 Superfund sites are undergoing some type of groundwater investigation. An additional 44 sites are perform-

ing regular groundwater and surface water monitoring. Of the 54 sites, 22 are performing groundwater remediation. The Department of Natural Resources requires periodic reporting from these sites. Contamination concentrations and trends are tracked in order to recommend future actions.

In 1994, the department began allowing hazardous waste sites to implement their own voluntary cleanup, thus creating Missouri's Voluntary Cleanup Program. These sites must qualify first by virtue of not fitting into the RCRA TSD category or the Superfund National Priority List (NPL), and then must express the willingness to remediate their site by entering into a formal agreement with the department. Currently, 80 sites are undergoing voluntary cleanup, and 23 other sites have completed cleanup and received certificates of completion. Of the 80 sites undergoing cleanup, 38 sites involve groundwater monitoring or remediation, either in place now or expected to become part of the site cleanup.

The department regulates underground storage tanks to ensure that they are installed properly and to protect water in the state. The products in many leaking tanks are petroleum products or other hazardous materials that pose a threat when released into the subsurface. The goal is to minimize the impacts of leaking storage tanks on groundwater and surface water resources. Many of the confirmed active leaking tank sites in Missouri involve some type of groundwater monitoring and cleanup. Most groundwater involved is shallow and not used for drinking. Unfortunately, shallow aquifers affected by leaking tanks are often connected either to drinking water sources or discharge into surface waters. Monitoring of a site is required until it has been shown to be effectively remediated.

SOLID WASTES

Historically, some landfills have been a source of surface and groundwater contamination. As of April, 1994, stricter federal subtitle D design and operational requirements affected all operating landfills in Missouri. Some of the new requirements relate to establishing, developing and maintaining surface and groundwater monitoring. These include: detailed hydrogeologic investigations; installation of groundwater monitoring wells capable of detecting any contaminants which could leave the site; and installation of a composite liner and leachate collection system on areas that were not covered by waste as of April, 1994.

Another change that should help protect water quality in Missouri relates to the final "cover cap" requirements. Areas already landfilled but not properly closed will require a final cover cap of at least two feet of compacted clay and one foot of soil. All areas with a geomembrane liner (an impermeable material that does not allow liquids to pass through it) require cap designs that include a geomembrane, even if the areas were previously permitted for another final cover cap design.

WELLS

The "Water Well Drillers Act" was passed in 1985. By the fall of 1987, rules were in place governing the construction of domestic water wells, pump installations, and the plugging of abandoned wells. The drilling contractors and pump installation contractors were required to be permitted, and their rigs were required to be registered.

This law was passed to ensure that the quality of Missouri's groundwater is main-

tained at the highest level practical to support present and future use. The importance of this law and its enforcement plays a pivotal role in the protection of our groundwater. If wells are not constructed properly, they may allow surface water, with its contaminant load, to bypass the earth's natural filtering system and enter directly into drinking water aquifers.

An important amendment to this law was passed in 1991. The amendment brought the heatpump, monitoring well, and mineral test hole drilling industries under regulation. It also created the Well Installation Board. The department's Division of Geology and Land Survey, with the approval of the Well Installation Board, is responsible for implementation of the Water Well Drillers Act.

A total of 8,369 wells were reported drilled in 1997. This includes 7,065 water

wells, 1,049 monitoring wells and 255 heat pump wells. Also, 1,278 wells were reported plugged and 274 wells were reconstructed. Contractors are currently permitted in the following areas: 525 water well; 1,064 pump installation; 677 monitoring well; 344 heat pump; and 69 test hole. A total of 1,370 rigs were permitted for 1997.

As a tool to aid in proper well construction, the Division of Geology and Land Survey has been accumulating geologic information on wells since the early 1900s. Data on over 25,000 wells drilled within Missouri has been assembled into a database system to allow easy access and retrieval of the information. As new wells are drilled, additional data is added to the system to improve our understanding of subsurface geology in Missouri. In early 1997, a project to edit the data for consistency with current terminology was completed by Division staff.

OTHERWELLS

The Oil and Gas Law was passed in 1965. This law requires wells used for oil and gas production, water disposal, enhanced oil recovery, gas storage and geologic information to be constructed in a manner that does not contaminate surface and groundwater resources. Approximately 4,500 wells have been permitted since 1966. In 1997, 20 wells were permitted.

In addition to ensuring proper well construction, the oil and gas law requires a plugging bond to be placed on all permitted wells. This bond is required to be maintained until the wells are properly plugged. In the event an



Rotary drilling rig. Photo by Jim Vandike.

operator improperly abandons a well, the plugging bond is forfeited and the State of Missouri, working through the Missouri Oil and Gas Council, has the authority to plug the well.

The Underground Injection Control Program is an EPA-delegated program for which the State of Missouri has primacy. Injection wells have been divided into five classes by EPA, based upon the type of fluid injected and where it is injected in relation to underground sources of drinking water. Missouri has wells that fit into two of these classes - Class II and Class V.

Class II wells are oil- and gas-related injection wells. These wells may be used for the disposal of other fluids produced during oil extractions (mostly water) back into the producing horizon, or for enhanced recovery methods to increase production. These wells are subject to regulation under the Missouri Oil and Gas Law.

Class V wells (also called shallow injection wells) include a variety of well types that inject fluid into or above an underground source of drinking water. In Missouri, this well category includes mine backfill wells, septic systems (tank and lateral field), sinkholes improved for drainage purposes, heat pump systems, and injection wells utilized in groundwater clean-up projects. Septic systems are regulated by the Department of Health. Most other types of Class V injection wells are regulated through the Clean Water Law. The department administers the program and maintains an inventory of Class II and Class V wells.

RECLAMATION OF MINED LANDS

The mission of the Land Reclamation Commission is to ensure that active mined lands are restored to a condition that sup-

ports uses equal to or better than pre-mining conditions. Active mining regulation includes permitting, inspection and enforcement activities. The minerals regulated include coal, industrial minerals (clay, barite, limestone, sand and gravel, oil shale, and tar sands) and metallic minerals (lead, iron, zinc, copper, gold, and silver).

At active coal mines, surface water-quality is protected through National Pollutant Discharge Elimination System permitting. As for the protection of groundwater, coal mining companies are required, under land reclamation permits, to conduct hydrogeologic assessment prior to, during, and after mining. They evaluate any impacts to groundwater quantity or quality in the vicinity of mine sites. Mine operators are further required to mitigate any adverse effects stemming from mining activities.

For industrial minerals sites, the hydrogeologic evaluations are not required. Measures to control erosion and sediment movement off site are required. Under the Metallic Minerals Law, the three lead mining companies and the one iron ore mining company in Missouri are required to provide plans and financial assurance for the continued maintenance of the mine waste sites after mining ceases. The objective is to assure that the sites are stable and not subject to wind or water erosion of the waste materials (tailings). This primarily involves a coordination role to assure that dam safety, water pollution control, air pollution control, and hazardous waste management regulatory requirements are met.

An estimated 14,200 acres at approximately 700 industrial minerals mine sites are permitted for mining. Nearly 19,000 acres at 17 coal mine sites are permitted and are either actively being mined or are in various stages of reclamation. In addition, there are 14 bond forfeiture sites with ap-

proximately 5,100 acres that the department now has responsibility to reclaim. Six of these projects have been completed and eight are in various stages of reclamation design or construction. The ten lead mine sites and one iron ore mine site permitted under the Metallic Minerals Law comprise approximately 4,600 acres.

Serious health, safety, and environmental problems associated with pre-law abandoned mine lands are eliminated over time as funding becomes available through the Federal Abandoned Mine Land Program. Over 72,000 acres of coal mine lands have been disturbed in Missouri's history. Since 1989, several projects have been completed which have improved water quality on 3,700 of those acres. Since 1989, several projects have been completed which have improved water quality. These areas include: Huntsville Gob II in Randolph County; Keota Gob in Macon County; Sweet Spring Creek in Randolph County; Crutchfield in Randolph County; Tebo Creek in Henry and Johnson counties; three separate Cedar Creek projects in Boone and Callaway counties; Middle River in Callaway County; and Upper Cedar Creek Watershed Reclamation in Boone and Cal-

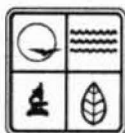
laway counties. Other projects include the closure of abandoned mine shafts and the stabilization of several mining subsidence sites.

EMERGENCY RESPONSE

The department staffs a 24-hour telephone line for reporting environmental emergencies, and maintains a unit that responds to the scene of environmental emergencies when situations warrant. Response personnel are trained to provide technical assistance concerning response, containment and cleanup of hazardous materials. This assistance includes responding to emergencies on the Missouri River and the Mississippi River, for which the department utilizes a 24-foot vessel equipped with specialized response gear. In FY '97, nearly 1,750 incidents were reported, for which DNR staff provided assistance. Staff have been assigned to five of the regional offices to improve response capability. Each region has a primary emergency response vehicle, supplied with specialized equipment, to assist in mitigation of emergencies.



Each DNR Regional Office has a primary emergency response vehicle, supplied with specialized equipment, to assist in mitigation of emergencies. Photo from DNR's Environmental Services Program.



MISSOURI DEPARTMENT OF NATURAL RESOURCES

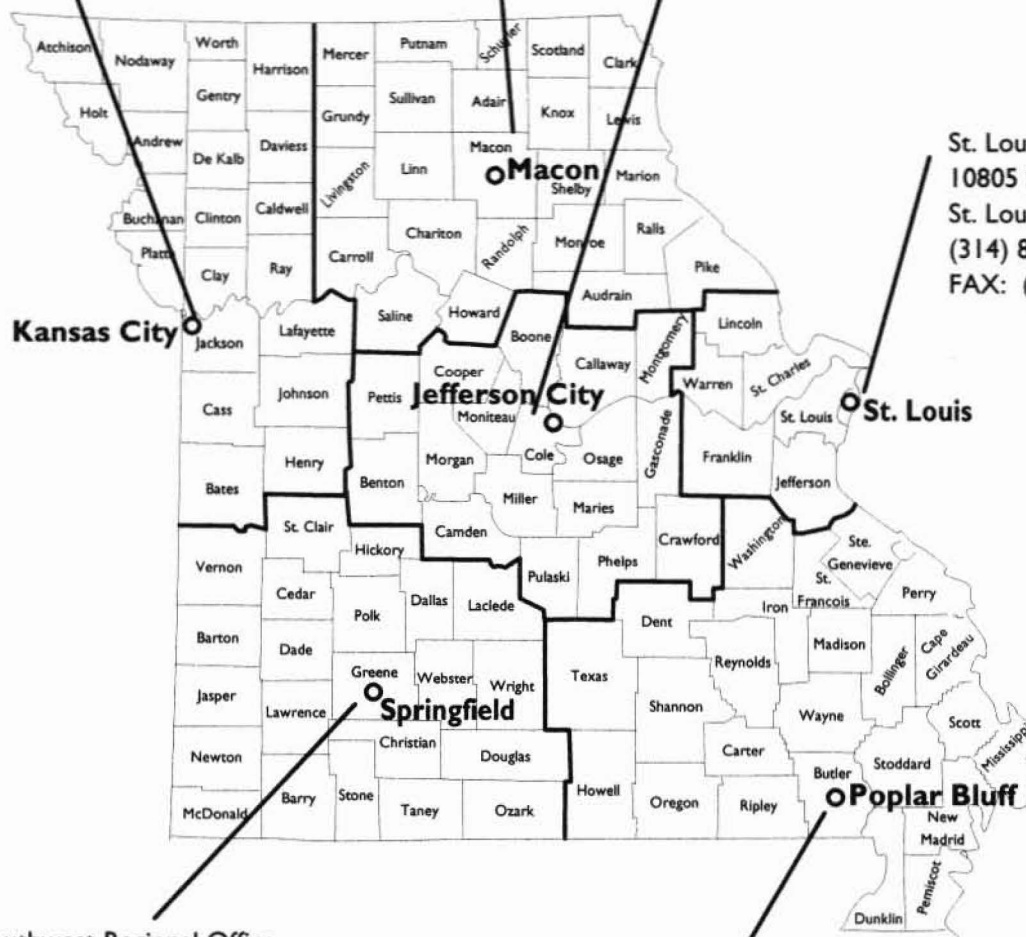
DIVISION OF ENVIRONMENTAL QUALITY

REGIONAL OFFICES

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FAX: (816) 554-4142

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INTERSTATE USE OF WATER

RSMo 640.405—The department shall represent and protect the interests of the state of Missouri in all matters pertaining to interstate use of water, including the negotiation of interstate compacts and agreements, subject to the approval of the general assembly. Any department of state government affected by any compact or agreement shall be consulted prior to any final agreement.

Missouri shares the waters of its major rivers with 19 other states. Upstream states and Indian tribes can use water from these rivers before they reach Missouri. Also, federal agencies manage much of this water. To make sure that Missouri's interests are considered, the department represents the state of Missouri in the following river basin associations:

UPPER MISSISSIPPI RIVER BASIN ASSOCIATION

The Upper Mississippi River Basin Association (UMRBA) is made up of representatives of Missouri, Wisconsin, Minnesota, Iowa and Illinois. Governor Carnahan appointed Steve Mahfood, director of DNR, as Missouri's representative in UMRBA.

The Association developed a master plan to balance economic development with environmental improvement on the

upper Mississippi River. UMRBA works through Congress and the states to carry out provisions in the master plan, and pursues a legislative agenda as agreed upon by the board members. The Association also serves in an oversight or review capacity for the ongoing Mississippi River Navigation Study, scheduled for completion in 1999, to improve river transportation with attention given to environmental concerns. The Association has been very successful at bringing in federal funding to enhance the Mississippi River.

The department is also participating in the development of a report to Congress on the progress of the UMRBA Environmental Management Program.

MISSOURI RIVER BASIN ASSOCIATION

Membership of the Missouri River Basin Association (MRBA) includes Missouri, Kansas, Iowa, Nebraska, North Dakota, South Dakota, Montana, and Wyoming, plus one member representing Indian tribes. Governor Carnahan appointed Steve Mahfood, director of DNR, as Missouri's representative in MRBA. The Association is currently working with the U.S. Army Corps of Engineers on revising the Master Water Control Manual for the Missouri River. It

also pursues a legislative agenda as agreed upon by its Board of Directors, and provides a forum for the discussion of contemporary water resource issues in the basin, such as tribal water rights, flow management, agricultural issues, and endangered species.

For the past 10 years, the states of the Missouri River basin have been embroiled in controversy over how the river should be managed. The disagreement, brought on by severe and persistent drought that began about 1988 and ended with the Great Flood of '93, focuses on the requirements embodied in the Missouri River Master Water Control Manual. This document, familiarly called the "Master Manual," guides the Corps' Reservoir Control Center in Omaha. The Control Center operates the system of dams and reservoirs that enable management of the river's flow.

The Master Manual was written to direct the Corps' administration of the Water Development Act of 1944, which authorized construction of the dams and directed the Corps to provide benefits as specified in the legislation. As long as rainfall in the basin was normal or above, there was little disagreement between the states of the upper basin and those of the lower river. However, the system was not severely tested by drought until reservoirs began to be drawn down in response to the six-year drought that began in the late 1980s.

The crux of the disagreement is fundamental. Upper basin states contend that reservoir levels ought to be held at high levels—even in drought—to protect the recreational industry that has developed around the six large lakes on the upper river. The downstream states view this position with considerable alarm, because it would deny them the use of a significant share of the water stored in the reservoirs.

In effect, if the upstream states were to be successful in changing the management

strategy to meet their demands, it would completely compromise the purposes for which the system was designed and built. The design objectives for the system were to store water in wet seasons, and release it in dry seasons, to provide flood control, navigation, water supply, power generation, irrigation water, and fish and wildlife benefits throughout even the most severe droughts.

During the past two years, the MRBA has been developing recommendations for improving the river.

ARKANSAS-WHITE-REDBASINS INTER-AGENCY COMMITTEE

The Arkansas-White-Red Basins Inter-Agency Committee (AWRBIAC) includes representatives from the states of Missouri, Arkansas, Louisiana, Texas, Oklahoma, Kansas and New Mexico. Governor Carnahan appointed Steve Mahfood, director of DNR, as Missouri's representative in AWRBIAC. Federal agencies in AWRBIAC include Dept. of the Interior, U.S. Geological Survey, Bureau of Reclamation, National Oceanic and Atmospheric Agency, Federal Emergency Management Agency, U.S. Army Corps of Engineers, and Natural Resources Conservation Service.

The committee exists primarily for coordination and communication purposes. Administration and hosting of meetings are rotated among both state and federal members. The primary activity of interest to Missouri is the development of a revised operating plan for the White River, which includes Table Rock Dam, Clearwater Dam, and part of Lake Norfork in Missouri. Also of interest is the development of abatement measures and methodology to improve dissolved oxygen content of tailwaters of White River dams. A new operating plan for the White River has been developed that

improves economic return while addressing issues related to low dissolved oxygen in tailwaters from hydropower dams.

LOWER MISSISSIPPI RIVER CONSERVATION COMMITTEE

The Lower Mississippi River Conservation Committee (LMRCC) has membership which includes the states of Missouri, Tennessee, Kentucky, Arkansas and Louisiana. Federal agencies represented include the U.S. Army Corps of Engineers, Environmental Protection Agency, U.S. Geological Survey, Natural Resources Conservation Service and U.S. Fish & Wildlife Service.

The LMRCC differs from other basin associations by including both fish and wildlife agencies as well as environmental regulatory agencies. The LMRCC has several operating committees that deal with specific subsets of lower Mississippi interests, such as fish and wildlife and water quality.

Missouri chaired the LMRCC in 1997. The LMRCC is addressing several water quality issues, including Gulf hypoxia. Hypoxia is thought to be caused by excessive nutrients in Mississippi River water flowing into the Gulf of Mexico. High nutrient levels ultimately result in oxygen depletion and the development of a widespread "dead zone" in the Gulf that has been characterized as the marine equivalent of the "ozone hole" over Antarctica. This is an issue for Missouri because the source of nutrients has been identified as nitrates and phosphates coming from grain-producing states in the Midwest, both point sources and non-point sources.

MISSISSIPPI RIVER PARKWAY COMMISSION

The membership of the Mississippi River Parkway Commission (MRPC) includes all states of the Mississippi River main stem, plus various other agencies and interest groups. The MRPC's major thrust is toward improving opportunities for tourism growth along the Mississippi River corridor from New Orleans to St. Paul.

In 1997, Governor Carnahan appointed four commissioners and the Missouri legislature appointed four members, to form a revitalized Missouri commission. The department participates in a technical advisory capacity, with the Missouri Departments of Transportation and Conservation, and the Division of Tourism.

Missouri's participation in the MRPC has focused on improving the environmental quality of the river corridor as a way to increase the region's attractiveness to tourism and economic development.

MISSISSIPPI RIVER BASIN ALLIANCE

The Mississippi River Basin Alliance (MRBA) includes both individual and agency/corporate memberships. It is a relatively new organization that focuses on environmental issues throughout the Mississippi River basin. Various committees focus their energies on issues of current importance, such as environmental justice, non-point source pollution, legislative agenda, and monitoring federal initiatives.

The MRBA meets annually, usually in St. Louis, for technical sessions and training activities.

MONITOR WATER QUALITY

RSMo 640.409 calls for the department to establish, develop and maintain an ongoing statewide surface and groundwater monitoring program, the purposes of which are the following: 1) determination of ambient surface and groundwater quality for use as background or baseline water quality data; 2) detection of trends in the character and concentration of contaminants in surface and groundwater resources; and 3) identification of areas highly vulnerable to contamination.

The Department of Natural Resources conducts an extensive monitoring program for chemicals in public drinking water systems. In FY 97, approximately 2,700 public water supplies were tested, with over 46,000 samples analyzed. This effort covers both surface and groundwater sources.

Most of the tests are performed on tap water, the "finished" water that people drink or use for cooking; this is water after treatment. Some "raw" water monitoring also is done to provide operational data to water system operators, and to help them in their treatment processes. For example, well water is tested to help the water companies know what is entering their water works.

The department is also testing for disinfection by-products (DBPs) in water, such as trihalomethanes, to help water suppliers comply with regulations that EPA will be making final in the near future. Trihalo-

methanes (THMs) are one family of DBPs. They are potentially cancer-causing agents, and have been regulated in drinking water since 1981 under Missouri regulations. To prepare Missouri's small surface water systems for the new EPA requirements, DNR has been providing THM testing since January, 1996.

A part of the monitoring plan is a vulnerability assessment performed to support the "waiver of monitoring" requirements. This indicates various threats to specific public water supplies and allows that information to be considered in establishing monitoring requirements.

The Public Drinking Water Program uses a vulnerability assessment to determine which sources of drinking water need to be tested for certain chemicals. If certain chemicals are located in a geographic area that may potentially affect a drinking water source, that source is monitored for the presence of that chemical in the water. This allows the cost of analysis to be focused on the vulnerable sources. Without these assessments, the department would have to test every source for every chemical listed by EPA. Vulnerability assessments save Missouri approximately \$4.5 million per year.

The department studies the recharge areas of springs, and delineates losing streams and sinkholes to determine areas

where groundwater is particularly prone to contamination. Harmless fluorescent dyes are used to trace the movement of groundwater from its recharge area to its discharge point.

Since 1989, the department has performed numerous water traces in karst areas where groundwater resources can easily become contaminated by surface activities. In karst areas, much surface water is channelled underground in losing streams and sinkholes. The water lost to the subsurface typically resurfaces, sometimes as far as 40 miles away, at a spring or springs. Water wells between the recharge point and the receiving spring can be affected by contaminants entering losing streams and sinkholes.

The results of individual dye traces are stored in the department's Dye Trace Data Base. Since 1989, several reports have been published that describe in-depth studies of several major spring systems (*Hydrogeology of the Bennett Spring Area, Laclede, Dallas, Webster, and Wright Counties, Missouri*, Water Resources Report No. 38; and *Hydrogeology of the Maramec Spring Area*, Water Resources Report No. 55).

The Water Well Drillers Law requires that all persons engaged in water tracing register with the department and renew the registration annually. All proposed injections must be reported to the department's Division of Geology and Land Survey prior to injection of dye, and written and graphical documentation of traces is provided to the department within 30 days after completion of each trace. The information will be provided to interested parties upon request at cost of reproduction. For the trace to be included in the department's dye trace data base, the data must be examined by a three-member Dye Trace Committee. If the data quality and documentation is satisfactory, then the results are entered into the department dye trace data base.

Compliance monitoring is performed to test wastewater from facilities with National Pollutant Discharge Elimination System (NPDES) state operating permits. In FY 97, over 1,000 analyses were performed to determine compliance with the Clean Water Law, state regulations, and the NPDES permit.

The department performs a variety of water- and sediment-quality investigations each year in the form of complaint investigations, wasteload allocations, ecological risk assessments, and fish tissue contaminant monitoring. Department biologists are currently developing aquatic macroinvertebrate-based "biocriteria" for assessing stream quality in each eco-region of the state. These criteria will eventually be incorporated into the state water quality standards.

Due to the Flood of 1993, a federally-funded sanitary landfill monitoring project for flood damaged sanitary landfills was implemented. Effects of the flood included periods of surface ponding, soil saturation, an elevated groundwater table and increased velocity in the subsurface movement of water. The department received equipment and training to monitor landfills that operated before and after the flood to determine if any surface or groundwater contamination occurred.

The results of the study indicated that landfills contributed no measurable contamination of surface water off-site. Also, no impact to groundwater could be determined to have taken place. However, many of the landfills studied did experience a significant increase in the migration of landfill gas (methane) through the soil away from their facilities.

Some of these migrations present a potential public safety problem due to the dangers associated with explosion, if the gas should accumulate in nearby structures. Through an extension of the original project, further study is underway to gain a better understanding of what can be done to evaluate and address these migrations.

SURFACE WATER QUALITY MONITORING

The major purposes of the water quality monitoring program are to (1) characterize “background” or “reference” water quality conditions, (2) better understand flow event, and diurnal and seasonal water quality variation and its underlying processes, (3) characterize aquatic biological communities and habitats, and distinguish between the impacts of water and habitat quality, (4) assess time trends in water quality, (5) characterize specific and regional impacts of point and non-point source discharges on water quality and, (6) to check for compliance with water quality standards or wastewater permit limits.

All of these objectives are statewide in scope. Reference conditions of water chemistry and of aquatic macroinvertebrates have been or are being used to develop water quality standards. Due to the cost of environmental monitoring, the department routinely coordinates its monitoring activities with other state and federal agencies.

The strategy for monitoring varies by the waters being sampled. Many water quality monitoring strategies exist including monitoring effluent discharges, monitoring the impacts of discharges upon localized surface waters, monitoring extended impacts from effluent sources, and conducting surveys of “background” conditions. The monitoring activities through which these strategies are implemented take several forms:

- 1.) Fixed station chemical monitoring networks
- 2.) Intensive surveys
- 3.) Special topic monitoring (fish kill investigations, bacterial monitoring, contaminant transport studies, etc.)

- 4.) Toxics monitoring
- 5.) Biological monitoring (of aquatic macroinvertebrates)
- 6.) Fish tissue, sediment, and shellfish monitoring.

MONITORING PROGRAM EVALUATION

The water quality monitoring program within the department evolved as a program to characterize and cope with point source wastewater discharges. This program, which has stressed chemical monitoring, appears to have been successful.

In 1997, the department will shift the emphasis of monitoring programs in the following ways: (1) maintain the size of the fixed station flow and chemistry network, and include chemical analysis of sediments in some streams; (2) increase the amount of intensive chemical and biological water quality studies; and (3) increase the amount of aquatic invertebrate sampling statewide toward the development of biological criteria within the water quality standards.

The major reasons for these changes are the perception that: (1) more large municipal or industrial wastewater discharges need substantial water quality study to fully understand their impacts on receiving waters than the department is presently able to conduct, (2) biological criteria may be better than conventional chemical monitoring for characterizing many non-point pollution sources, (3) many problems in streams are not due to water chemistry problems, but to physical problems in the stream channel, in the riparian zone, or farther up in the watershed.

The biggest challenge will be to find a way to assess the water quality impact of thousands of confined animal feeding operations across the state. To date, the De-

partment of Natural Resources and the Department of Conservation have been able to investigate and document at least a portion of all discharges that have caused fish kills,

but no monitoring program has ever tried to assess the day-to-day subacute impacts of these pollution sources, which may be significant.



Water-quality investigations include streamside analysis of water chemistry. Photo from DNR's Environmental Services Program.



Macro-invertebrate sampling is an integral part of determining the overall condition of Missouri's aquatic resources. Photo from DNR's Environmental Services Program.

INVENTORY WATER USE AND AVAILABILITY

RSMo 640.412—The department shall maintain an inventory on ground and surface water uses, quantity and users.—The department shall inventory the following: 1) existing surface and groundwater uses; 2) quantity of surface and groundwater available for uses in the future; 3) and water extraction and use patterns.

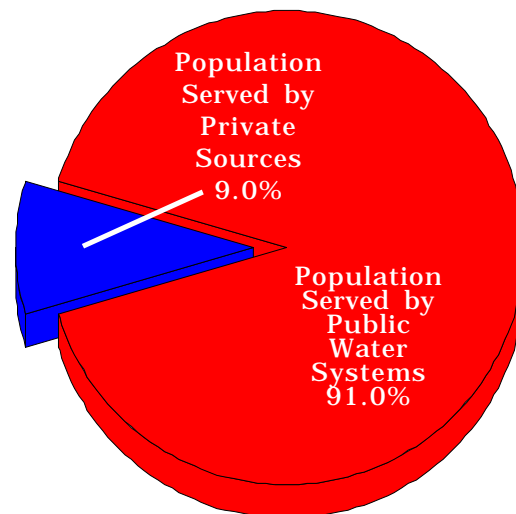
WATER USE

As part of the Major Water Users Law (RSMo 256.400), the department compiles water use information. Major water users are defined as those users that are capable of pumping greater than 100,000 gallons per day from either groundwater or surface water. There are 1,878 users registered. There is no penalty for failing to report. Most likely, there are many major water users that do not report. The Major Water User Database includes information about location, amount of water used and type of use (domestic, municipal, irrigation, recreation, industrial, electrical generation, fish and wildlife, and drainage.)

Public drinking water systems are significant users of both surface and groundwater. The Census of Missouri Public Water Systems, published by the department, provides many details about water

use by public water systems. It includes the water source, the production capacity and average daily consumption, the location of surface water intakes, and the number of customers served. Today, there are 1,400 public water systems serving cities, water districts, subdivisions, trailer parks, and institutions. Almost 5 million citizens of Missouri use public water systems as their source of water. The total production capacity of our community water systems is 2,579.5 million gallons daily (MGD), with an average consumption of 1,146 MGD.

DRINKING WATER PROVIDED TO MISSOURI CITIZENS BY PUBLIC WATER SYSTEMS AND PRIVATE SOURCES



GROUNDWATER AVAILABILITY

Most cities in southern Missouri rely on groundwater for all of their water-supply needs. The department is sometimes called upon to determine if the amount of water being used is causing long-term water level changes in aquifers, or causing water quality changes. The results of some of these studies have been published (i.e. *A Hydrologic Analysis of the Ozark Aquifer in the Rolla Area*, Water Resources Report No. 41; *Hydrogeologic Investigation of the Fulbright Area, Greene County, Missouri*, Water Resources Report No. 43).

The department operates and maintains a network of approximately 50 groundwater-level observation wells throughout the state that are equipped with automatic recorders. The recorders measure and record the distance from land surface to the water level in the well. Water levels in the wells change in response to changes in natural conditions. Precipitation will generally cause a decrease in the depth-to-water in shallow wells. During extended periods of dry weather, depth-to-water in most wells increases as water drains from the aquifer through springs and streams. Water levels also change in response to pumping. The observation well network is used to monitor the quantity of water available from particular aquifers across the state.

The data from the observation well network is processed and published in an annual report (currently available through Water Year 1993). The data reports contain the average daily water level for each station, a graphic representation of the data, and daily precipitation from the nearest National Weather Service recording station.

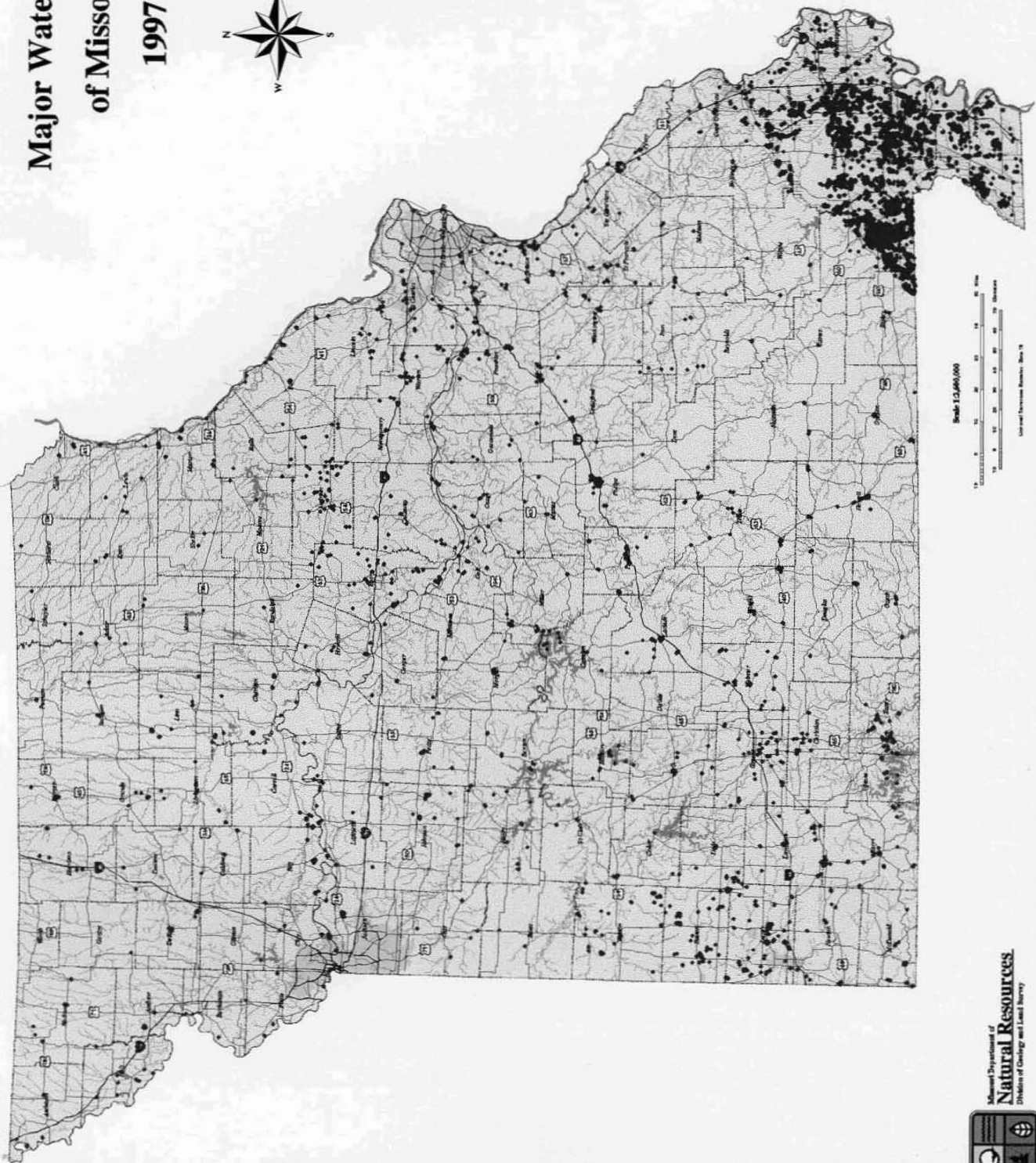
Recently published is the *Hydrology of Maramec Spring*, Water Resources Report No. 55. This report contains information on the history, geology, and hydrology of Maramec Spring's recharge area, and its water quality. Among other things, the 98-page book describes the exposed bedrock, the caves, the sinkholes, the springs, and the losing streams in the area of Maramec Spring, Missouri's fifth largest spring.

This publication was paid for in part by a grant from the Water Pollution Control Program, DEQ. It and other Water Resources Reports can be obtained from the Maps and Publications Desk, DGLS, Rolla.

SURFACE WATER AVAILABILITY

The department is a cooperator in the U.S. Geological Survey program that collects and publishes water data for Missouri's surface and groundwater resources. Substantial amounts of surface and groundwater information have been collected through this effort, and published annually in a report series entitled *Water Resources Data—Missouri*. Records have been collected in this manner for nearly 75 years. The scope of data collection efforts has widened to include surface and groundwater quality information. Presently, the stream-gaging network monitors flow and stage at 109 stations, the stage at 12 lakes and reservoirs, and surface water quality at 58 sites statewide (including 2 lakes and reservoirs). Water quality stations include physical, chemical, and biological parameters such as water temperatures, specific conductance, dissolved oxygen, pH, carbonate, bicarbonate, alkalinity, inorganic constituents, nutrients, trace elements, indicator bacteria, sediment, and pesticides.

Major Water Users of Missouri 1997



Scale 1:3,000,000



United States National Map Series 19

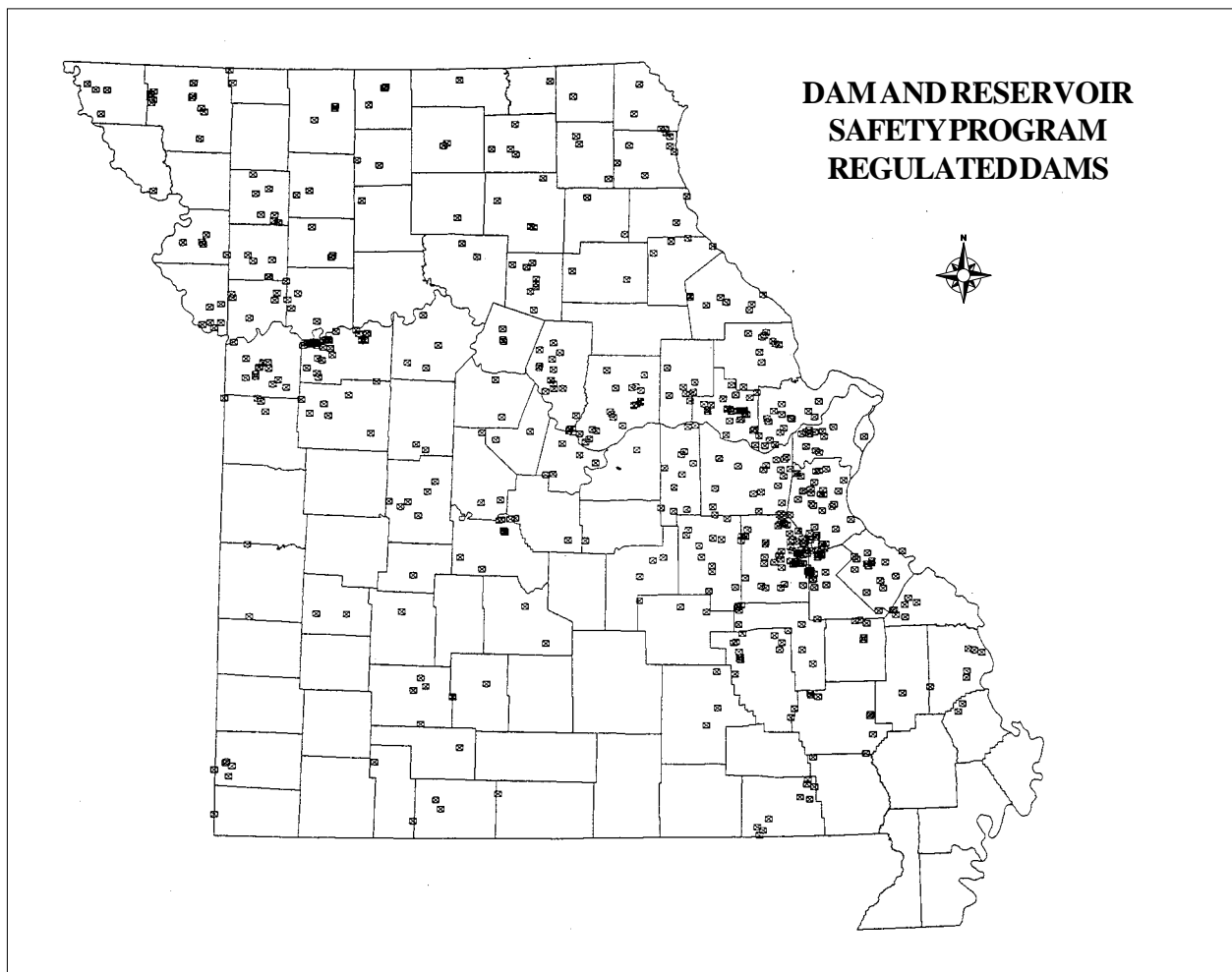


DAMSAFETY

The department maintains two databases on dams in the state. The STATUS database contains only those dams that are regulated in accordance with Chapter 236 of the Revised Statutes of Missouri. This includes dams that are 35 feet or more in height as measured from the crest to the downstream toe of the dam. The number of dams currently included in this database is 613. The database includes spatial and physical data, downstream hazard classifications, ownership information, water use, and the current regulatory status of each dam.

The NATDAM database is maintained through a continuing contract with the Fed-

eral Emergency Management Agency (FEMA) and the Association of State Dam Safety Officials. This database includes dams that meet the height and storage criteria established by FEMA and are identical to the criteria established by the U.S. Army Corps of Engineers for the original national inventory compiled in the 1970s. Dams which are 25 feet or more in height with a storage volume of at least 15 acre-feet, or which are 6 feet or more in height with a storage volume of at least 50 acre-feet, are included in this inventory. The number of dams currently inventoried in this database is 4,037. The database includes spatial and physical data, downstream hazard rating, water use, ownership information and purpose of the dam.



STATE WATER PLAN

640.415—1. The department shall develop, maintain and periodically update a state water plan for a long-range, comprehensive statewide program for the use of surface water and groundwater resources of the state, including existing and future need for drinking water supplies, agriculture, industry, recreation, environmental protection and related needs. This plan shall be known as the “State Water Resources Plan.”

2. The department shall establish procedures to ensure public participation in the development and revision of the state water plan.

3. The department shall submit a report to the general assembly at least one year prior to the submission of the state water resources plan, and may recommend any statutory revision which may be necessary to implement the requirements of this section. The plan shall be submitted to the general assembly for approval or disapproval by concurrent resolution.

BACKGROUND

Since 1989, when the Water Resources Law was passed by the Legislature, DNR has undertaken activities to address and fulfill the requirements set forth in RSMo 640.415. Specifically, these activities in-

clude public participation, issue identification, needs assessment, resource inventory, and multi-level planning and coordination.

DNR has sought public input through the use of various forums that have included statewide public meetings and conferences, regional meetings and stakeholder meetings. This effort has included the Missouri Rural Opportunities Council (which is composed of various private groups as well as state and federal agencies), Regional Planning Commissions, the Water Quality Coordinating Committee, the Missouri Irrigators Association, Missouri Association of Counties, the Clean Water Commission, Distributive Educational Clubs of America, DNR sponsored “Open Houses,” the Small Watershed Program Conference, Ozark Scenic Riverways Association, and the Missouri Municipal League. These public input forums serve to support, enrich, and further define the water resource issues first defined in 1990, identify new issues, and inform and educate the public on the broader, and often interrelated, water resource planning issues.

An example of this is the joint effort by the Department of Economic Development, Regional Planning Commissions and DNR. A series of 18 meetings were held throughout the state to solicit public comment on the issues, problems and needs

associated with rural water supply. This effort resulted in a set of recommendations that will improve rural water supply development funding if implemented.

Another very successful public participation activity was related to the issues surrounding the interstate flow and use of the Missouri River. A series of four conferences were held across the state to bring together a Missouri River constituency. These conferences not only provided an informational forum for Missouri citizens and businesses but attracted attendees from as far as Montana and Louisiana. The meetings served to heighten awareness of the issues and to identify the needs of the people of the state concerning the operation of the Missouri River.

Following the passage of the 1989 Water Resource Law, DNR prepared the *1990 Pre-Annual Status Report*. This report provided the initial step in issue identification and needs assessment by listing fifty-two water resource issues facing the state and its citizens. The issues were divided into five categories: water management, water conservation, water quality, water development, and research/studies. Additionally, each identified issue was prioritized as: a) requiring immediate action due to its impact on public health, the environment or economic prosperity, b) important issues requiring study and attention, or c) long-term water resource issues which require data and/or extensive evaluation and analysis.

Through a coordination and planning effort, the issue of drought was addressed; resulting in the development of the *Missouri Drought Response Plan*, Water Resources Report No. 44, 1995. This plan was prepared by DNR with the cooperation and support of the Missouri departments of Agriculture, Public Safety, Health, Conservation, Economic Development, the Universi-

ty of Missouri-Columbia and others. This plan establishes processes for drought monitoring, and coordinated advanced planning and response. It complements and supports the State Consolidated Plan and the State Emergency Operations Plan. Its basic purpose is to lessen the negative impact of drought on Missouri citizens through coordinated resources management and response.

STATE WATER PLAN VOLUMES

The department is completing a series of technical documents to provide basic information about Missouri's surface water, groundwater, water use, water quality, interstate issues, hydrologic extremes and water law. These volumes will assist in focusing the development of the Missouri State Water Plan. They will serve to support and complement public participation, issue identification, needs assessment, and multi-level planning coordination. When these volumes are completed, the department will work with groups and individuals across the State to gather input on a regional and watershed basis for the development of the State Water Plan. The Interagency Task Force will also have input into the State Water Plan before it is finalized and submitted to the governor and General Assembly.

The seven volumes are being published as this report is being written. Already published are Volume I, *Surface Water Resources of Missouri*, Water Resources Report No. 45, by James E. Vandike; Volume III, *Water Quality Assessment*, Water Resources Report No. 47, by Cynthia N. Brookshire; Volume IV, *Water Use of Missouri*, Water Resources Report No. 48, by Charles B. DuCharme and Todd M. Miller; Volume V, *Hydrologic Extremes in Missouri: Flood*

and Drought, Water Resources Report No. 49, by John D. Drew and Sherry Chen and Volume VI, *Water Resource Sharing: The Realities of Interstate Rivers*, Water Resources Report No. 50, by Jerry D. Vineyard. The other volumes are nearing publication.

The purpose and contents of these seven volumes are summarized in the following paragraphs.

SURFACE WATER RESOURCES OF MISSOURI

This volume contains a basin-by-basin assessment of Missouri's surface water resources. In the report, basins are grouped into (1) Upper Mississippi River Tributaries, (2) Missouri River tributaries north of the river, (3) Missouri River tributaries south of the river, (4) lower Mississippi River tributaries, (5) White River tributaries, and (6) Arkansas River tributaries.

It characterizes the current surface water resources within the state so that comparisons and evaluations can be prepared from one basin to the next. Text and illustrations in the report describe water budget information (precipitation, evapotranspiration, total yield, surface water runoff), long-term flow data for major rivers, flow-duration curves, runoff volumes, draft-storage relations for different areas, baseline natural water quality, and brief statements on major water quality problems.

The close relationship between quality, recharge, and discharge of groundwater and surface water in the Ozarks are discussed. River discharge hydrographs for years of lowest and highest flows are included for many basins. Streams that are used as public water supplies are identified. Volume and surface area information for major reservoirs, such as the Corps of Engi-

neers impoundments, major private reservoirs such as Lake of the Ozarks, and other reservoirs that are used for public water supply are included in the report. In addition, reservoirs owned by the Department of Conservation and Department of Natural Resources are listed.

GROUNDWATER RESOURCES OF MISSOURI

This volume will present a detailed statewide assessment of the groundwater resources of Missouri. It will provide information concerning the availability and natural quality of groundwater throughout the state. With this report, users will be able to determine if groundwater in a particular province will supply the quantity and quality of water necessary to meet a particular purpose. Additionally, the report will be useful in helping to protect groundwater resources from degradation.

Unlike surface water, it is inappropriate to discuss groundwater resources based on surface watersheds. For this report, Missouri has been subdivided into seven groundwater provinces whose boundaries were established using geologic and groundwater-quality criteria. The provinces are: (A) the Ozarks (Salem Plateau); (B) Springfield Plateau; (C) Southeastern Missouri (Bootheel), Mississippi River alluvium, Missouri River alluvium; (D) St. Francois Mountains; (E) northwestern Missouri; (F) northeastern Missouri, and (G) the Osage Plains of west-central Missouri. The geology, aquifer characteristics, groundwater availability, and general quality of groundwater in the seven groundwater provinces will be presented in this report. The report will also include information on groundwater development, well construction criteria, groundwater contam-

ination potential, fluctuations and trends of groundwater levels, aquifer volumes, and groundwater recharge and storage.

WATER QUALITY OF MISSOURI

This volume focuses on the current quality of Missouri's surface water and groundwater. The volume looks at chemical, bacteriological, and radiological quality of water, natural and man-induced water-quality changes, and the effects of waste disposal on water. It will serve as a valuable reference for anyone seeking water quality information whether for resource development or resource protection.

Data collected by various programs in DNR, the Department of Health, the Department of Conservation, and the U.S. Geological Survey are used to depict the current state of Missouri water quality, and delineate areas of water-quality problems.

WATER USE OF MISSOURI

This volume presents currently available water use information, describing such things as public water supply in Missouri, including residential, industrial, and commercial water use; livestock water use; irrigation water use; thermoelectric water use, including power plant cooling, steam power generation, and a discussion of consumptive use versus return flow use; in-stream flows and their uses; hydro-power uses; waterborne commodity transport water use, broken down by Missouri River and Mississippi River; water-based outdoor recreation, and fish and wildlife needs.

Descriptions of water uses include withdrawal quantities, and locations of registered major water users for selected categories.

THE HYDROLOGIC EXTREMES: FLOOD AND DROUGHT

Both flood and drought are important topics in water planning. This volume provides basic information about floods and droughts, specific to Missouri. An historical perspective is given, as well as information that can be used in the planning and design of water-related facilities. It describes concepts and terms that are helpful in understanding floods and droughts.

WATER RESOURCE SHARING— THE REALITIES OF INTERSTATE RIVERS

Missouri is the farthest state downstream on the Missouri River. It's in the middle section of the Mississippi River, and an upstream state on the Arkansas and White rivers. Because of its location, Missouri can be greatly affected by activities and water policy in the upper basin states of the Missouri River and Mississippi River basins. Missouri policy can also affect downstream states on the Mississippi, Arkansas and White rivers. Many serious issues affecting these rivers have less to do with their physical characteristics than with political, economic, and social trends. The issues affecting the Missouri, Mississippi, White, and Arkansas rivers are very complex, and their potential impact on Missouri is so great that a detailed presentation of Missouri's views and policy concerning these great rivers is necessary and are presented in this volume.

WATERLAW IN MISSOURI

This volume will provide an overview of Missouri Water Law. Previous publications on Missouri Water Law were completed by T.E. Lauer in 1964 and 1969, and updated by Peter Davis and James Cunningham in 1977. Sufficient changes have occurred in the field of environmental law and regulation since 1977 to warrant the drafting of a new publication covering the topic.

Legal restrictions and requirements on how we manage, use, and protect our water resources serve to balance individual rights with the needs of society. Water law is an integral part of the larger realm of water resources management. Public health, public safety, and the economic well-being of the state and its people depend on adequate availability of quality water.

This volume deals with statutory law, case law (court decisions), and legal doctrines. It is being prepared with the help of the Attorney General's Office.

REGIONAL REPORTS, PHASE 2

The seven technical volumes have been prepared in Phase 1 of the State Water Planning effort. Editing and publishing of these volumes is continuing. Meanwhile, Phase 2 of the effort has commenced, with an expected completion date of late 1998 for the first reports.

Beginning with Northeast Missouri, the department is preparing a series of six regional reports, identifying water use problems and opportunities. The six regions are congruent with the six regional office territories of the Division of Environmental Quality. The staff of the Water Resources Program is preparing the reports, with the help of DEQ Regional Office personnel and other agency staffs.

SPECIAL WATER QUALITY PROTECTION AREAS

640.418 Special water protection area, procedure to establish.—1. The department may establish special water quality protection areas where it finds a contaminant in a public water system in concentration which exceeds a maximum contaminant level established by the environmental protection agency pursuant to the Safe Drinking Water Act, as amended, or a maximum contaminant level established by the department pursuant to this chapter or sections 640.400 to 640.435 or a contaminant in surface or groundwater which exceeds water quality standards established pursuant to chapter 644, RSMo, which presents a threat to public health or the environment. In making such a determination, the department shall consider the probable effect of the contaminant or contaminants on human health and the environment, the probable duration of the elevated levels of the contaminant, the quality, quantity and probable uses of surface or groundwater within the area, and whether protective measures are likely to prevent, mitigate or minimize the level of the contaminant in the surface or groundwater.

2. If the department determines that a special water quality protection area should be established, it shall consult with the interagency task force and with the public

water system or systems affected and determine the boundaries of such area. When the boundaries of any such areas have been determined, the department shall, after a public hearing, issue an order designating the area as a special water quality protection area. Such an order shall include a geographic, hydrologic and stratigraphic definition of the area.

3. The department shall hold a public hearing or a public meeting within the area under consideration for designation as a special water quality protection area. The department shall notify every city and county within the proposed area and shall notify the public by press release and by publication of a notice in a newspaper of general circulation in the region.

640.420 Special water protection area, information program to be established, purpose, duties.—When a special water quality protection area has been established, the department shall implement an area informational program to help prevent, eliminate, mitigate or minimize the continued introduction of the contaminant or contaminants into the surface or groundwater.

640.423 Designation as protection area removed, when.—The department shall determine when the level of a contaminant or contaminants in a special water quality

protection area does not exceed, and are not likely to exceed, the water quality standards established pursuant to sections 640.400 to 640.435 and this chapter, and chapter 644, RSMo. Upon such determination, the designation of an area as a special

water quality protection area pursuant to section 192.300, RSMo, sections 640.100, 640.120, and 640.400 to 640.435 shall be removed.

No special water quality protection areas have been formed under this statute.

INTERAGENCY TASK FORCE

640.430—Interagency task force established, members, meetings.—1. The department shall establish an interagency task force consisting of the departments of health, conservation, agriculture, the University of Missouri College of Agriculture, and other such departments and agencies as may be necessary to effectuate the purposes and provisions of sections 640.400 to 640.435.

2. The interagency task force shall meet at least semi-annually. The department shall be the lead agency in matters related to surface and groundwater protection.

Late in 1997, then-department director, David A. Shorr wrote to all the department heads that constitute the Interagency Task Force, and provided the latest information regarding the State Water Plan effort. In re-

sponse to his request for them to designate contact people for this effort, the department heads named seven officials to work with the DNR point-of-contact, Steve McIntosh, Water Resources Program Director. McIntosh met with these department representatives in late autumn, 1997, soliciting topics and issues to be addressed in the State Water Plan. The names of these members of the Interagency Task Force are listed below. No formal meeting of the entire group has been scheduled.

Agriculture	Marla Young
Conservation	James Czarnezki
Economic Dev.	Martha LaMond
Health	Randall Maley
Public Safety	Sgt. Hans Huenik
Transportation	John Howland
University of Missouri	Jerry Carpenter

RECOMMENDATIONS

640.426 The department shall prepare and submit to the general assembly and the governor an annual report which details the progress it has made in meeting the objectives of sections 640.400 to 640.435 and which contains recommendations in furtherance of the purpose and provisions of sections 640.00 to 640.435.

This *1998 Annual Report* explains how the staff of the Missouri Department of Natural Resources carry out the legislative mandates of the Missouri Water Resources Law. It demonstrates the breadth of activi-

ties that the department conducts and the progress that has been made in meeting the objectives of the Water Resources Law. This report is not a comprehensive listing of the department's water-related activities.

As the State Water Plan volumes and reports continue to be published, the state's water quantity and quality needs will become more apparent. The goal of the State Water Plan is to produce a set of recommendations for local, regional, and statewide implementation, both short-range and long-range.

