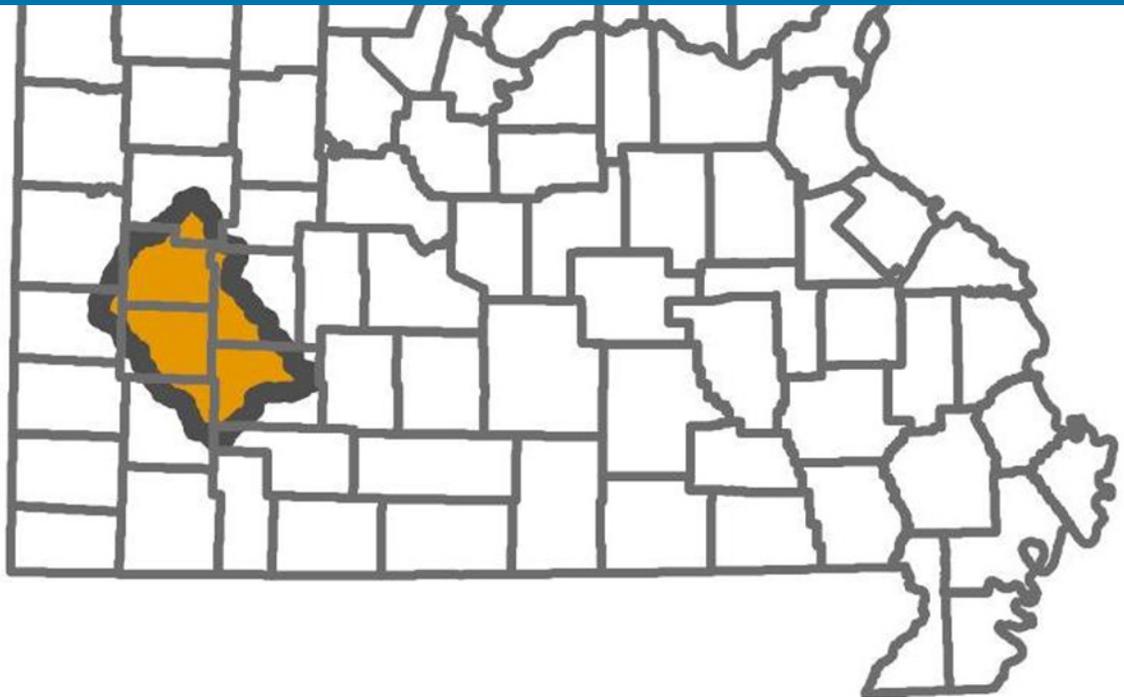


## The State of *Our Missouri Waters*

### Sac River Watershed



The Missouri Department of Natural Resources seeks to improve the availability of water resource information to communities where impact to these water resources is felt most.

The information presented in this summary is intended to increase awareness of how activities on land and in water have an influence on water resource quality and quantity. The department greatly values local input and engagement regarding the mission of ensuring safe and ample water resources, and will continue to seek local guidance to further focus department efforts and funding strategies for the betterment of *Our Missouri Waters*.

# Sac River Watershed

The State of Our Missouri Waters

## Importance of Water Quantity and Quality

Water shortages can have severe and expensive consequences. Adequate water supplies are vital not only to human health and safety, but also to the prosperity of our state. Whether it is for crop irrigation, industrial manufacturing or power generation, water is at the core of human existence and sustainability. A few decades ago, the supply of water in Missouri was considered virtually unlimited. As population and industry have increased, a need for statewide water planning has emerged.

Water quality impairments can also have severe impacts on human health and the environment and be extremely expensive. Unfortunately and more importantly, many water quality impairments are only discovered once the consequences of poor water quality have been realized. For this reason, it is important that locals are involved in the protection of their water quality and quantity so as to prevent irreversible consequences.

## Key Points

In the northern portion of the watershed, low dissolved oxygen levels in water bodies often cause negative impacts to aquatic life and create challenges for the watershed. These low dissolved oxygen levels are often a result of excess organic materials, which consume oxygen, and may be discharged from wastewater treatment system types less effective in removing organics. Other sources of excess organics in water bodies may include excess animal waste, excess nutrient loads (fertilizer) and excess sedimentation from stream bank and erosion.

In the southern portion of the watershed, there are challenges regarding bacteria levels in water bodies, which can cause serious public health and recreational safety issues. Nonpoint sources of contamination, such as animal waste and contaminants carried by stormwater runoff, can have a serious cumulative impact on surface waters in a largely rural watershed. However, agricultural best management practices can significantly reduce nonpoint source impacts. Pollution prevention is also critical due to connectivity of surface water and groundwater. Point and nonpoint sources of pollution to water bodies or in and around karst features, such as sinkholes, can lead to regional contamination of groundwater wells and springs.

Groundwater quantity is also important to consider as groundwater levels in the predominant aquifer of the area, the Ozark aquifer, are declining in some areas of high use. Water conservation efforts by groundwater and surface water users can be implemented to help mitigate impacts of increasing water needs in the area. Missouri shares water resources with many other states, some of which regulate water use and have already established their demand for water. It is important for Missouri to document its need for water and to protect our right to that water. Registering major water use, annually, establishes a users need for water and helps the department understand the water needs of Missouri citizens.

## Opportunities

### Community Involvement

- Through education, advocacy and hands-on projects, communities, groups and individuals can be involved in and promote watershed improvement activities. Some examples include, watershed education for schools, litter control, tree planting, water quality monitoring and storm drain stenciling.

### Education and Outreach

- Technical assistance providers are available for training and assistance regarding several topics such as source water protection, municipal drinking water loss, water main leak detection, asset management, water conservation planning and implementation, and I/I (inflow and infiltration) reduction.
- Training is also available to livestock operations and landowners regarding the benefits of alternate watering sources for livestock, improvements to land application practices, best management practices and associated cost-share programs.

### Financial Assistance

- **Clean Water and Drinking Water State Revolving Funds** are available to build or improve municipal wastewater and drinking water infrastructure and support agricultural and urban projects such as improvements to urban runoff, wet weather flow, stormwater and sewer overflow issues, water reuse and conservation and alternative treatment projects.
- **319 Nonpoint Source Funds** are available to assist organizations with implementation of on-the-ground practices that control, reduce or manage nonpoint source pollution such as riparian buffer strips, detention ponds, limitation of animal waste to stream and sinkholes.
- **Source Water Protection Grants** and **Well Plugging Grants** are available to public water systems to support safe well abandonment procedures and source water protection implementation and planning efforts.
- A full list of department funding sources is available at <http://dnr.mo.gov/financial.htm>

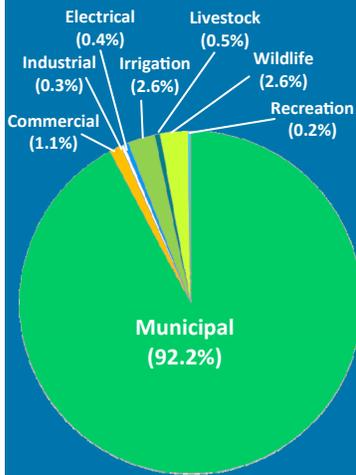


# Sac River Watershed

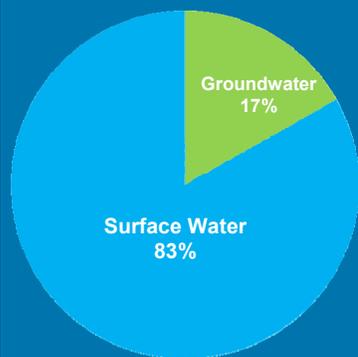
The State of Our Missouri Waters—Current Conditions and Trends

## Climate and Water Availability

### Estimated Annual Major Water Use by Category (2013)



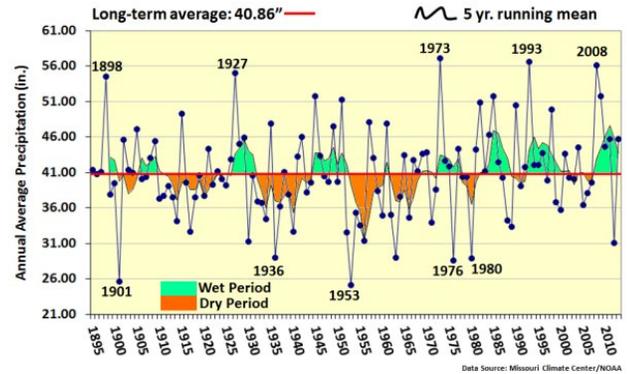
### Estimated Annual Major Water Use by Source



### Precipitation

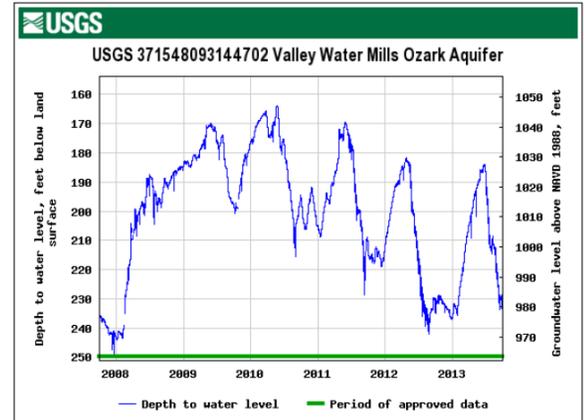
Annual precipitation totals reveals several wet periods have dominated since the early 1980s. This wet pattern has also been accompanied by an increasing trend of heavy precipitation events. Severe drought occurred during 2012, but this drought was brief compared to major multi-year droughts that occurred in the 1930s and 1950s. Tree ring analyses conducted in Missouri and historic observation data show periods of multi-year severe droughts in Missouri's history, indicating that extended dry periods are likely to occur in the future.

Missouri Annual Average Precipitation (1895-2013)



### Groundwater and Stream Monitoring

There are six groundwater monitoring wells within the watershed as part of the Missouri Observation Well Network. Groundwater levels fluctuate several feet throughout the year, with groundwater lows typically occurring in winter and highs occurring in late spring. There are currently nine stream gauges in the watershed. Downstream of Stockton Lake on the Sac River near Caplinger Mills, average stream flow is 538 MGD (millions of gallons per day).

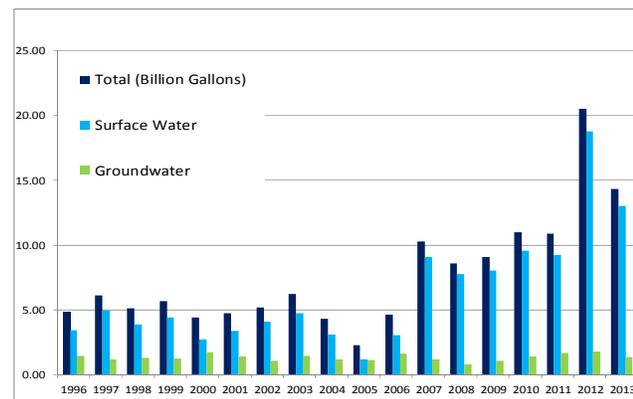


### Major Water Use Characteristics

A major water user is defined as the capacity to withdraw more than 70 GPM (gallons per minute) or 100,000 GPD (gallons per day). The reported estimated annual water use as of 2013 is 8.1 billion gallons, of which 83 percent is diverted surface water and 17 percent is groundwater. Thirty major water users are registered in the basin. The majority of water diverted is used for municipal drinking water (92.2 percent).

There are 110 public drinking water systems serving approximately 235,701 people. Waters systems that are required to report to the department show that approximately 35 million gallons of water are consumed per day. There is 82.5 million gallons of available drinking water capacity per day for public water use.

### Major Water Use Trends in Sac River Basin (1996-2013)



# Sac River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

## Watershed Protection

### Protection of Our Natural Resources

The department exercises authority under Missouri's Clean Water Law to regulate point sources of pollution. When point sources are known or discovered, the department issues permits for these sources to limit the amount of certain water contaminants that may be discharged into the water body.

The department also has resources to help people proactively plan to protect water resources, such as:

- Source Water Protection Plans for drinking water sources
- Section 319 funding for watershed planning and projects
- Funding to plan for source water protection
- Soil and Water Conservation funding
- State Revolving Fund grants and loans for community drinking water and wastewater improvements

A full list of department funding sources is available at [dnr.mo.gov/financial.htm](http://dnr.mo.gov/financial.htm)

It is important to note that resources are limited and local involvement, in determining most critical and effective focus areas, is invaluable.

### Water Quality Impairments

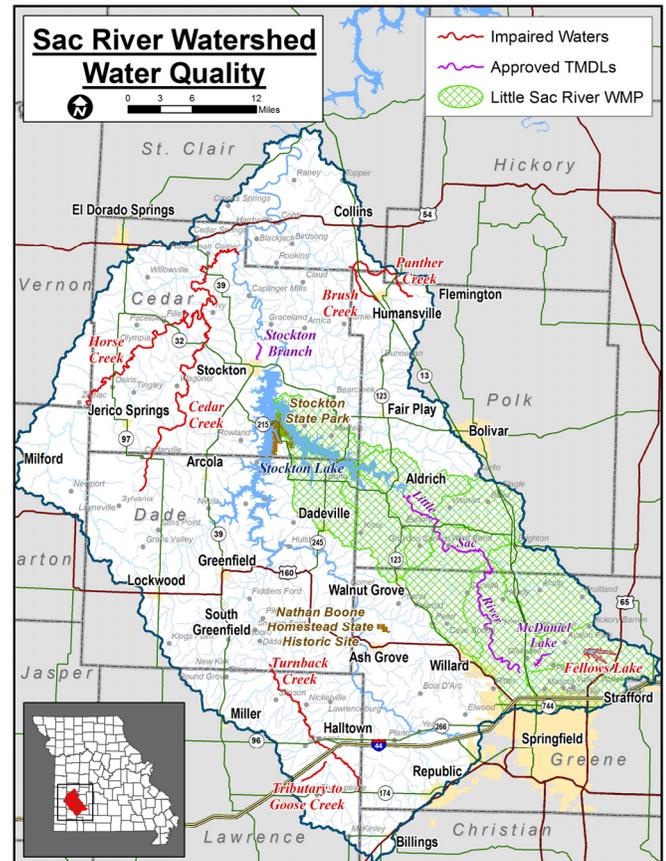
Section 303(d) of the federal Clean Water Act requires each state identify waters that do not meet water quality standards and for which adequate water pollution controls are not in place. These identified waters are considered impaired. Water quality standards protect beneficial uses of water such as whole body contact (e.g. swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock and wildlife.

The following lake and streams within the watershed are listed on the state's 2012 list of impaired waterways and are presented on the adjacent map: Turnback Creek (E. coli), Tributary to Goose Creek (E. coli), Horse Creek (aquatic macroinvertebrate assessment), Cedar Creek (aquatic macroinvertebrate assessment), Panther Creek (dissolved oxygen), Brush Creek (dissolved oxygen) and Fellows Lake (atmospheric deposition of mercury).

Impairments can be caused by known sources like point or nonpoint source pollution, or may be unknown; however, identifying activities near impaired water bodies can provide key information in determining the sources of contamination as well as developing solutions for impaired waters.

Examples of **point sources** of pollution include municipal wastewater treatment plants, land disturbance sites, large confined animal operations, and treated industrial wastewater discharges. Common challenges for wastewater treatment include the limited contaminant removal capacity of certain types of treatment. When facilities experiences difficulty in providing the proper level of treatment and contaminant removal, the department often works with them to improve the treatment process and quality of the discharge. In the case that point source emitters are unwilling to improve the quality of their discharge, the department has regulatory authority to ensure that inappropriate discharges are discontinued in a timely manner.

**Nonpoint** pollution sources refer to contaminants that do not come from specific conveyances and may come from multiple sources, such as failing septic systems and contaminants carried in stormwater runoff from rural, urban, and agriculture lands. Other causes of water body impairments include natural causes like precipitation, climate, and drought which can alter stream flow and channel characteristics leading to changes in water quality.



# Sac River Watershed

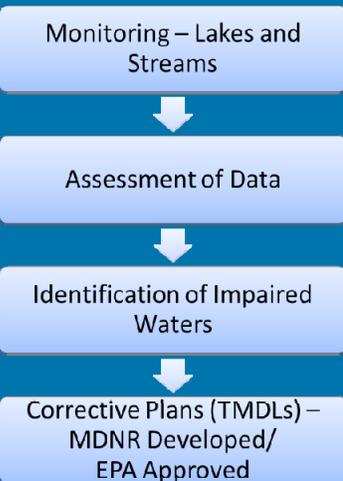
The State of Our Missouri Waters—Current Conditions and Trends

## Watershed Protection

### General Water Quality Criteria

A water body is considered impaired if it does not meet water quality standards that specifically protect its beneficial uses, such as drinking water, recreational uses and fish or other aquatic life health.

### Missouri's Process to Improve Water Quality



### NPDES:

National Pollutant Discharge Elimination System. In Missouri, NPDES permits are also known as Missouri State Operating (MSOP) permits.

### Total Maximum Daily Loads (TMDL)

A TMDL is the mathematical calculation of the amount of a specific pollutant that a water body can absorb and still meet water quality standards. A TMDL study identifies the potential or suspected pollutant sources in the water and allocates the allowable pollutant load among these sources. It also includes an implementation plan to identify how the load will be reduced to a level that will protect water quality. In this watershed, TMDL's have been developed for the Little Sac River and McDaniel Lake, which include pollutant reduction recommendations for fecal coliform and algae, respectively. Stockton Branch also has a permit-in-lieu-of-TMDL, which requires reduction of the pollutant (organic sediment) through NPDES permit limits. Impaired uses for these TMDL's include whole body contact, drinking water and protection of warm water aquatic life. The department has developed pollutant reduction recommendations and measures for all TMDLs, aside from the permit-in-lieu-of-TMDL which has an enforceable requirement. These recommendations are plans, for which actions still can and need to be taken to protect, preserve and enhance these watersheds.

For more information regarding these TMDLs, please visit the links provided:

**Little Sac River TMDL:** <http://www.dnr.mo.gov/env/wpp/tmdl/1381-l-sac-r-record.htm>

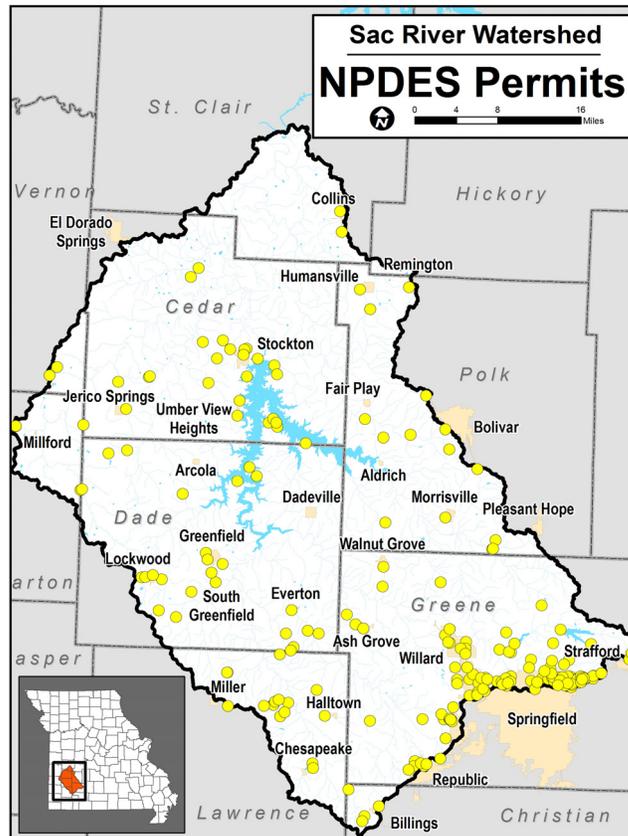
**McDaniel Lake TMDL:** <http://www.dnr.mo.gov/env/wpp/tmdl/7236-mcdaniel-lk-record.htm>

**Stockton Branch Permit-in-lieu-of-TMDL:** <http://www.dnr.mo.gov/env/wpp/tmdl/1361-stockton-br-record.htm>

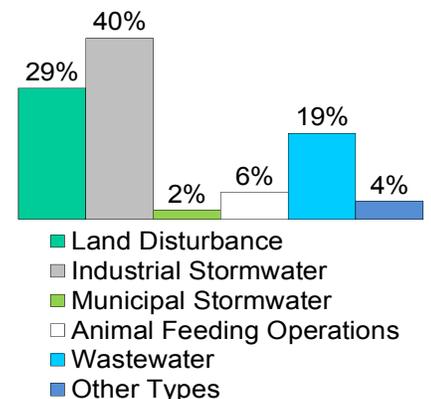
### Regulated Point Sources

The department regulates point sources by issuing permits that prescribe conditions of operating the point discharge and limit the discharge of water contaminants. In addition, the department inspects regulated facilities and analyzes water samples to ensure the facilities are not polluting waters. It's also important that communities look to the future for watershed planning in order to maintain awareness of wastewater treatment types, their impacts and upcoming regulations.

The following graphics illustrate the type and distribution of permitted sites in the Sac River Watershed.



### NPDES Permit Types



# Sac River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

## Local Watershed Improvements

### Local Awareness

Is it safe to fish or swim in the nearby stream? Does the stream provide habitat suitable for fish? What does it cost to make this water potable? Will I have enough water during a drought?

Impacts to water quality and quantity are most critical to local communities; however, impacts are often not realized until a dire situation arises as a result of poor water quality or quantity. Local awareness and involvement can lead to pollution prevention and reduction, water supply sustainability and can give communities the upper hand in protecting, preserving and enhancing local water supplies for generations to come.

### 2014 Conservation Practices



### Missouri Stream Team and Volunteer Water Quality Monitoring

Missouri Stream Teams strive to gain and share knowledge regarding the state's stream systems and the problems and opportunities they face. The Missouri Stream Team Program is a partnership between the departments of Natural Resources and Conservation as well as the Conservation Federation of Missouri and the citizens of Missouri. Besides improving stream conditions, Stream Teams often provide useful data in targeting areas that should be monitored more closely for impairments. The Missouri Stream Team Watershed Coalition has compiled and reported monitoring data which demonstrates the importance of watershed protection, preservation and enhancement by local communities. (image from <http://mstwc.org/who-we-are/vision-mission-goals/>)



The Volunteer Water Quality Monitoring Program is one of the most popular activities of the Missouri Stream Team Program. There are 108 Stream Teams in the Sac river basin that work to supply the department with water quality data.

### Soil and Water Conservation and Nonpoint Source Grants (319 Grants)

Over the last five years, the department has provided several watershed project grants to local communities to improve water quality through reduction of nutrient and sediment loads and deposition, rehabilitation and removal of failing or neglected septic systems, watershed management planning, water quality monitoring, incentivized soil conservation practices, education/outreach efforts and other activities. These grant projects have included: the Fellows/McDaniel/Fullbright Watershed Nutrient Reduction Project, the Little Sac Watershed Management Plan Project, Springfield/Greene County Urban Watershed Stewardship Project, the Asher Creek 319 Project and the Little Sac Restoration and Improvement Project.

### Source Water Protection Program and Grants

This voluntary program is designed to assist public water systems and the communities they serve with developing local voluntary source water protection plans to protect their source of drinking water from existing or additional contamination sources. Participating public water systems include: Willard; Lamar; City of Springfield, Barton, Dade, Cedar, and Jasper Counties Consolidated Public Water Supply District #1; and Walnut Grove. Lamar, Willard, Fair Play and Springfield have received source water protection and/or wellhead protection grants.

### Abandoned Well Plugging Grants

As part of Source Water Protection, the department offers grants to plug abandoned wells. Inactive wells can act as a direct conduit for pollutants to enter our water sources. Safely closing these wells is another layer of protection for pollution prevention. The City of Willard has participated in the department's well plugging grant program and received two grants for the purpose of safely closing inactive wells.

### Soil and Water Conservation Cost Share Programs

Soil and Water Conservation Districts set annual goals to address resource concerns. Practices specific to these concerns are funded and implemented to help districts meet their resource conservation goals. These practices conserve soil, which consequently improved water quality by reducing sedimentation in our rivers, streams, and lakes. The chart on the left illustrates the number of practices implemented for each resource concern in the watershed in 2014. Grazing management, followed by sheet, rill, and gully erosion practices are the most popular in this watershed.

# Sac River Watershed

The State of Our Missouri Waters

## Contact Information for this Watershed

Southwest Region  
Watershed Coordinator -  
Gwenda Bassett  
2040 W. Woodland  
Springfield, MO 65807  
417-891-4300

Or visit the Web at  
[dnr.mo.gov/omw](http://dnr.mo.gov/omw)

## Resources

### Education and Outreach Resources include:

Missouri Department of Natural Resources' Our Missouri Waters [dnr.mo.gov/omw](http://dnr.mo.gov/omw)

Missouri Department of Natural Resources Financial Assistance Opportunities  
<http://dnr.mo.gov/pubs/financial-asst-brochure-2014.pdf>

Natural Resources Conservation Service (NRCS) <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/>

Missouri Rural Water Association (MRWA) <http://www.moruralwater.org/training.php>;  
<http://www.moruralwater.org/tools.php>; <http://www.moruralwater.org/dlcenter/>

Missouri Public Utilities Alliance (MPUA) <http://www.mpua.org/Training.php>; [http://www.mpua.org/Untitled\\_Page\\_4.php](http://www.mpua.org/Untitled_Page_4.php)

EPA Region 7 Environmental Finance Center (EFC) [http://webs.wichita.edu/?u=HUGOWALL&p=/Centers\\_Research/Environmental\\_Finance\\_Center/](http://webs.wichita.edu/?u=HUGOWALL&p=/Centers_Research/Environmental_Finance_Center/)

### Funding Resources include:

Natural Resources Conservation Service (NRCS) <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/>

United States Department of Agriculture Rural Development (USDA-RD) <http://www.rurdev.usda.gov/ProgramsAndOpportunities.html>

Missouri Department of Economic Development (DED) <http://www.ded.mo.gov/BCS%20Programs/BCSProgramDetails.aspx?BCSProgramID=10>; <http://www.ded.mo.gov/Community/InfrastructureAssistance.aspx>

## References

2010 Census data (<http://www.census.gov/>)

Center for Applied Research and Environmental Systems (<http://www.cares.missouri.edu/>)

Department of Natural Resources' Groundwater Level Observation Well Network Page (<http://dnr.mo.gov/env/wrc/groundwater/gwnetwork.htm>)

Department of Natural Resources' Missouri State Water Plan Series, Surface Water Resources of Missouri, 1995, Groundwater Resources of Missouri, 1996. (<http://dnr.mo.gov/env/wrc/statewaterplanMain.htm>)

Department of Natural Resources' Source Water Protection Program Page (<http://dnr.mo.gov/env/wpp/pdwb/swpp.htm>)

Department of Natural Resources' Major Water Users Page (<http://dnr.mo.gov/env/wrc/mwu-forms.htm>)

Missouri Stream Team Program Website, (<http://www.mostreamteam.org/aboutTeams.asp>)

Missouri Stream Team Watershed Coalition Website, (<http://mstwc.org/>)

Multi-Resolution Land Characteristics Consortium, 2011 and 2001 National Land Cover Database, (<http://www.mrlc.gov>)

Missouri Climate Center, (<http://climate.missouri.edu/modata.php>)

U.S. Army Corps of Engineers, Southwest Missouri Water Resource Study—Phase I. Sept. 2012 ([http://tristatewater.org/?page\\_id=12](http://tristatewater.org/?page_id=12))

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