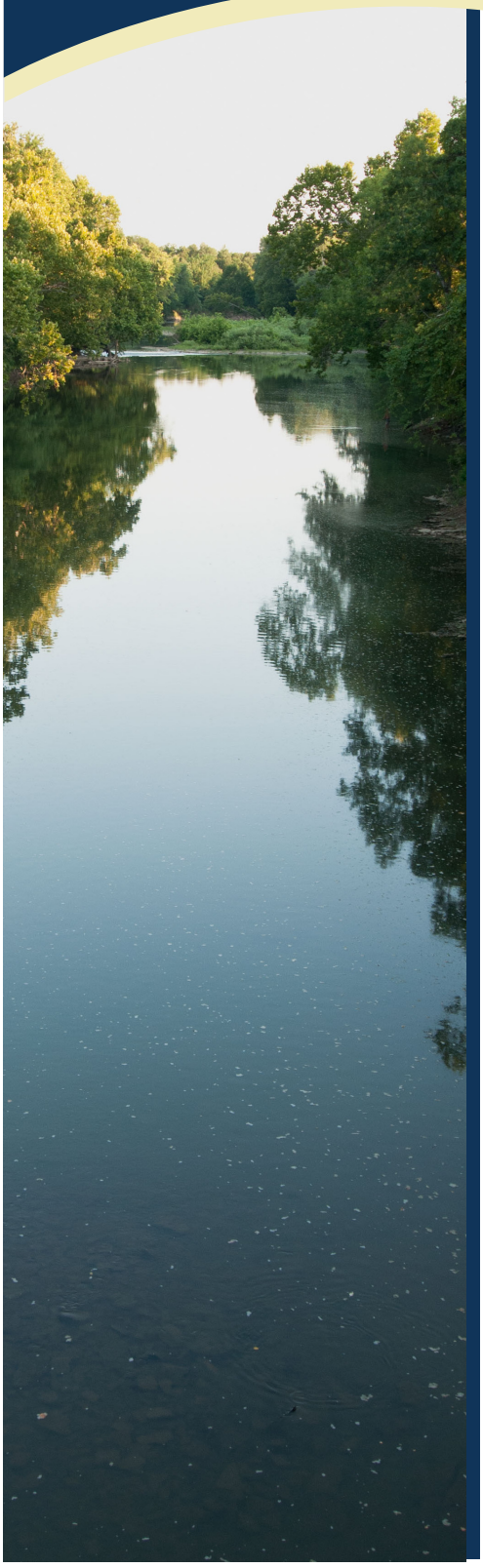
2013 SPRING RIVER WATER SUMMIT



OUR MISSOURI WATERS INITIATIVE
SPRING RIVER WATERSHED

2013 Spring River Watershed Tour

Field Guidebook

May 29, 2013

Barton, Jasper
and Newton Counties

MISSOURI DEPARTMENT OF NATURAL RESOURCES

OUR MISSOURI WATERS INITIATIVE MISSOURI

HSTCC

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A Special Thanks to our Financial Sponsors

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2013 SPRING RIVER WATER SUMMIT

Introduction

Welcome to the 2013 Spring River Water Summit - Watershed Tour! The Spring River Watershed is one of the focus areas of the Missouri Department of Natural Resources Our Missouri Waters initiative. The goal of the initiative is to identify water resource related issues in an area, work with local citizens and local governments to develop solutions, and partner with agencies and watershed citizens to focus available resources. The Spring River Water Summit Tour and Conference will together serve as a platform to bring local watershed leaders and stakeholders together to inspire water-based discussion, collaboration and problem-solving to improve watershed health. From agricultural producers to wastewater and drinking water managers, watershed users are actively engaged in improving and maintaining the important water resources of the Spring River basin.

The goals of this tour are to:

- Provide a visual perspective of the diverse characteristics of the Spring River basin.
- Recognize practices and projects in the basin that benefit water resources and the watershed community.
- Provide an opportunity to learn and connect with a broad spectrum of watershed users and interests.
- Network with a diverse cross section of watershed citizens, organizations and other interested groups that all have a different role in maintaining a healthy watershed.

Encompassing an area of 2,589 square miles, the Spring River basin in southwest Missouri includes drainage area in Kansas and Oklahoma and is part of the larger Grand Lake O' the Cherokee drainage basin, a well- known recreational lake in Oklahoma (Figure 1). In Missouri, the watershed includes 2,043 square miles and includes the counties of Barry, Barton, Dade, Jasper, Lawrence and Newton. Major streams in the basin are Center Creek, North Fork of the Spring River, Shoal Creek and Turkey Creek. Cities and towns in the watershed include Joplin, Carthage, Neosho, Carl Junction, Webb City, Monett, Mount Vernon, Lamar and numerous others.

The Spring River basin is diverse in characteristics from geology to land use, to water quality and water quantity challenges. As the tour follows the U.S. Interstate 49 corridor from south to north, from tour Stop A in Neosho to Stops C and D in northern Jasper County and Lamar, this route will highlight the physiographic differences in the watershed from the rugged, Ozarks terrain typical of the Springfield Plateau in the south to the edge of the Osage Plains in the north (Figure 2). The Osage Plains physiographic region in the northwest portion of the watershed gives way to sand and silt bottomed prairie type streams, while the remaining watershed is underlain by the Springfield Plateau. Streams are typical Ozarks-type streams with gravel and bedrock substrates and higher gradients. This area is also host to numerous sinkholes, losing streams and other karst features.

Land use in the basin is dominated by agriculture lands, with pasture and croplands making up nearly 70 percent, and urban and developed areas only 9 percent (Figure 3). Population in the basin, according to the 2010 U.S Census is 270,036 people, with the highest density occurring in the Joplin area with 50,150 people. Historically, mining was an important economic and population driver for the region and still today mining lands make up about five percent of the watershed.

Lead and zinc mining in the Joplin area began in 1848 and developed into the major economic industry for the region through the early 1900s. Today, historical mining activities and legacy sediments from the Tri-State Mining District have resulted in two sites on the National Priority List and hundreds of abandoned historical mining sites (Figure 4) in the watershed. Tour Stop G at the Oronogo-Duenweg mining belt site will highlight the remediation activities currently taking place in the watershed to address this legacy pollution source. Stream impairments linked to historical and current land use activities have led to 648 stream miles on the proposed 2012 federal Impaired waterways, or 303(d) list (Figure 5). Due to increasing population in the surrounding southwest Missouri region, the area has been subject to water use and long term water supply studies to better understand the future water needs of municipalities, agriculture and industry. At tour Stop D, an overview will be given on the Department's Southwest Missouri Agricultural Irrigation Water Use Project which benefits local producers to help them better understand and manage their water needs during the growing season.

This watershed tour will provide a look at seven unique locations in the watershed that together show the diversity in both the physical characteristics and water resource concerns in Spring River basin. This field trip guidebook will provide an itinerary for the trip and the background and important characteristics of each tour stop. Following are figures referenced above, a field trip itinerary and a location map of the 2013 Spring River Watershed Tour Locations (Figure 6).

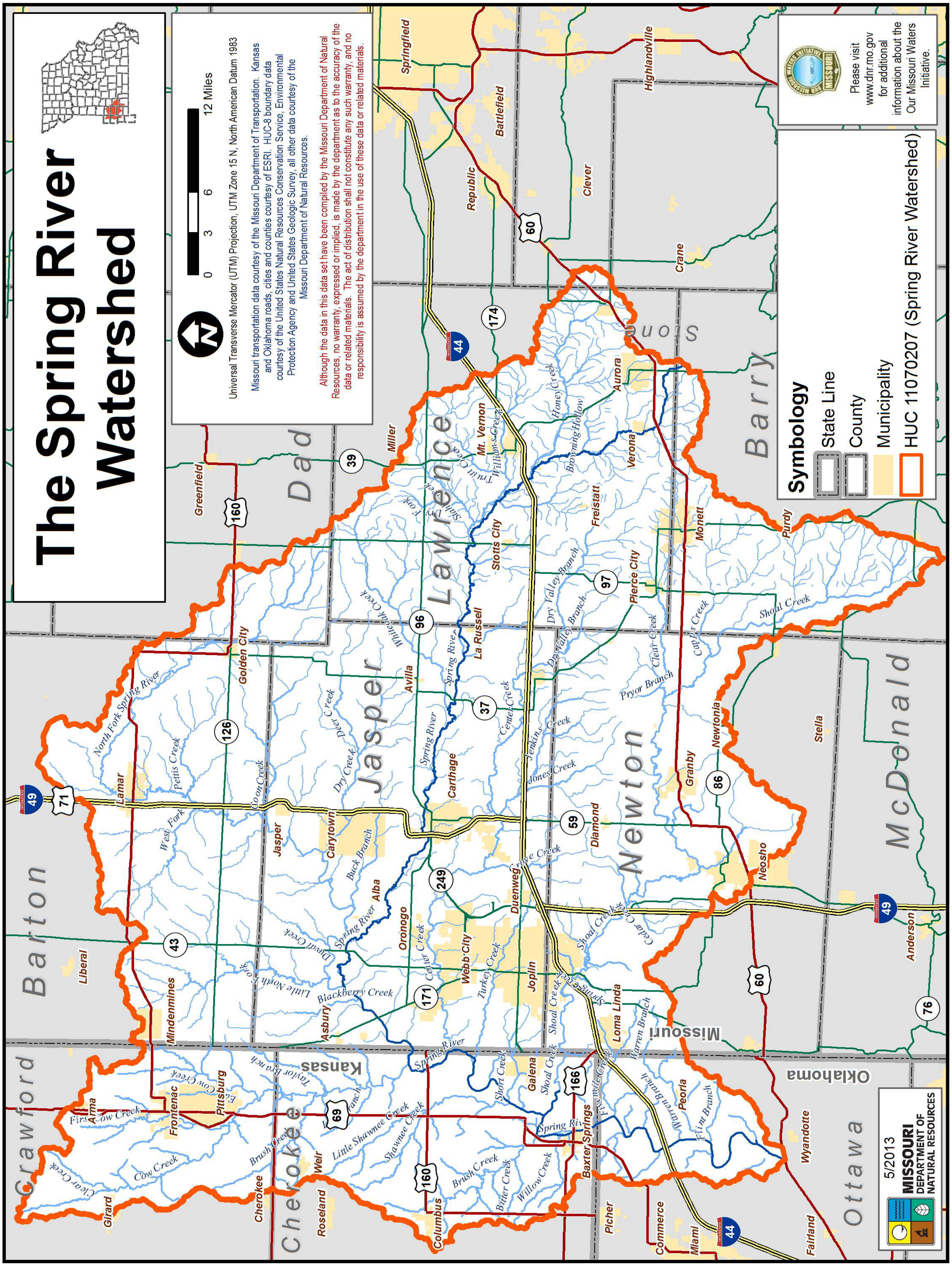

Figure 1. Spring River basin general reference map.

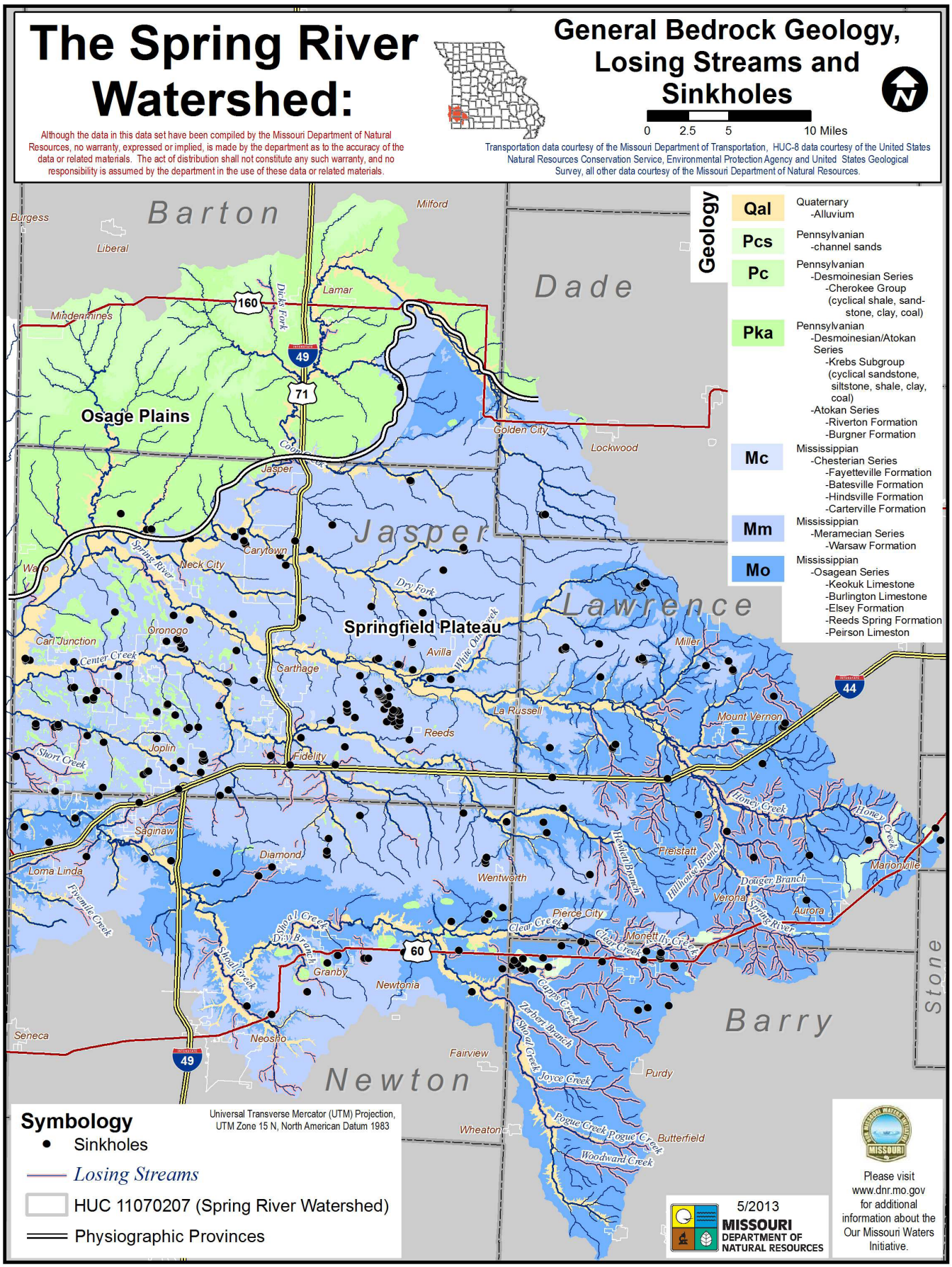

Figure 2. General bedrock geology, losing streams and sinkholes.

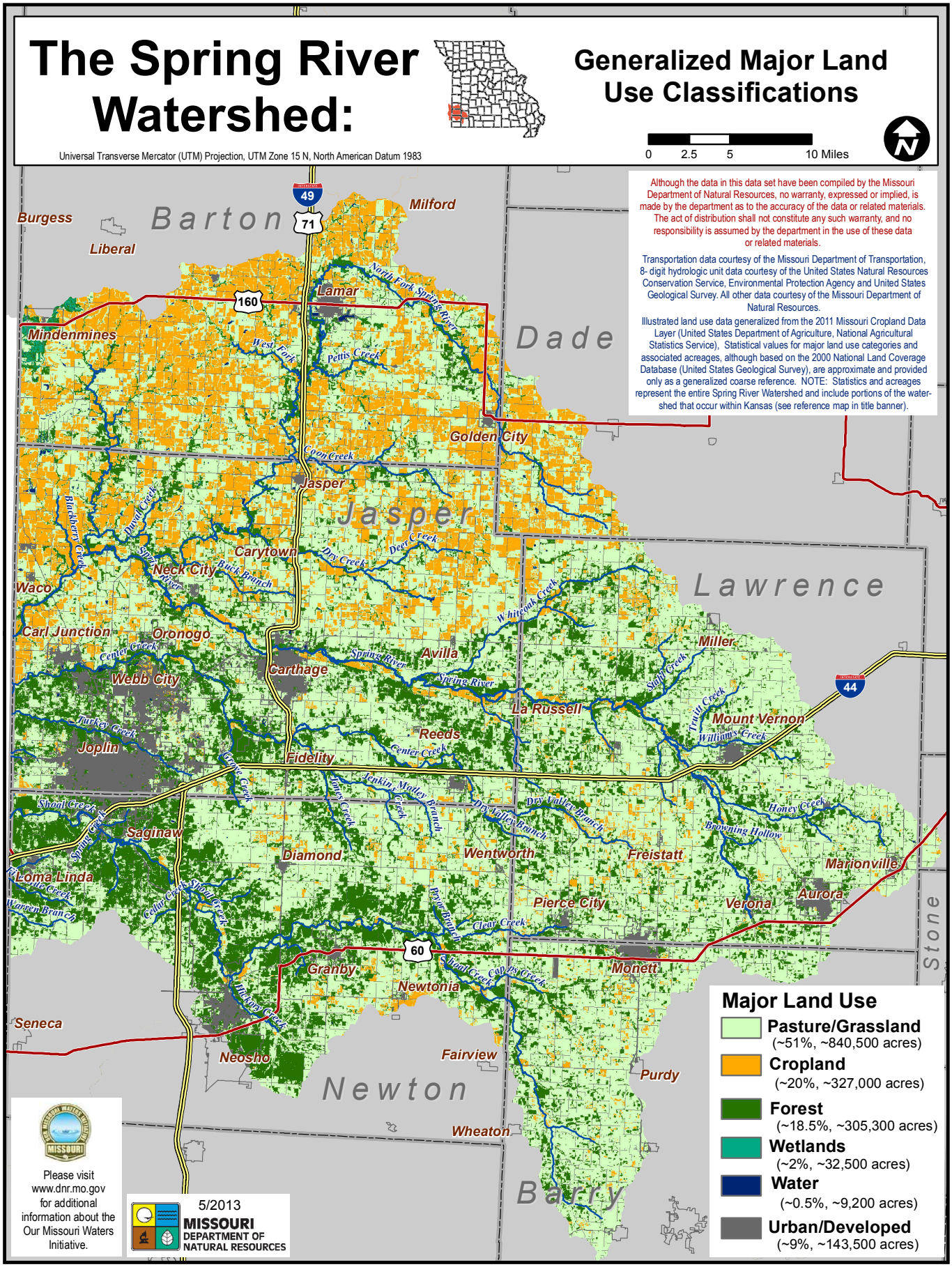

Figure3. Generalized major land use classification.

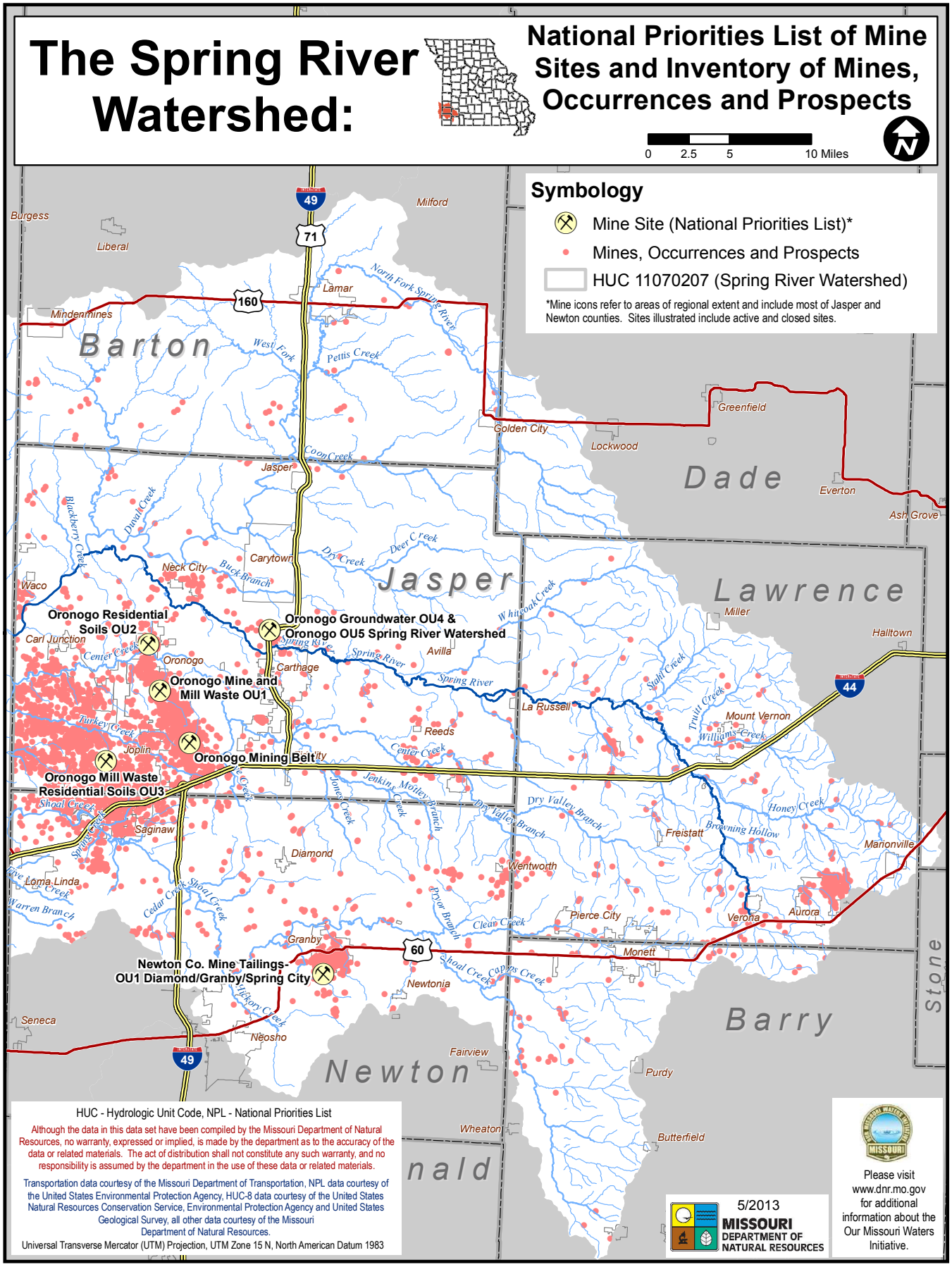

Figure4. National priorities list of mine sites and inventory of mines, occurrences and prospects.

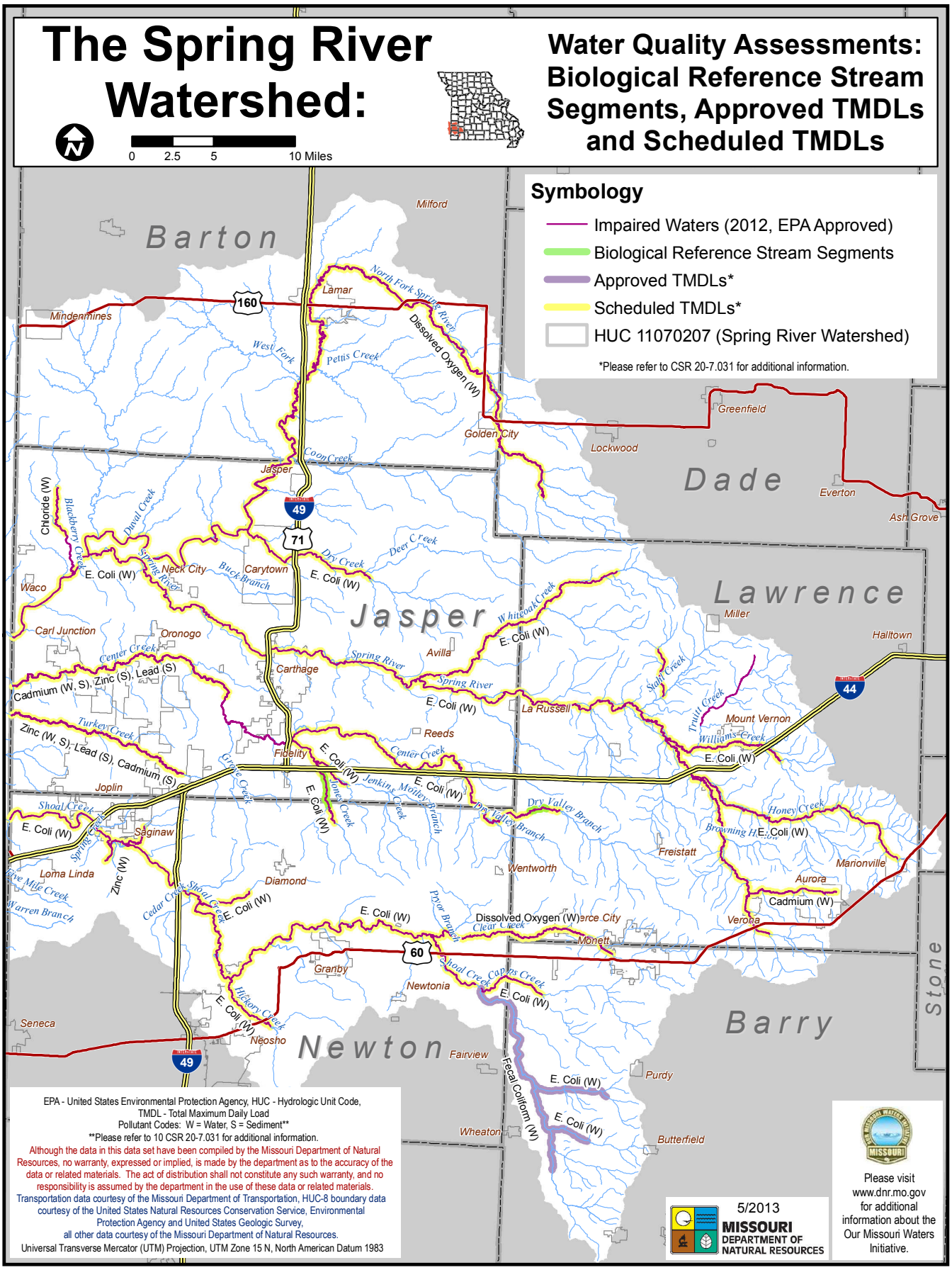

Figure 5. Impaired waterways, biological reference streams and total maximum daily loads, or TMDLs.

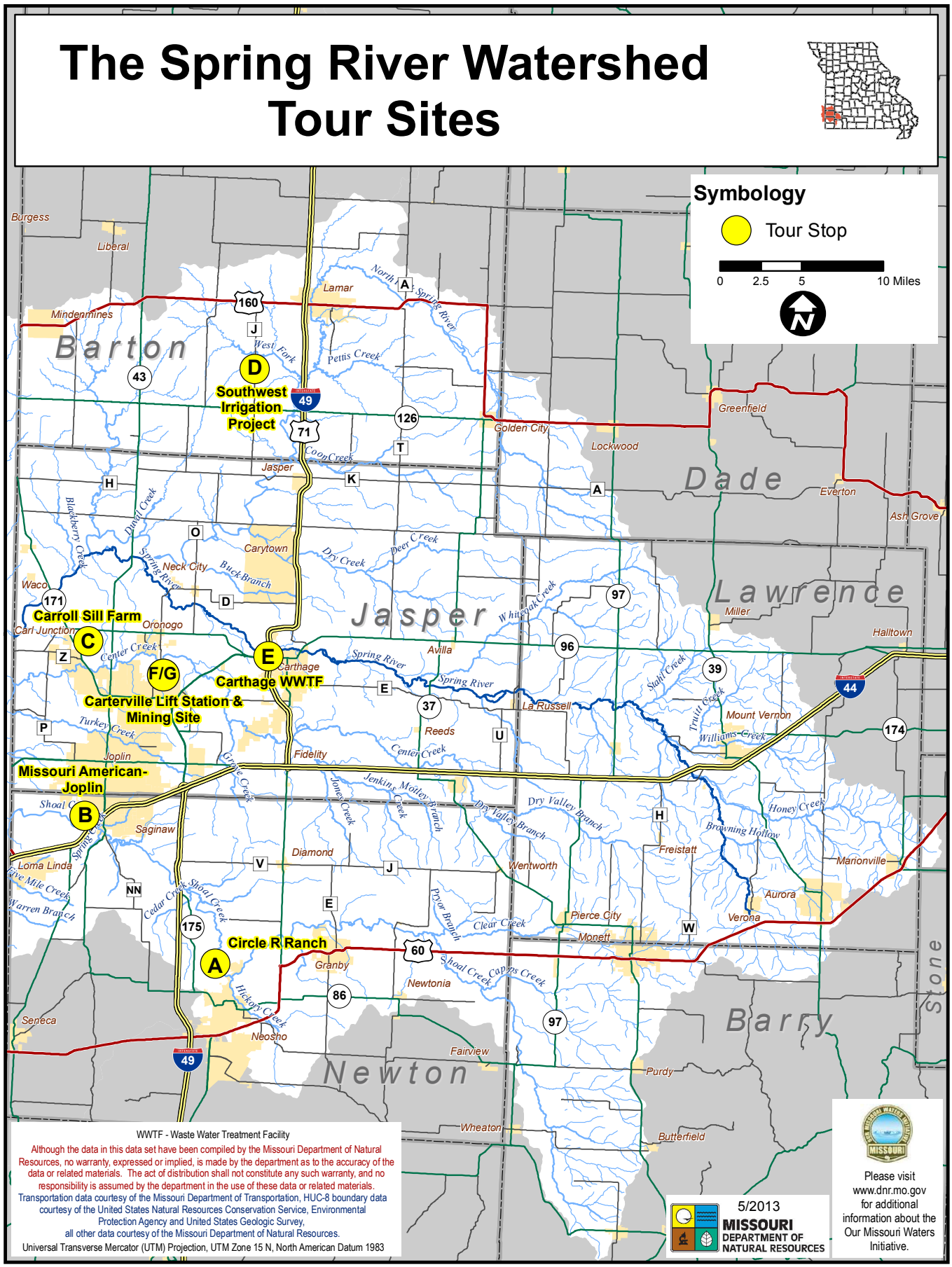

Figure 6. Spring River Watershed tour stop locations.

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Field Trip Itinerary

8 a.m.	Depart from Holiday Inn- Joplin, 3615 Range Line Rd., to Stop A
8:30 a.m.	Stop A – Circle R Ranch in Neosho
9:30 a.m.	Depart and travel to Stop B
10 a.m.	Stop B – Missouri American Water- Joplin's Shoal Creek Intake in Joplin
10:30 a.m.	Depart and travel to Stop C
11 a.m.	Stop C –Carroll Sill Farm, Grassways and Terraces in Carl Junction
11:30 a.m.	Depart and travel to lunch stop
11:45 a.m.	Lunch at Center Creek Park, 203 Valley Lane, Carl Junction
12:45 p.m.	Depart lunch stop and travel to Stop D
1:30 p.m.	Stop D –Southwest Missouri Agricultural Irrigation Water Use Project in Lamar
2:15 p.m.	Depart and travel to Stop E
2:45 p.m.	Stop E – City of Carthage Wastewater Treatment Facility in Carthage
3:30 p.m.	Depart and travel to Stop F
4 p.m.	Stop F – City of Carterville Wastewater System Improvements in Carterville
4:30 p.m.	Stop G – Oronogo-Duenweg Mining Belt in Carterville
5:15 p.m.	Depart for Holiday Inn- Joplin
5:30 p.m.	Arrive at Holiday Inn- Joplin

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Stop A: Circle R Ranch

Steve Roark, owner and manager

Circle R Ranch, home to the annual Barnyard Days festival, is a 1,100-acre cattle ranch along Shoal Creek in Neosho. Over the years, the owner, Steve Roark, has incorporated several agriculture best management practices that together provide a sustainable farming system with numerous benefits to the water resources of the Spring River Watershed and to the well-being of their nearly 200 cattle. The ranch has utilized Natural Resources Conservation Service,cost-share programs for Management Intensive Grazing systems and Riparian Exclusion from livestock access. The concept of rotational grazing on this ranch is not new. In the early years, a similar grazing method was used by the ranch manager. In addition, the ranch is managed for wildlife habitat and has an extensive area where livestock are excluded.

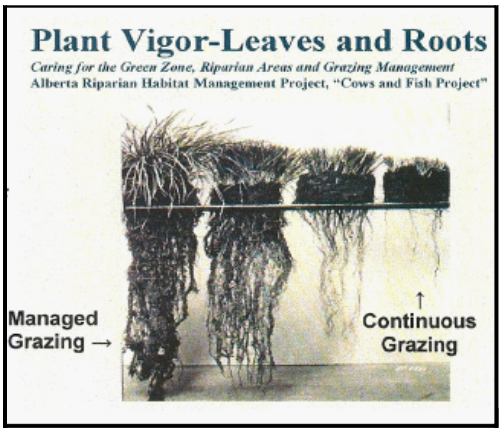


Figure 1. Continuous grazing keeps grass short, resulting in less root mass. Managed grazing allows for a period of rest and growth, allowing grasses to build a better root system, form a dense sod and add soil structure. Grasses with deeper, well-formed root structure are more persistent in droughts.

Management Intensive Grazing system:

- Applied in 2010 using NRCS-Environmental Quality Incentives Program, or EQIP.
- Consists of two groundwater wells, four miles of waterline, 38 new watering locations and 10 miles of cross-fencing for paddocks.
- Provides improved soil health and plant health (Figure 1).
- Improves overall well being of livestock.
- Lower farm equipment costs.
- Reduces erosion by increasing filtration and decreasing runoff, minimizing soil loss.

What is Management Intensive Grazing?

Management Intensive Grazing or MIG, is rotational grazing. This system subdivides larger pastures into smaller paddocks and moves livestock through the system to manage the forage. Limiting animals to one fenced paddock at a time, allows remaining paddocks to recover which improves grassland condition, spreads nutrients and improves animal health.

Cattle behind paddock fencing, waiting to be moved.

Tire water tank connected to well and water line that provides water to cattle in this paddock.

Riparian Exclusion System

Unlimited access of livestock to waterways often can lead to streambank erosion, increased sediments in stream beds, and increased sources of bacteria in waterways. Fencing off streambanks and providing alternate sources of water to livestock benefits both water quality and the well-being of livestock.

Riparian exclusion area installed in 2010.

Riparian Exclusion System

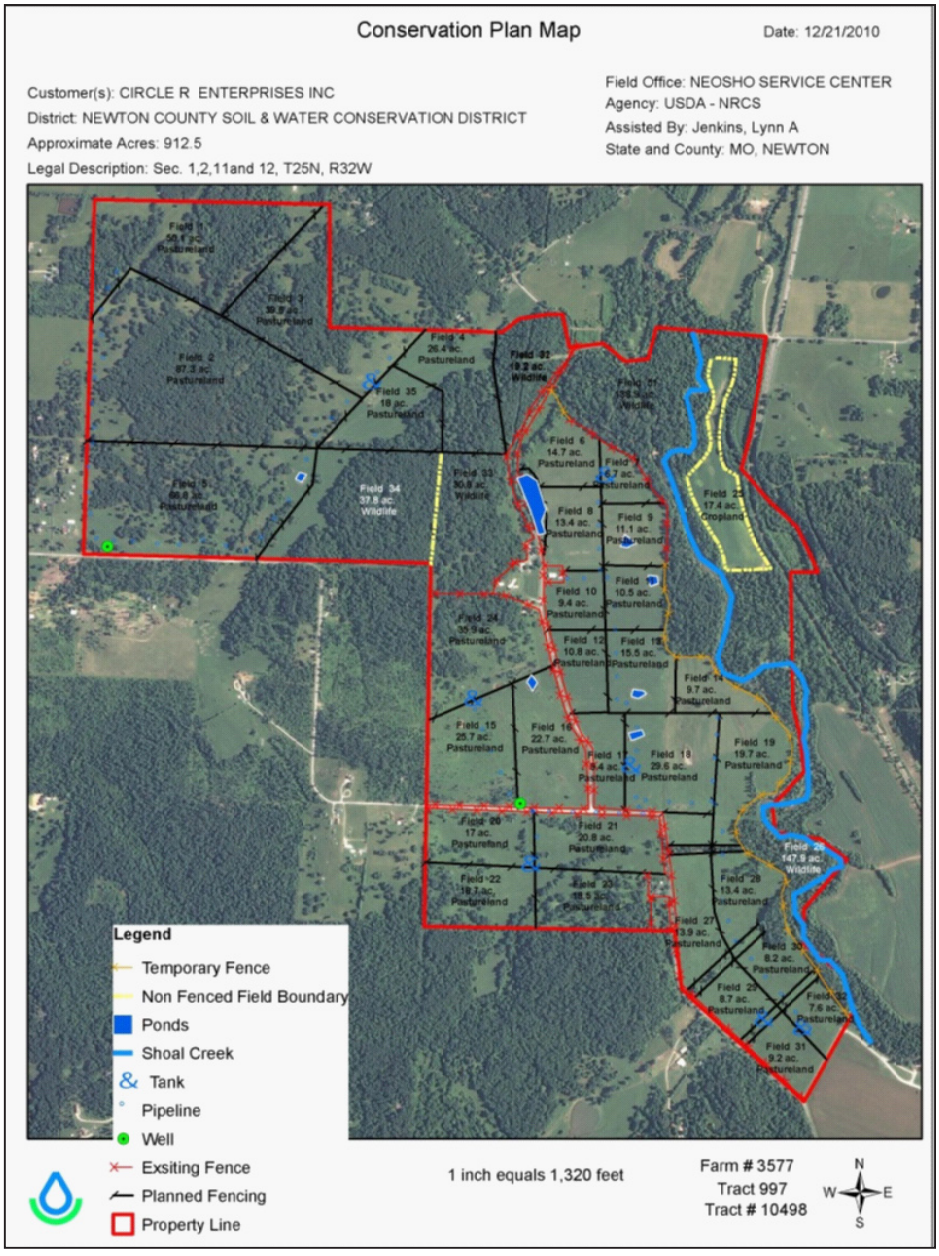
- Applied in 2010 using NRCS- EQIP.
- Provides stream corridor protection of Shoal Creek.
- Reduces streambank erosion, provides improved aquatic habitats and allows for natural filtering of contaminants.
- Promotes natural flood debris break for pastures.

Other Practices:

- Foraging grasses are a mix of Bermuda grass, fescue and clover.
- Pastures are managed to reduce the use of fertilizers and lime and maintain nutrient levels naturally.

Resources Used:

- NRCS program funds: EQIP.
- MU Extension, Southwest Research Center– provided technical assistance on soil testing, recommendations on proper chemical use and training through grazing schools and field days.
- Missouri Department of Conservation – provided guidance on wildlife plantings and timber management and information on streambank erosion and control.



Source: NRCS, Neosho Service Center

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Stop B: Missouri American Water – Joplin's Shoal Creek Intake

Matt Barnhart, Missouri American Water

Missouri American is an investor-owned utility specializing in water and wastewater treatment. This utility serves several communities in Missouri for potable water needs, including the city of Joplin. Drinking water for the city of Joplin comes from both surface and groundwater sources and is treated at the Missouri American-owned Blendville Treatment Plant. Shoal Creek, a tributary to the Spring River, serves as the primary surface water source for the city of Joplin. This facility is one of the two surface water intake stations in the Spring River Watershed used for raw water intake that is treated to make potable water. The city of Neosho also has a surface water intake.

Intake pump station that houses 5 pumps . The lower half of the structure is divided into two wetwells used to store water before pumping it to the treatment plant.

The Shoal Creek intake structure draws water from the stream through a water crib structure, located about five feet below the waterline. The water level at this location is maintained by a weir structure a little less than 1-mile downstream of this facility. As water is taken in through the intake, it flows by gravity to a set of five pumps housed in the intake pump station. In total, this pump station can pump about 30 MGD (or 20,830 gallons per minute). The raw, or untreated surface water, is then pumped to Missouri American's treatment facility (Blendville Treatment Plant) for treatment into potable water safe for human consumption. After treatment, the water flows throughout Missouri American's 502-miles of distribution system piping to serve 24,000 connections. This pipe network serves about 50,000 Joplin residents. Missouri American also provides potable water wholesale, through sales contracts, to other neighboring communities such as Webb City.

What is a water crib?

A water crib is a structure that collects water close to the bottom of a waterway (stream, lake, etc.) to supply water to a pumping station. The crib surrounds an intake pipe or structure to protect it from damage.

Water Use Statistics for 2012:

- A total of 4,836 million gallons of potable water was produced and treated for retail and wholesale customers in the regional Joplin area from the Blendville Treatment Plant and wells combined.
- Blendville Treatment Plant treated 4,171 million gallons of surface water.
- Groundwater wells in Joplin produced 665 million gallons.
- July 30, 2012 was the peak usage day, with the total amount of water pumped to customers at 21.2 million gallons.

Water line that takes water from intake structure to wetwell.

Treatment Considerations of Surface Water:

- Surface water sources are exposed directly to runoff from weather events; terrestrial and aquatic animal life; and man-made activities. As a result, these waters contain disease-causing microbes and must be treated in order to meet Federal standards.
- Surface water sources must be treated by both physical and chemical process. The treatment process is aimed at preparing the water to be as clean and clear as possible before disinfection.
- In the disinfection step, the microbes are killed or inactivated, making the water safe to drink.
- This final water treatment activity is one of the most significant public health advances made in the 20th century.

Shoal Creek near the intake structure.

Watershed Characteristics Upstream of Shoal Creek Intake:

- 439 square miles of drainage area.
- Majority in Barry and Newton counties.
- Mostly pasture and woodlands, little urbanized area.
- 50 stream miles.

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Stop C: Carroll Sill Farm- Grassways and Terraces

Mr. Carroll Sill, owner and C & C Dairy (Ronald Craig) operator

The Carroll Sill farm is a 128-acre operation along Center Creek near Carl Junction. Most of the acreage is devoted to row crops. Ronald Craig, of C & C Dairy, is the operating producer of the crop land. In recent years, the owner and operator have been incorporating several agriculture best management practices that provide a sustainable cropping system that, in turn, provides numerous benefits to the soil and water resources of the Spring River Watershed. Construction practices such as the waterway and terrace system that is visible from Hawthorne Road, along with other management operations such as Conservation Crop Rotation, Reduced Tillage and Residue Management, reduce the erosion rate on the land surfaces. These management tools, in turn, reduce the amount of sedimentation and pesticide/herbicide runoff that is entering Center Creek of the Spring River Watershed.

Aerial overview of waterway and terrace system.

Looking south from Hawthorne Road (State Hwy Z). Waterway at upper right with terraces extending left.

Sill waterway in October 2010, after construction and seeding.

Grassed Waterway:

- Installed in Oct., 2010 with State Cost-Share.
- Rebuilt from waterway that had silted full.
- Covering 2.7 acres.
- Applied to address active gully erosion.

Terrace System:

- Originally built in mid-1990's with State Cost-Share.
- Currently serving 14 acres.
- Adding two additional terraces to system once the grass is established in waterway.
- Applied to address gully erosion, as well as sheet and rill erosion.

Conservation Crop Rotation:

- Applied voluntarily by operator.
- Crops grown in specific sequence to improve soil health.

Reduced Tillage:

- Applied voluntarily by operator.
- Less tillage facilitates a reduction in soil erosion.

Residue Management:

- Applied voluntarily by operator.
- Leaving more residual plant materials from harvested crops through reduced tillage operations and higher cutting heights during harvest increases soil stability and adds organic material to the soil.

What is the State Cost-Share Program?

The (Missouri) State Cost-Share Program is a program that provides financial assistance to landowners to help them implement better management practices on their land to reduce soil erosion and improve the quality of our natural resources. Funding for this program is provided by a 1/10th-cent sales tax approved by Missouri voters. This tax is known as the Missouri Parks and Soils Tax and the initiative is voted on by the citizens of Missouri every ten years. This tax was last passed on Aug. 8, 2006 by a 76 percent majority.

View of typical terrace construction, with up center of photo and terrace berm up left side of photo.

Resources Used:

- Natural Resources Conservation Services – Provided technical assistance (practice design, layout, construction checkout and inspecting the practice seeding).
- Jasper County Soil and Water Conservation District – Provided local administration for the State Cost-Share Program financial assistance (applications and claims).
- Missouri Department of Natural Resources –Provided administration and payment processing for all State Cost-Share practices applied.

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Stop D: Southwest Missouri Agricultural Irrigation Water Use Project

Brian Fredrick, Missouri Department of Natural Resources- Water Resources Center

In an effort to understand more about water use in the region, the Missouri Department of Natural Resources' Water Resources Center initiated a program that begins the process of collecting agricultural irrigation water usage to help evaluate needs in southwest Missouri. This cooperative effort between agricultural producers in Barton, Dade, Jasper and Lawrence counties and the department began in 2009.

Center pivot of an irrigation system.

Irrigation well meter equipment.

- Fifteen agricultural irrigation wells were equipped with flow meters to assess growing season water use
- Historically, little was known about agricultural irrigation water use in this region of the state.
- According to the U.S. Geological Survey (USGS 2009), Missouri ranks 15th in the nation in irrigated land acreage and 17th for irrigation water withdrawals, 96.5 percent of which is groundwater. The metered wells in this project range in depth from 1,000 to 1,400 feet and draw water from the Ozark Aquifer.
- During the 2012 growing season:
  - Water use at the fifteen wells ranged from 21,070,700 to 69,795,600 gallons.
  - Total water use for the fifteen wells during the 2012 growing season was 530,923,400 gallons.
  - The 2012 growing season water use is 5.8 percent greater than the 2011 growing season and 52.2 percent greater than the 2010 growing season when 348,877,300 gallons was used.
- Irrigation metering helps producers better understand the relationships between applied water and production yield in order to manage their irrigation water use more effectively. Irrigation metering is also useful to water resource managers, it allows them to improve water management and complete annual water use reports.

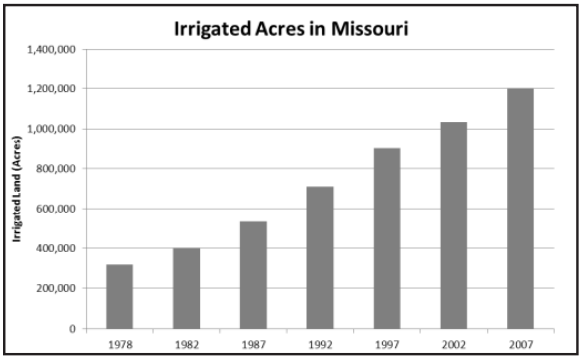

Figure A. The total number of irrigated acres has increased in Missouri since 1978, from 320,387 to 1,199,981 acres in 2007.

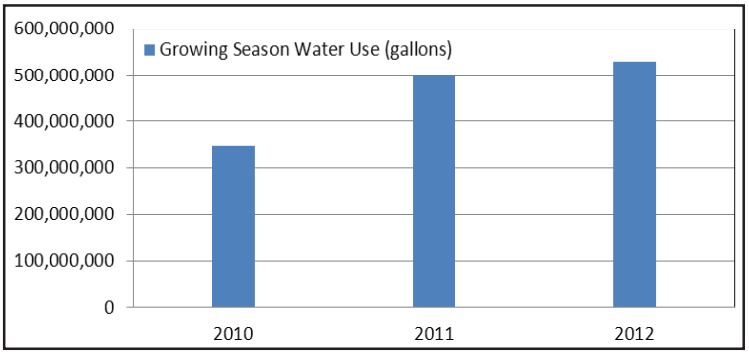

Figure B. There are 15 flow meters installed on wells to provide information about growing season water use.

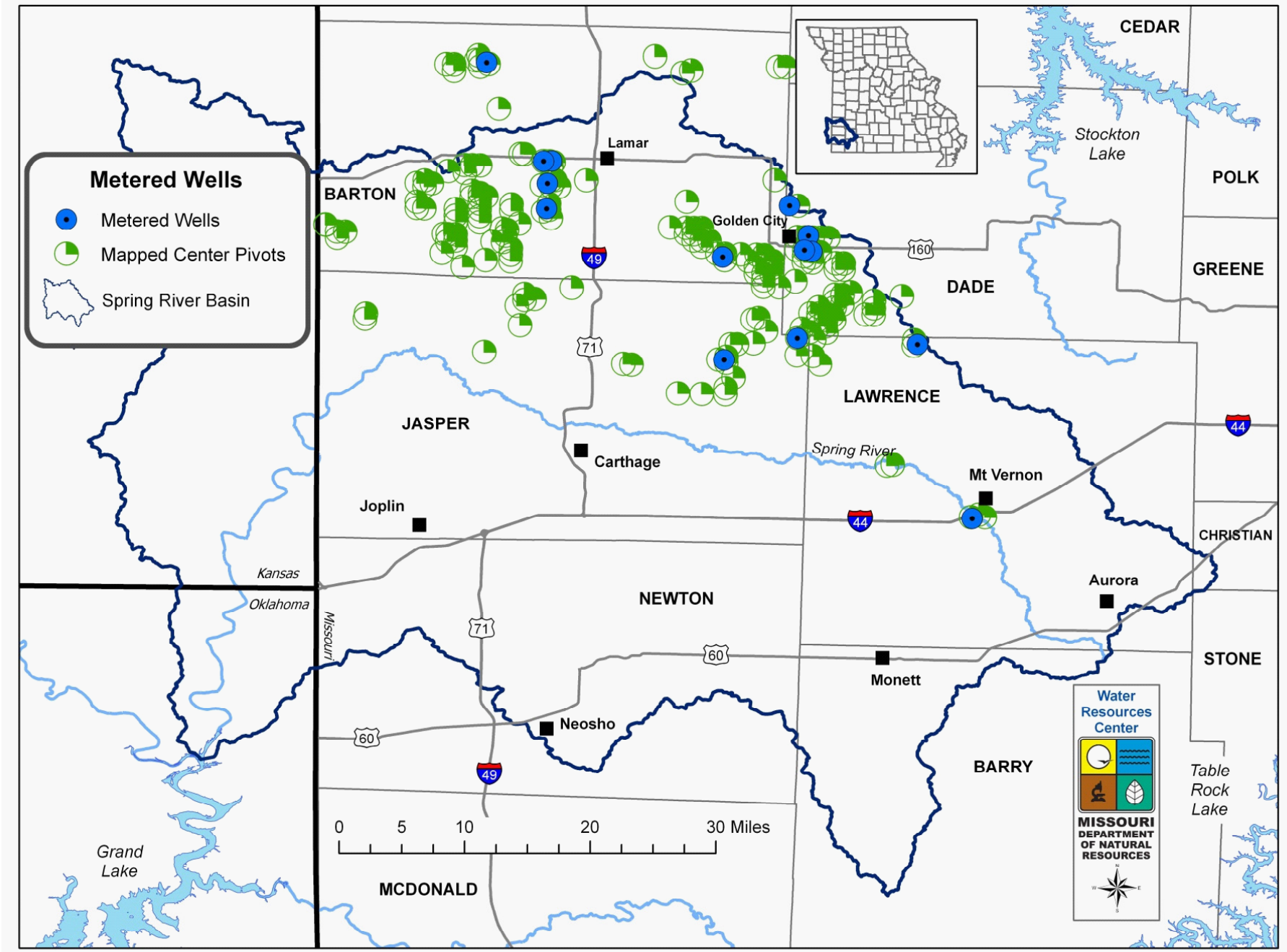

Figure C. Major water users and center pivot irrigation system in the Spring River Watershed.

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Stop 5: City of Carthage Wastewater Treatment Plant

Glenn Chambers, Chief Operator and Nathan Terry, Lab Technician and Operator

The city of Carthage Wastewater Treatment Plant is located just west of the city, in the shadows of U.S. Interstate 49. The facility serves 14,400 people and 775 commercial accounts and includes 87.6-miles of sewer lines in the collection system. On a typical day, the facility treats 5.2 MGD (million gallons per day) of wastewater, but can handle treating up to 16.0 MGD during heavy rains. This facility treats both residential and industrial wastewater, with industrial flows making up 25 percent of the total influent received.

Influent Pump Station ➤ Grit Removal and Bar Screen ➤ Aeration Basin ➤ Screw Pumps ➤ Clarifier ➤ Ultraviolet Disinfection ➤ Discharge to Spring River

Treatment Process:

When wastewater reaches the plant, the raw sewage is sent through a grit removal chamber and bar screen that act to remove inorganic solids from the water, preventing the solids to be carried any further through the treatment process, decreasing wear and tear on equipment and problems in the treatment process. This type of treatment is considered preliminary treatment. The water is then conveyed through a flow splitter box that carries water to one of two aeration basins, or an oxidation ditch. This secondary treatment technology is a biological treatment process that relies on microorganisms to consume biodegradable organics. After treatment in the oxidation ditch, the wastewater flows to a set of screw pumps that are used to lift the wastewater to one of three clarifiers. Clarifiers allow the clear water to separate out from the microorganism-rich sludge. The sludge is then returned to the oxidation ditch, or aeration basins, to continue the treatment process and the clear liquid, or supernatant, is conveyed to the disinfection system for final treatment before discharge. Disinfection of the effluent, or treated wastewater, is provided by ultraviolet light during the recreation season prior to discharge into the Spring River. The effluent discharged into the stream is required to meet stringent effluent regulations and water quality standards outlined in the Missouri State Operating Permit promulgated by the Missouri State Clean Water Law. The discharge must be protective of the beneficial uses of the receiving stream.

How much water is used daily by a household?
For wastewater treatment system design, it is estimated that one household uses approximately 370 gallons per day.

Periodically, the sludge is 'wasted' from the clarifier and sent to a sludge thickener. A sludge thickener is used to remove excess liquid from the sludge before transporting it to a sludge holding tank. In the sludge holding tank, aerators promote decomposition of the organics in the sludge. Aerobic digestion produces a stable Class B sludge product, reduces mass and volume, and reduces pathogenic organisms and vector traction. The city uses land application to dispose of the treated sludge, which promotes beneficial reuse and recycling of biosolids.

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Stop F: City of Carterville Wastewater System Improvements

Glen Davidson, PE, Allgeier, Martin and Associates Inc.

Carterville lift station: Wastewater lift stations are designed to move sewage from lower to higher elevation, where elevations do not allow for gravity flow from the source to a wastewater treatment plant.

The city of Carterville capitalized on the American Resource and Recovery Act funds (commonly referred to as Stimulus funding) to build a new lift station. The purpose of the project was to replace an existing lift station with an upgraded facility capable of transporting peak wet weather flows to the regionally-based Center Creek Wastewater Treatment Plant.

The existing lift station had two 15-hp pumps that together were capable of pumping up to 550 gallons per minute (gpm). When incoming flow exceeded 550 gpm, the station was designed to divert peak wet weather flows to an existing downstream lagoon built in the 1960s that was converted to a peak flow storage basin. The Missouri Department of Natural Resources issued a permit allowing the basin to discharge to an unnamed tributary to Center Creek. The tributary empties into Center Creek, which after 13 stream miles flows into the Spring River. The original design allowed effluent flows of up to 330 gpm (480,000 gallons per day).

Over the years, incoming flows exceeded the station's capacity more frequently and discharges from the basin occurred more frequently as well. Because of this, the department would not renew the basin's discharge permit after 2011. The city began to make plans to replace the station.

The new lift station utilizes two normal-duty and two peak flow pumps and can pump up to 1,700 gpm. The station provides automatic screening of incoming flows, continuous flow measurement and standby power. The project included construction of a new force main and interceptor sewer to receive pumped peak flows. The project was completed in December, 2010 at a total project cost, including construction and engineering, of approximately $1,388,500.

Upon completion of the new lift station, the peak flow basin was closed by the EPA as a part its ongoing remediation of surface mine wastes in the Oronogo – Duenweg Mining Belt site in Jasper County. The remediation is a Superfund activity authorized by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by Superfund Amendments and Reauthorization Act.

Contractor: Southard Construction Co. of Joplin, Inc.
Engineer: Allgeier, Martin and Associates, Inc.

Resources Used:

- American Resource and Recovery Act funds.
- U.S. Environmental Protection Agency - Provided technical guidance and assistance in closing the existing peak flow storage basin.
- Missouri Department of Natural Resources - Provided administration and payment processing for all State Cost-Share practices applied.

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Stop G: Oronogo-Duenweg Mining Belt

Mark Doolan, U.S. Environmental Protection Agency

Typical mining waste area prior to remediation activities.

Mining area post-remediation, after contaminated sediments have been removed and the site revegetated.

The Oronogo-Duenweg Mining Belt Site is part of the Tri-State Mining District, which covers approximately 2,500-square mile area in southwestern Missouri, southeastern Kansas and northeastern Oklahoma. Mining, milling, and smelting of lead and zinc ore began in the District in the 1850s and continued until the 1970s. Mining operations in Jasper County generated 150 million tons of wastes, of which approximately ten million tons remain today. The wastes from the mining, milling, and smelting of the lead and zinc ore resulted in the contamination of ground water, surface water and surface soil with heavy metals. Investigations of the mining wastes indicate the piles are causing significant risk to people that live on or near the wastes, and to the environment, particularly fish and mammals. The EPA completed a Record of Decision for cleanup of the wastes in 2004 and began the cleanup activities in 2007. The cleanup actions consist of excavating metals contaminated mining wastes, soils and sediments. These materials are disposed in mine subsidence pits or above ground repositories, and then are capped with clean clay and topsoil and revegetated with native warm-season grasses.

In addition, approximately 500 homes located in the site relied on private shallow ground water wells for drinking water. EPA identified at least 100 of these wells that had lead and cadmium contaminants exceeding health-based action levels. Over 70 miles of new public water supply mains were installed to replace the contaminated wells and provide safe drinking water to residents. Also, approximately 2,600 residential yards were contaminated with lead above acceptable levels from the mining and smelting activities. These contaminated properties were remediated by excavating and replacing the topsoil in the yards.

EPA is currently investigating the metals contamination in the perennial streams within the Tri-State Mining District. Numerous sediment and surface water samples have been collected and analyzed. A risk assessment has been conducted and EPA is currently conducting sediment transport modeling to identify areas of sediment contamination with high concerns. Decisions concerning stream cleanup will be made after the modeling efforts are complete.

Ben's Branch before cleanup

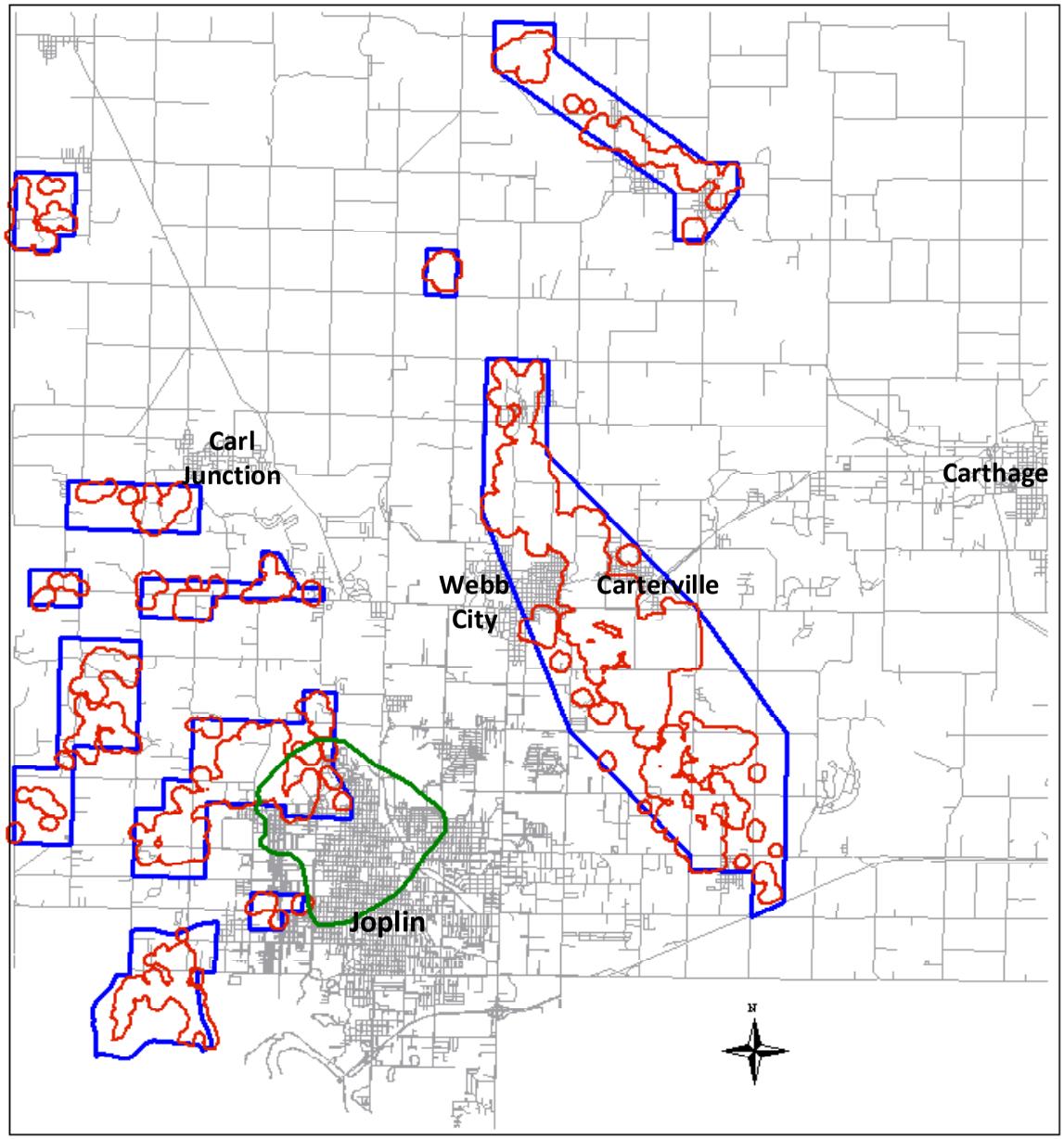
Ben's Branch after cleanup

Jasper County

Mine Waste Areas and Smelter Zone

Smelter Zone

Area of Mine Waste

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