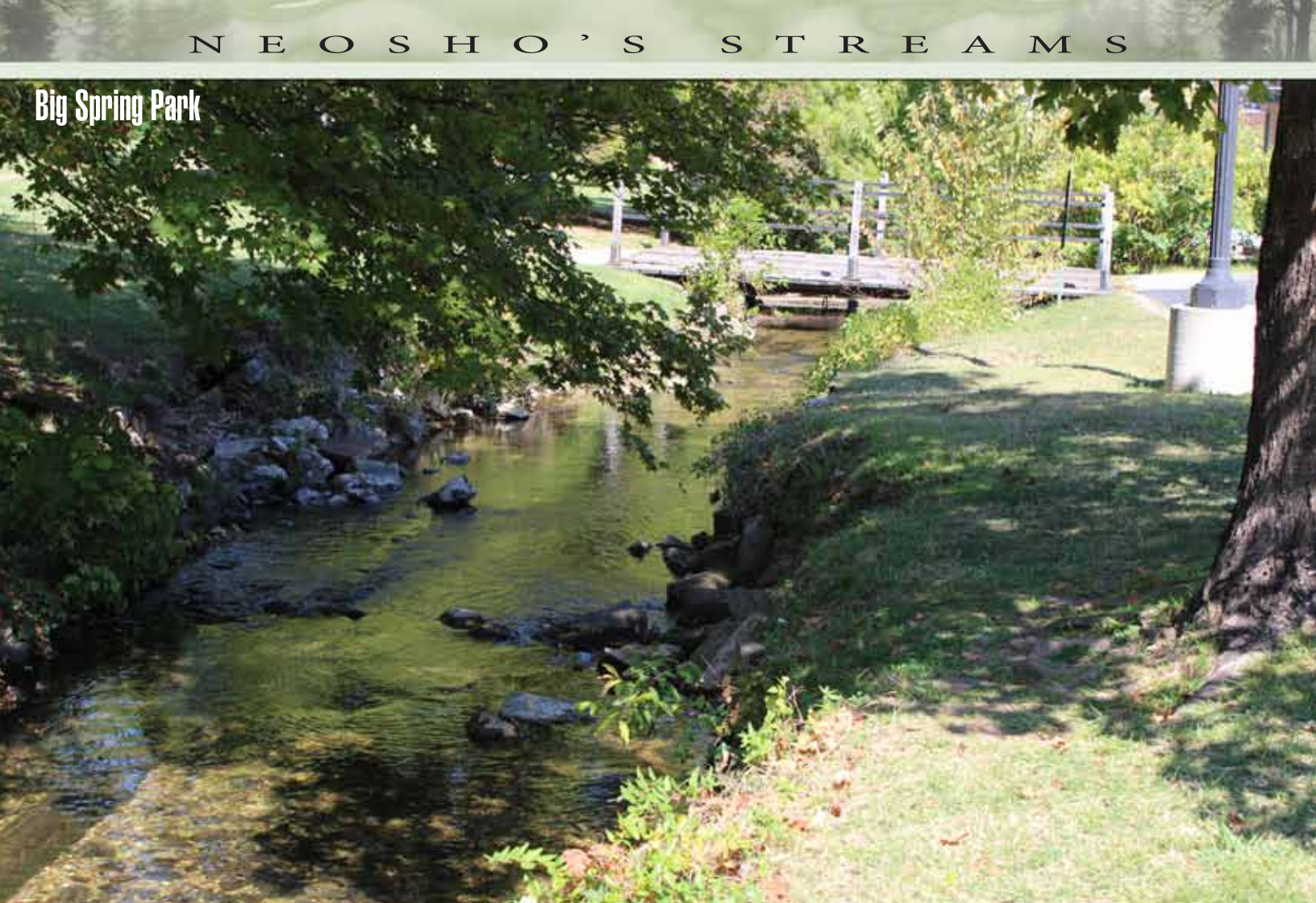




Big Spring Park

Going with the flow

A citizen's guide to understanding Neosho's Streams

It should come as no surprise that Neosho's name is a derivation of *Ne-o-zho* or *Ne-u-zhu*, a Native American term meaning "clear water" or "abundant water." Nine springs and a network of streams and tributaries have provided Neosho residents easy access to a clear and abundant water supply throughout the city's history.

Like Neosho, many Missouri communities have springs and streams that were part of local history. Some towns feature a spring that watered early settlers and kindled the first sparks of community through the establishment of a trading post or stagecoach station. Other towns trace their communal beginnings to a stream-powered gristmill that created the area's first gathering place.

Urban waterways are still important today. They provide drinking water, play supporting roles in industrial and commercial activities and, in many cases, are aesthetic anchors of recreational amenities such as parks and greenway trails.

In Neosho, the trout fishing opportunities in Hickory Creek, the beauty of Big Spring Park and the flooding events that have occurred periodically in the city's history are but a few of numerous examples of why urban stream management needs to be a relevant issue for all who work or live in this beautiful community. Maintaining the health, beauty and functionality of the city's springs and streams is a task in which all Neosho citizens have a part. Citizen stewardship will play an important role in keeping the city's waterways what they are now – the crown jewels of a vibrant community.

Water, Water Everywhere



The city of Neosho is in two major watershed basins. Approximately half the city (the southern and western parts) drains into Elk River. Three streams in the Elk River Watershed that are in close proximity to Neosho are Indian Creek, Lost Creek and Buffalo Creek, which has its headwaters on the south side of town. The other half of Neosho (the northern and eastern parts) drains into Spring River. Hickory Creek and Shoal Creek are the two streams in this watershed that Neosho residents know best. These two streams run through town. Two tributaries of Hickory Creek – Seneca Road Branch and High School Branch – flow through Neosho. A third tributary – Elm Spring Branch – is near Neosho. It flows into Hickory Creek just outside the city limits.

The Basics

Managing an urban stream, whether it's in Neosho or another community, begins with understanding a few basic principles of what a stream is and how it works. A stream is a naturally occurring body of running water that flows along a linear course on or under the earth's surface. Some people call smaller waterways creeks and larger ones rivers, but "stream" is the hydrological term used for naturally occurring linear waterways of all sizes. However, a stream is more than a line of water that flows randomly across the landscape: It's a complex mechanism of interlocking parts. Knowing how these parts work together and understanding the impacts urbanization can have is the key to developing successful management strategies for an urban stream.



Hickory Creek



Anatomy of a Stream

Hickory Creek

Channel: A stream's channel conveys all non-flood water flow and a portion of the flow during flood events. It consists of the space between the stream banks. Determined by precipitation patterns and groundwater condition, stream channels have either perennial flow (continuous throughout the year), intermittent flow (sporadic, but pools occur throughout all or most of the year) or ephemeral flow (occurs briefly after precipitation or melting events). Healthy streams have balanced energy-sediment-water interactions, unconstrained meander patterns and properly sized channels to convey runoff from the watershed without excessive damage to stream banks and beds. Stream channels also provide habitat and travel corridors for wildlife and aid in the dispersal of plant species.

Riffles and pools: Riffles are the shallow gravelly areas of streams where water flows more swiftly. Riffles are separated from each other by deeper, slower-flowing pools. In an undisturbed stream, riffles and pools occur in a relatively evenly spaced sequence. This pattern helps control the flow of streams and plays an important role in the life cycles of the creatures living in them.

Bends: Though the bends of a stream appear to be little more than randomly occurring curves, they are vital parts of a naturally occurring waterway. The bends of a stream serve as brakes that help slow the speed of the water flowing in the channel. As streams are artificially straightened, bio-diversity tends to decrease and flooding events are likely to increase.

Riparian Corridor: The riparian corridor (sometimes called the stream corridor) is vital to a stream's operation and overall health. It is the strip of land adjacent to both sides of a stream. An ideal corridor consists of a heavy growth of plants, shrubs and trees that prefer wetland-type soils. This vegetative belt filters water entering the stream and is also wildlife habitat. The desired width of a riparian corridor varies according to the size of the waterway.

Floodplain: The floodplain is the relatively level area on both sides of a stream's main channel that carries excess water the channel cannot handle. All streams, regardless of size, have a floodplain, part of which is the riparian corridor.

Watershed: A stream's watershed is the total land area that contributes runoff to a stream. It's composed of the landscape and smaller tributaries surrounding the stream. Watersheds vary from a few acres to thousands of square miles. Watershed conditions influence stream hydrology and groundwater recharge as well as the quantity and quality of a stream's water. Watersheds that contain abundant and diverse vegetation trap pollutants, slow sediment erosion, and help streams maintain an even-paced flow by delivering water at a slow pace. In an undisturbed watershed, the majority of water flowing into a stream enters it as groundwater rather than surface runoff.



Urban Stream Biology

Depending on water depth, landscape features and the quality of its watershed; an urban stream's biology can be quite varied. A waterway's diversity of species is a good indicator of water quality. The cleaner a stream's water is, the more types of creatures you're apt to find. Thanks, in part, to an abundance of springs that keep fresh water flowing into Neosho's streams, a variety of stream-related life can be seen (depending on the season) within the city. Here are a few:

Ozark cavefish: These small (two to three inches in length) translucent fish are among the more unique residents found in Neosho's underground waters. Residing primarily in cave streams and subterranean springs, this state-endangered species has become a symbol of good water quality.

Creek chub: Because of their tolerance of moderately high turbidity, these five to seven-inch fish are common in urban waterways (and other streams, too).

Neosho midget crayfish: This small (around 2 inches in length) brownish creature exemplifies the localized populations of some species of crayfish. It's found only in the Elk and Spring river systems.

Blanchard's cricket frog, southern leopard frog: These two frogs are two commonly sighted amphibians in urban waters. Blanchard's cricket frogs are small (a half-inch to slightly over an inch in length) and can be easily identified by the series of quick, erratic hops they make when startled. Southern leopard frogs are slightly larger (two to three inches) and can be identified by their spots.

Belted kingfisher: About the size of a blue jay, belted kingfishers can be identified by their distinctive head crests and the sudden dives they make to snatch small fish.

Yellow-crowned night herons: Fairly small for herons (around 2 feet in length); these long-legged birds with distinctive white facial striping have been spotted at the edge of Hickory Creek in summer. They mainly eat crustaceans, mollusks, insects and small fish.

Mink: These cat-sized mammals (1 ½ to 2 feet in length) that have long been famous for the quality of their fur are found on stream banks and marshes state-wide and have been seen along Hickory Creek in Neosho. Their diet consists of small mammals, frogs, crayfish and fish.

Dragonfly: This insect is commonly seen along streams in Neosho and elsewhere. Dragonflies don't sting or bite humans. They benefit us by preying on mosquitoes and other flying insects. At least 65 dragonfly species live in Missouri – and probably more are yet to be discovered.

What's bitin'

One of the prized catches anglers will find in Hickory Creek is rainbow trout. This popular sportfish's presence in Hickory Creek is maintained through regular stockings by the Missouri Department of Conservation and the U.S. Fish and Wildlife Service. The influx of cold water Hickory Creek gets from "feeder" springs allows trout to thrive in this stream. The portion of Hickory Creek that flows through Neosho has been designated a White Ribbon Trout Management Area by the Missouri Department of Conservation. This management zone stretches from Missouri Highway 86 to where Hickory Creek enters into Shoal Creek. Highlighting this trout fishing area is Morse Park, which features two disability-accessible fishing platforms and several parking lots and access points. Anglers fishing for trout within Hickory Creek's management zone need to remember there is no length limit, but the daily limit is four. It should be noted you can fish for trout at Hickory Creek year-round. You're allowed to keep what you catch (up to the four trout limit) from March 1 through October 31. From November 1 through February 28, trout fishing at Hickory Creek can only be done on a catch-and-release basis. A Missouri fishing permit is required. If you plan to keep the trout you catch, a trout permit is also required.

Rainbow trout isn't the only species you can hook in Hickory Creek. During periods of high flow, anglers may find pockets of rock bass (also known as goggle eye), bluegill, smallmouth bass and channel catfish on some stretches of the stream. You can fish for these fish throughout the year adhering to state-wide regulations for those species. Check the Wildlife Code of Missouri for fishing regulations that apply to species that reside in Hickory Creek.

Trout anglers who fish Hickory Creek and trout streams elsewhere in the state are being asked to do their part to help keep the potentially harmful algae known as didymo – or "rock snot" – out of Missouri. Anglers should clean their fishing equipment in a two percent bleach solution or with dishwashing detergent or dry any item that has been in the water by exposing it to sunlight for at least 48 hours. Replacing felt-soled waders with non-porous or rubber-soled waders will also help minimize the risk of spreading rock snot and other invasive species.



Fishing for trout in early March on Hickory Creek

Effects of urbanization on a stream

Construction and development can have a significant impact on an urban stream. Building placement, street design and other man-made changes to the landscape alter the runoff of water into streams. These significant modifications to what had been a balanced system can produce noticeable alterations of healthy stream functions.

More flooding: As land around an urban stream is developed, more terrain in the stream's watershed is topped with impervious cover in the form of parking lots, streets, building and sidewalks. Even un-paved areas often lose water retention capabilities as the soil becomes compacted and the land-cover changes from diverse vegetation to mowed and manicured lawns. These factors increase the amount of water that flows into urban streams from rain or snowmelt. This increases the frequency of times the stream's channel cannot contain all the water it receives from the surrounding landscape. As a result, flooding events occur more often.

More erosion: The increased velocity of stream flow and the increased volume of runoff during rain events can lead to stream bank erosion and the creation of channels that are much wider than those found in a similarly sized rural stream.

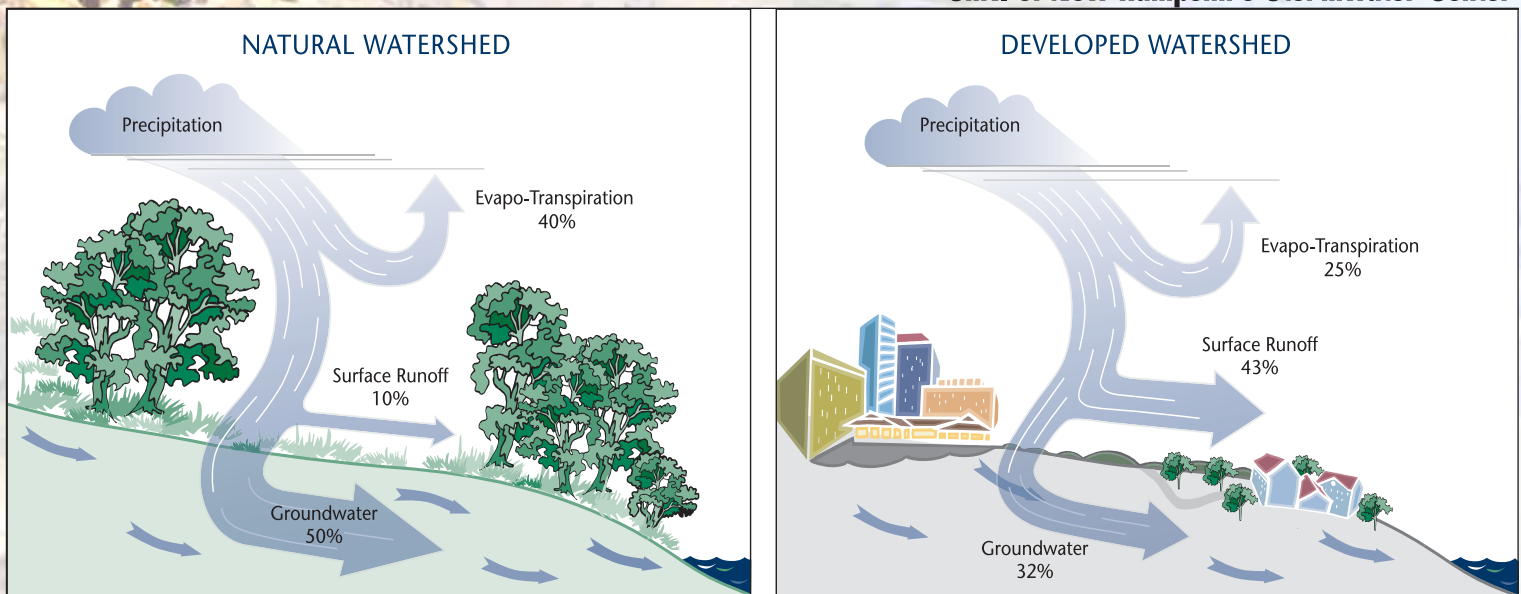
More pollution: This high amount of runoff from the surrounding watershed often results in higher pollution levels in urban streams. Runoff from developed areas can contain oil, grease, phosphorus, nitrogen, herbicides, pesticides, carbon, fecal matter and high levels of bacteria. The worst pollution often occurs in the "first flush," the period immediately after a rain event when large amounts of litter and pollutants are suddenly washed off of ground surfaces.

Water temperature fluctuations: In summer, an urban stream's surrounding paved areas and nearby building roofs act as heat storage areas. Some of this heat gets transferred in water runoff during a summer rain. This warm water runoff has been known to increase an urban stream's temperature by as much as 20 degrees F. This surge of warmer water can have negative impacts on organisms which are sensitive to temperature change.

Water level fluctuation: Ironically, the same watershed conditions that create higher-than-normal water levels in an urban stream during rainfalls and snowmelts can also cause lower-than-normal stream levels at other times. Because most rain in urban watersheds runs off surfaces rather than soaking into the ground, there is less groundwater to feed streams during dry periods. As a result, urban streams – particularly small ones – dry up much faster than rural streams of the same size.

Erosion

Univ. of New Hampshire Stormwater Center



How we can help

Everyone who lives in Neosho's watershed is a steward of the springs and streams that flow through the community. The integrity of these natural resources can be protected through the implementation of practices that slow, filter, and infiltrate rain water runoff. These three practices reduce the volume and velocity of water entering streams after a rainfall and also lessen the amount of pollution carried by that water. This, in turn, leads to fewer floods, less erosion and a number of other stream-related benefits. Healthy urban streams are a key component of a community's green infrastructure, which is a name given to working landscapes and ecological systems that provide functions that benefit human populations. Utilizing the appropriate native plants and land management strategies along a stream and in its surrounding watershed can help keep urban waterways in a healthy working condition.

Missouri Native Plants for Drainage Ways and Filter Strips

SEDGES RUSHES GRASSES	Palm Sedge	<i>Carex muskingumensis</i>
	Tussock Sedge	<i>Carex stricta</i>
	River Oats	<i>Chasmanthium latifolium</i>
	*Bottlebrush Grass	<i>Elymus hystrix</i>
	*Soft Rush	<i>Juncus effusus</i>
	*Switchgrass	<i>Panicum virgatum</i>

Missouri Native Plants for Riparian Corridors

SHRUBS	Black Chokeberry	<i>Aronia melanocarpa</i>
	*Button Bush	<i>Cephalanthus occidentalis</i>
	Gray Dogwood	<i>Cornus racemosa</i>
	Vernal Witchhazel	<i>Hamamelis vernalis</i>
	*Possum Haw	<i>Ilex decidua</i>
	*Spicebush	<i>Lindera benzoin</i>
	*Ninebark	<i>Physocarpus opulifolius</i>
	*Fragrant Sumac	<i>Rhus aromatica</i>
	Arrowwood	<i>Viburnum dentatum</i>

TREES	*Downy Serviceberry	<i>Amelanchier arborea</i>
	River Birch	<i>Betula nigra</i>
	Eastern Redbud	<i>Cercis canadensis</i>
	Fringetree	<i>Chionanthus virginicus</i>
	*Flowering Dogwood	<i>Cornus florida</i>
	*American Sycamore	<i>Platanus occidentalis</i>
	*White Oak	<i>Quercus alba</i>
	*Bur Oak	<i>Quercus macrocarpa</i>
	Bald Cypress	<i>Taxodium distichum</i>

*Native to Newton County

What to plant along streams

Wherever possible, buffer streams with a dense, wide stand of uneven-aged trees and shrubs. Incorporate a warm-season grass component at the stream corridor's edge. Besides filtering pollutants, native vegetation along streams and in floodplains helps stabilize stream banks, moderate water temperatures, prevent erosion, control flooding, recharge groundwater through infiltration, enhance aesthetics and provide wildlife habitat. Terrestrial and aquatic wildlife benefit from the abundance of insects and other organisms that are drawn to areas planted with a diversity of native vegetation. The plants also supply seed and forage for resident and migrating birds as well as organic matter to the aquatic system. Structures should not be built within riparian corridors or flood plains, but in some instances, community open space and recreational trails in the general vicinity of a stream can enhance the value of an urban stream. Also keep in mind that trees soak up considerable amounts of water so invest in the health of existing trees and protect them from being unnecessarily damaged or removed during construction projects

Strategies to slow rain water runoff:

1. Plant native plants with thick foliage such as grasses, sedges, and rushes along drainage paths. Forcing water to pass through dense stands of vegetation will slow its flow significantly.
2. Place gravel or larger decorative rock along drainage ways where plants are not a viable option. Gravel's rough surface dissipates some of the energy in fast-moving runoff and reduces its velocity compared to smooth pavement or mowed lawns.
3. Disconnect down spouts from underground pipes and allow the water to drain across the surface of your yard or into a rain garden.
4. Harvest rainwater from your roof in a rain barrel to reduce the volume of water that leaves your yard.

Missouri Stream Team Program



A joint effort of the Missouri Department of Conservation, the Missouri Department of Natural Resources and the Conservation Federation of Missouri, the Stream Team program is a chance for citizens of all ages to get involved in caring for the state's streams.

A Stream Team can be a family of three or a church group of 30. It can be a senior citizen group or a troop of young scouts. In other words, Stream Teams are for everybody. Trash pick-ups are Stream Team efforts that get the most publicity, but Stream Teams do much more than fill bags with litter. They do water quality testing and collect samples of aquatic animals. This data, which is passed on to government and environmental agencies, helps these larger groups develop management plans for watershed areas. You can volunteer with an existing Stream Team or start one of your own by contacting one of the organizations listed below. There are over 4,000 Stream Teams in Missouri and several are active in the Neosho area. The table to the right lists the springs and streams in Neosho and the surrounding area that have been adopted by Stream Teams. It is possible for several teams to work on the same stream, as is evidenced by the number of teams that have adopted sections of Hickory Creek and Shoal Creek.

Missouri Stream Teams in Neosho			
Water Type	Name of Spring/Stream	Stream Team #	
Springs	Big Spring	524	
	Oak Spring	569	
	Bartholic Spring	1,929 2,569	
	Elm Spring		
	Hearrell Spring McMahan Spring		
Small Streams	Elm Spring Branch	546	
	Hickory Creek Branch	1,150	
Larger Streams	Buffalo Creek	2,855 2,864	
	Hickory Creek	845 1,150 1,639 2,383 2,568 2,569 2,895 2,929 3,860	
		Shoal Creek	298 1,400 1,150 2,855 2,895 3,433

Missouri Department of Conservation Neosho Office: 417-451-4158 http://www.missouriconservation.org	University of Missouri Extension Service Newton County Office: 417-455-9500 http://extension.missouri.edu/newton/
Missouri Stream Team Program www.mostreamteam.org	Missouri Master Naturalists Chert Glades Chapter www.chertgladesmn.org http://extension.missouri.edu/masternaturalist/
Southwest Ozarks Stream Team Association http://www.swost.org	Environmental Task Force of Jasper & Newton Counties Lower Shoal Creek Watershed Partnership Spring River Watershed Partnership http://www.envtaskforce.com
Elk River Watershed Improvement Association 417-223-3414 http://www.erwia.org	

This booklet was funded by the Missouri Department of Conservation and was published in cooperation with the City of Neosho.

