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Cumberland River Basin and Four Rivers Region

Status Report

March 2000

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Basin or Watershed?
The *basin* of a river or stream is all the land that is drained by a lake, river or stream. Another word for basin is *watershed*, which comes from the observation that water is shed from an area of land and flows downhill into a body of water.

Karst Topography
Karst topography is defined as that type of terrain and geologic region underlain by bedrock that easily dissolves, such as limestone, and characterized by depressions in the ground, or sinkholes, caves, and underground drainage. Because water can enter the subsurface easily through conduits and fractures in the soluble limestone bedrock, karst aquifers are highly susceptible to contamination.

Geography and Stream Health
How does geography affect the health of streams? The lay of the land, soil types, and vegetation in an area can directly affect water quality – especially when the land is cleared or tilled. For example, basins with loose soils, steep hills, or little vegetation are often severely eroded by rainstorms, leaving streams and rivers muddy and subject to flooding from rapid runoff. Vegetation can reduce flooding by slowing down runoff from rainstorms and can even filter out silt and other contaminants before they reach streams. Trees, bushes, and tall grass along stream banks also reduce erosion along the channel and create valuable habitat for birds, mammals, and other creatures.

What is a watershed?

No matter where you live, work, or play, you are in a watershed. A watershed is a geographic area where all water running off the land drains to a specific location. This location may be a stream, river, lake, wetland, or ocean; or the water may drain underground into the groundwater. You may live on a creek, which is considered a small watershed. Your creek may join a river, which is a larger watershed. The river may have many smaller creeks, known as tributaries, that drain into it and each of these tributaries has a small watershed associated with it, and each is part of the larger watershed of the river.

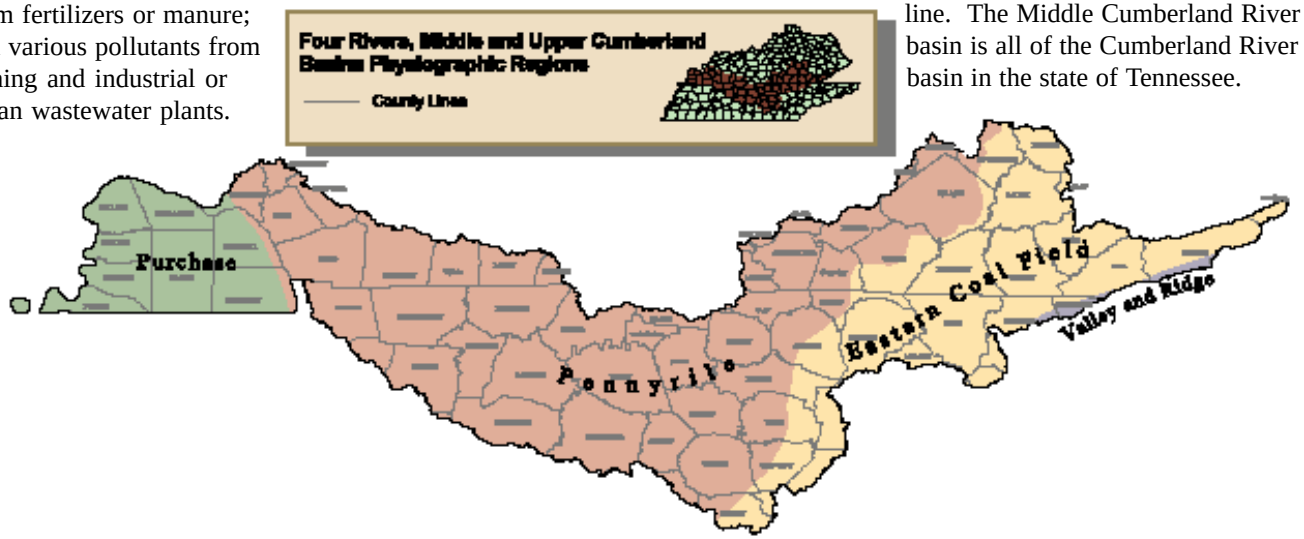
Is the watershed healthy?

That is the main question this report explores. In order to determine if the region's streams are contaminated, we have reviewed water sampling data, assessments of stream and river bank conditions, discharge permits for wastewater treatment plants, and activities like farming, development, logging, and mining. We have found that what happens in the river basin – or *watershed* – directly impacts water quality and habitat conditions. Some tributaries in the Cumberland River basin and the Four Rivers region are contaminated by agriculture (204 miles of streams), urban runoff (283 miles), resource extraction (1,075 miles), municipal wastewater discharges (358 miles), and waste disposal on the land (192 miles). These sources of pollutants contribute bacteria from sewage or livestock; silt from erosion, construction, or logging; algae blooms fed by nutrients from fertilizers or manure; and various pollutants from mining and industrial or urban wastewater plants.

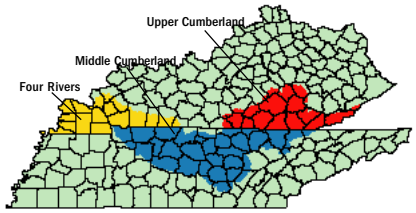
Most of the streams in the region, however, seem to be free of excessive pollution. Maintaining good water quality in the unpolluted parts of the river and cleaning up contamination in other sections will require a closer look at what is happening in the watershed, how it impacts watershed health, and what can be done to improve conditions. That is what this report is all about.

Regions of the watershed

The Four Rivers Region includes the far western portion of Kentucky, with portions of the Lower Cumberland River basin, Lower Tennessee River basin, and direct tributaries to the Ohio and Mississippi rivers. The Upper Cumberland River basin includes the headwaters of the Cumberland basin down to the Kentucky Tennessee state line. The Middle Cumberland River basin is all of the Cumberland River basin in the state of Tennessee.



Description of the Cumberland River Basin and the Four Rivers Region



To understand the health of the watershed, one must also understand the natural conditions of the watershed. The geology, or physiographic makeup of the basin, the type of terrain, the amount of water, population, land-use activities, etc., all have a bearing on where and how pollutants move in the environment and how we are exposed to them. In the end, these natural conditions affect the health of the watershed and the people who live there.

Physiography

The headwaters of the Cumberland River lie within the Eastern Coal Field physiographic region. Although there are some folded and faulted rocks, such as along the Pine Mountains, most of this region is characterized by flat-lying sandstones, shales and sedimentary rocks composed of sedimentary shale and limestone that have been deeply cut, creating steep hillsides and narrow valleys. Groundwater flow in this region is predominantly through cracks in the rocks, with wells in valleys typically producing more water than wells on ridges.

From the Eastern Coal Field, the river flows onto the Pennyrile Plateau. This plateau consists primarily of thick flat-lying limestone, with minor shale beds, and is characterized by flat to gently rolling terrain with well-developed karst topography. Groundwater flow in this region is mostly through well-developed conduits and enlarged fractures. Several springs in this region discharging from major conduits are large enough to support municipal water systems.

The Four Rivers Region in Kentucky is characterized by gently rolling terrain underlain mainly by loose sediments such as sand and silt. Groundwater flow is through the space between the grains of sediment. Shallow wells in the area are widely used for domestic water supplies; in addition, deeper wells in confined aquifers provide abundant water for industrial, municipal, and domestic use.

Biodiversity

Because of the variety of biological and physiographic regions that occur in the Cumberland River basin and the Four Rivers region, the natural biodiversity is high compared with many surrounding areas. For example, there are great diversities of fish, aquatic insects, and freshwater mussels, many of which exist only in this part of the state and should be protected. But biodiversity is threatened by pollution, siltation, and loss of habitat. Natural biological systems help humans by filtering and cleansing water, storing and detoxifying pollutants. The Kentucky Biodiversity Task Force is an excellent source of information on the status of Kentucky's plant and animal biodiversity at http://www.nr.state.ky.us/nrepc/dnr/ksnpc/biodiv.htm.

While the loss of biodiversity is a concern, the invasion of non-native species also poses a threat to other species and the integrity of the flora and fauna of the state. Exotic species often have no natural predators and can continue to reproduce to levels that will displace and out compete other species. This not only affects the existence of other species but has economic implications as well. The zebra mussel and quagga mussel attach themselves to any available hard substrate, including other mussels and snails, as well as water intakes, discharge structures, mooring and boating structures, etc. Maintenance and clearing of these mussels is very costly, and the costs get passed on to us, the consumers of drinking water systems.

Vegetation

The region is characterized by forest vegetation typical of the oak-hickory forest type, primarily white oaks, red oaks, and hickories, and a large number of other species.

Riparian area
Stream banks and the land along them are called a riparian area. With appropriate vegetation, riparian areas provide natural protection from pollutants that drain off the land. Good riparian management can prevent erosion and flooding. It also provides important habitat for wildlife because it offers food, water, shelter, and a travel corridor.

Biodiversity
Biodiversity is a term that applies to the health and function of streams, lakes and wetlands. Biodiversity is the number and kind of organisms present (or that should be present, including bacteria, plankton, plants, fungi, and animals).

Drinking Water Supplies
Water for drinking must be piped from some well or surface water supply. Public drinking water utilities have to be concerned with the quantity of the supply in order to meet the needs of the public. This can be greatly affected by droughts and other upstream practices. While the water is treated prior to distribution, the raw water that comes from the well, lake, or river must be of high enough quality to allow safe treatment. In times of drought or heavy rainfall, the quality can be adversely affected by discharges of wastewater or pollutants that run off the land. Protecting the drinking water source, or its watershed, is important to everyone.

Consumer Confidence Reports
The Safe Drinking Water Act of 1996 required that all community water systems annually report to water users information about the quality of the water delivered by the system. This report will let you know where your water comes from, how the water is delivered to you home, and violations and levels of regulated contaminants that have been found in the water.

Also included are remnants of the original bottomland hardwood forest, 80 percent of which has been converted to other use, primarily agriculture. Included in the bottomland forest are swampy areas containing such trees as bald cypress and water tupelo. While there is still a good diversity of tree species and some excellent stands scattered throughout the region, the quality of forest resources overall is mixed due to a general lack of resource planning, poor management practices, and impacts from poor harvest techniques and skid roads. As more and more acres of public land such as national forests are becoming off-limits to logging, harvesting pressure is increasing on private forest holdings such as those in the basin. An increasing source of pressure comes from demand for smaller trees that can be used for raw material for paper and chip mills. These demands have increased in number in recent years. This is reflected in the ratio of growth to harvest that is approaching 1:1 in the western part of the basin.

Water resources

The Cumberland River basin and the Four Rivers region are unique portions of the nation. Because of the rich supply of streams and other surface water, water use relies heavily on both surface water and groundwater. Drinking water is drawn almost equally from above-ground and below-ground sources. When you add the fact that much of the karst topography results in an intermingling of the surface and groundwater, these water supplies are very vulnerable to contamination from activities on the land.

There are approximately 27,668 miles of streams in the Four Rivers Region and the Cumberland River basin. These streams start as high-gradient mountain streams in the eastern headwaters of the Cumberland basin and transition to wider, slower moving streams in the western region. Because of the more gentle terrain and types of soil and geology, the lower portions of the Tennessee and Cumberland Rivers and the tributaries to the Mississippi may have wide meanders and frequently receive much of their stream flow from pockets of wetlands scattered about the region. These wetlands play a critical role in flood control by slowly releasing water to the rivers after a rain. They also play a vital role in providing habitat for wildlife. The Four Rivers area is also rich in man-made lakes, especially in the Land Between the Lakes Region. These impoundments provide flood control, water supply, recreation, and wildlife habitat.

How do people and land use affect a watershed?

Environmental studies in the Four Rivers/Cumberland River region demonstrate the close link between land activities and water quality. Headwaters of the basin contain old oil and gas wells, abandoned coal mines, and poorly logged areas, which can contribute brine, acidity, and silt, respectively, to the river. The middle section of the basin is a mix of urban, forest and agriculture, and the lower section flows through agricultural lands that produce row crops, livestock, and their periodic by-products – water-borne sediments and manure. Fecal contamination can come from hog farms or chicken manure disposal sites, mostly located in the lower Cumberland watershed, but found all over the basin. Manure contamination can also come from dairies along the middle reaches of the river, beef cattle on farms in the middle and lower reaches, and even household pets throughout the watershed.

Storm water runoff from the cities in the middle reaches of the Cumberland basin contains automotive oils, sediment from land clearing activities, particulates from cars and other

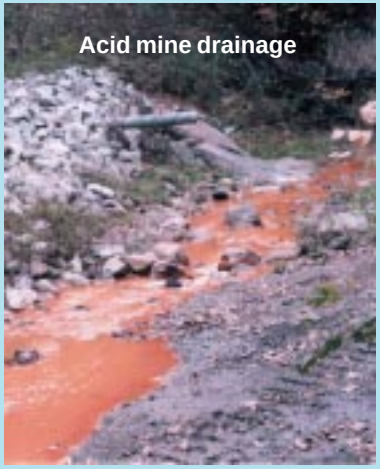
sources, nutrients that feed algae blooms, and other urban contaminants. Development and loss of greenspace also causes surges in stream levels due to rapid runoff - from roofs, roads, and parking lots - which erodes stream banks and can cause localized flooding. Finally, the loss of trees, shrubs, and grasses along stream banks causes further instability and erosion, with resulting increases in siltation and decreases in both instream and stream bank habitat. Channelization, the clearing and straightening of stream channels, aggravates both flooding and sedimentation, despite the common notion that it reduces flooding. Power boating can contribute an oily sheen on the water and, with improper disposal and direct discharges of waste holding tanks from houseboats, can degrade water quality. Land application of sewage and sludge from septic systems is practiced in some counties and can lead to runoff of nutrients and bacteria if not done properly. Illegal dumps of solid waste can result in the runoff of any number of pollutants from metals to pesticides to bacteria, depending upon what happens to be in the dump.

Obviously then, what happens on the land can have a significant impact on water quality in the streams and lakes. The predominant land-use activities within a watershed are good indicators of the potential contaminant sources within that watershed.

Agricultural land represents about 39.5% of the region and is used to grow crops or raise farm animals. Farmers may apply chemicals such as fertilizers, herbicides, or insecticides that could be carried off into the river by stormwater. Other impacts include soil erosion, resulting in sediments entering the streams, and pathogens and nutrients from animal wastes entering the streams.

Forestland represents about 51% of the region and may be a natural area that is relatively undisturbed or an area where intensive harvesting occurs or something in between. A forest area that is managed as a natural area may have relatively little or no impact on the waters within the watershed. However, a poorly managed forest that is harvested for lumber may impact the watershed through soil erosion, primarily from logging roads.

Residential land includes small communities and suburban areas of homes. Land disturbance during construction as well as land changes affect the hydrology of streams. Many homes depend on septic tanks, which, if not propely



Contaminants and their effects

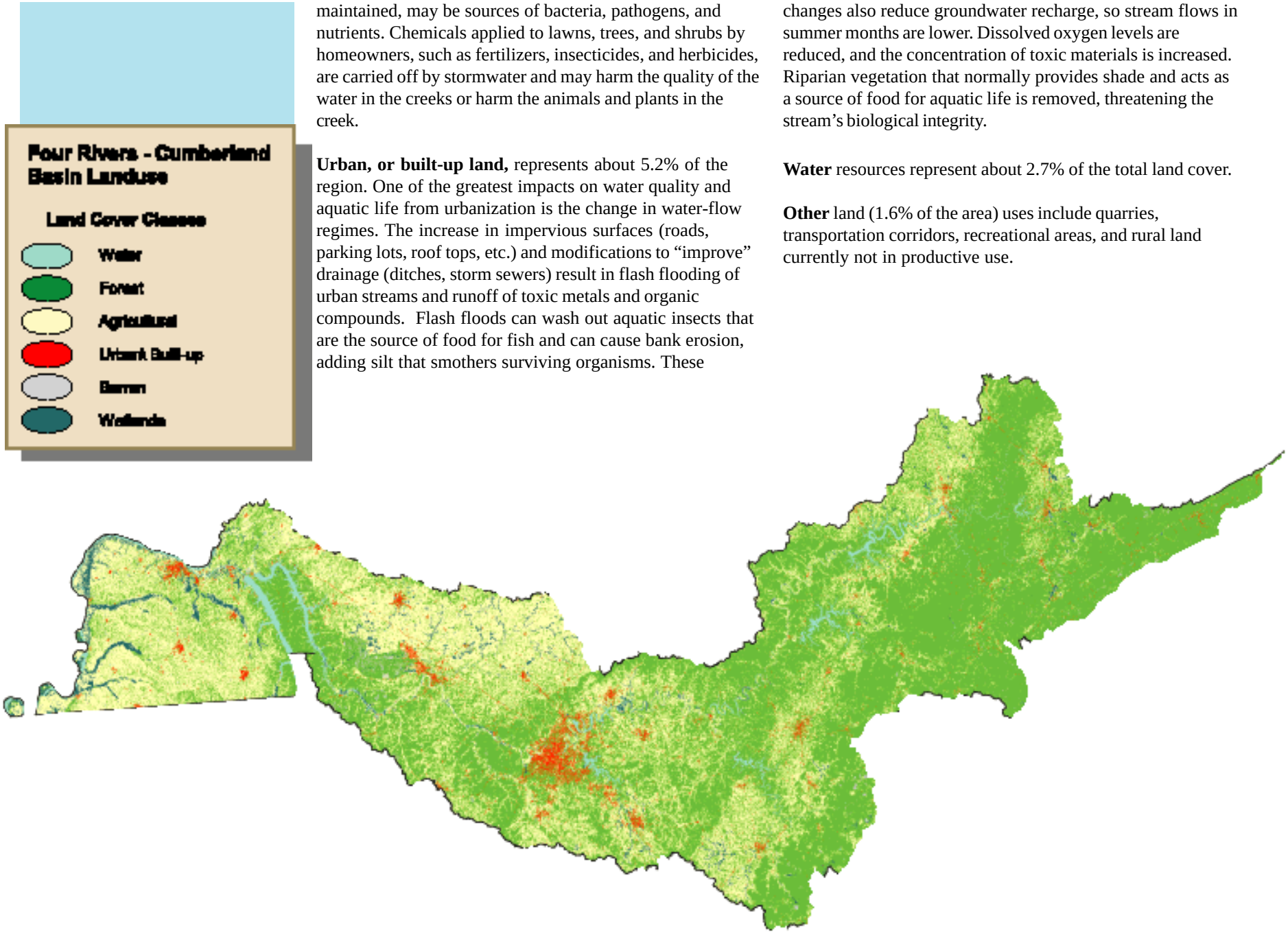
Nutrients – nitrogen and phosphorus can cause an increase in algal growth; when the algae die, their decomposition removes oxygen from the water; these result in low dissolved-oxygen concentrations. The breakdown of some nitrogen compounds by bacteria also lowers dissolved oxygen.

Pesticides – runoff of pesticides into streams results in harm and/or death to beneficial plants and animals that live in or use the water.

Pathogens – a high concentration of pathogens (bacteria, viruses, protozoans) may cause illness in humans and other animals and, in some instances, can cause death.

Sediments – the result of soil erosion causes reservoirs to lose capacity as the silt settles out, reduces suitable habitat in streams, and transports attached contaminants (nutrients and metals).

Metals – are toxic to fish, humans, and other animals and can cause illness, deformities, and death.



maintained, may be sources of bacteria, pathogens, and nutrients. Chemicals applied to lawns, trees, and shrubs by homeowners, such as fertilizers, insecticides, and herbicides, are carried off by stormwater and may harm the quality of the water in the creeks or harm the animals and plants in the creek.

Urban, or built-up land, represents about 5.2% of the region. One of the greatest impacts on water quality and aquatic life from urbanization is the change in water-flow regimes. The increase in impervious surfaces (roads, parking lots, roof tops, etc.) and modifications to “improve” drainage (ditches, storm sewers) result in flash flooding of urban streams and runoff of toxic metals and organic compounds. Flash floods can wash out aquatic insects that are the source of food for fish and can cause bank erosion, adding silt that smothers surviving organisms. These changes also reduce groundwater recharge, so stream flows in summer months are lower. Dissolved oxygen levels are reduced, and the concentration of toxic materials is increased. Riparian vegetation that normally provides shade and acts as a source of food for aquatic life is removed, threatening the stream’s biological integrity.

Water resources represent about 2.7% of the total land cover.

Other land (1.6% of the area) uses include quarries, transportation corridors, recreational areas, and rural land currently not in productive use.

What is the condition of the Four Rivers Region?

Description

The Four Rivers region includes the Lower Tennessee River basin, the Lower Cumberland River basin in Kentucky, and tributaries in the Jackson Purchase of Kentucky that drain to the Ohio and Mississippi Rivers. These watersheds drain approximately 4,703 square miles of Kentucky. This region contains many karst flow systems that affect underground water movement and quality. This area includes all or parts of 13 counties. Cities in the region include Clinton, Bardwell, Paducah, Mayfield, Murray, Benton, Calvert City, Cadiz, Hopkinsville, and Elkton. Major impoundments include Kentucky and Barkley Lakes.

Water Quality

Water quality in the region is generally good. To date, 1,070 miles of stream have been monitored and assessed for water quality and biological integrity of a total 7,259 miles of streams (15 %). The results of these surveys have revealed that approximately 75 percent of the assessed streams are fully meeting water quality standards. Streams not meeting standards are shown on the centerfold map. These impairments can be attributed to agriculture (219 miles of stream), physical alteration of the stream (40 miles), land disposal of waste (64 miles), municipal and industrial discharges (104 miles), resource extraction (18 miles), and urban runoff (77 miles).

Species of Concern

Much of the habitat for fish reproduction has been lost because of stream and river channel maintenance in the Four Rivers Region. As a result, several sensitive species are threatened. (See side bar.)

There are ten federally listed endangered species known to occur in the Four Rivers region. The Bayou de Chien system in Graves and Hickman counties is designated as an Outstanding State Resource Water due to the presence of the relict darter.

Historically, the Ohio, Tennessee, and Cumberland rivers supported the most diverse native freshwater mussel fauna in the United States. The decline in the number and types of freshwater mussel species in the basin can be attributed to industrial and transportation development, reductions in water quality, building of lakes, straightening and dredging streams, commercial mussel harvesting, gravel mining, and introduction of non-native species.

Mussels are filter feeders, siphoning algae, plankton, and other material from the water. Mussels are an integral part of aquatic ecosystems, also serving as a source of food for muskrat, raccoon, otter, mink, and fish. Because they feed by filtering particulates from the water column and because they tend to accumulate some types of pollutants (such as certain pesticides and metals), they can serve an important role as biological indicators of water quality. The Tennessee River below Kentucky Lock and Dam is also designated as an Outstanding State Resource Water because of federally listed endangered species and is also a state mussel sanctuary. A reach of the Mississippi River is an OSRW due to the recent discovery of the federally endangered fat pocketbook.

Other species are of concern because they are not safe to eat. A fish consumption advisory is a warning to the public to avoid eating too much of certain fishes because they are too contaminated for eating unlimited quantities. Fish consumption advisories for various species are in effect for the entire Ohio River mainstream (PCBs and chlordane), Little Bayou Creek in McCracken County (PCBs), and five ponds on the West Kentucky Wildlife Management Area in McCracken County (mercury). For more information on fish consumption advisories contact the Division of Water at (502) 564-3410.

Special Resources

The Four Rivers region is filled with opportunities for outdoor activities and provides important natural functions and refuge for wildlife. The Clarks River National Wildlife Refuge (NWR) is the first wildlife refuge established wholly within the state

Species of Concern

- Sturgeon chub, sicklefin chub, lake sturgeon, paddlefish, shovelnose sturgeon, relict darter
  Reason for Concern: Threatened by development and maintenance of the major rivers, especially from gravel dredging and flood control efforts in the tributaries.
- Alligator gar
  Reason for Concern: Threatened by loss of floodplain waters and wetlands adjacent to the major rivers.
- Fat pocketbook mussel, pink mucket pearly mussel, orange-footed pimple back pearly mussel, little wing pearly mussel.
  Reason for Concern: Reduced populations because bottom-feeding habits expose them to significant levels of contaminants.
- Zebra mussel, quagga mussel.
  Reason for Concern: Introduced species: threaten other sensitive species by competition and physically

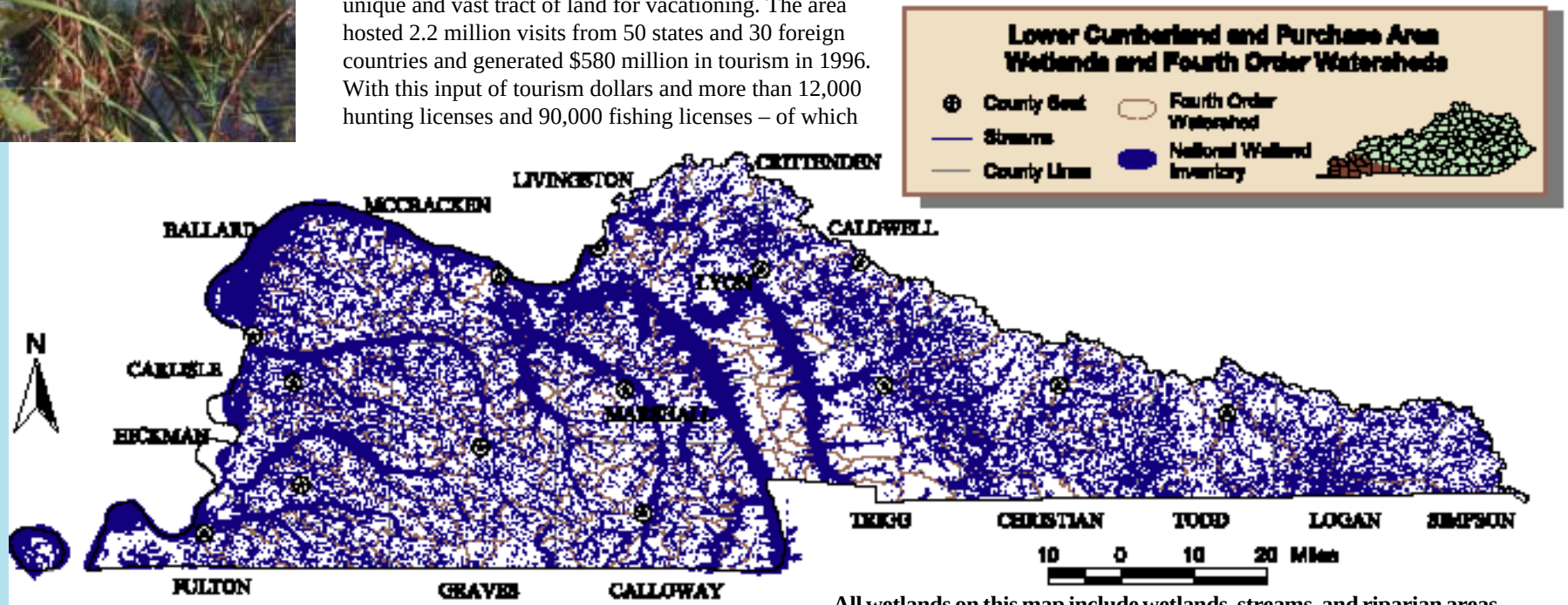
Threatened freshwater mussels

of Kentucky. The refuge will eventually encompass approximately 18,000 acres in Marshall, Graves, and McCracken counties. It will be managed for wintering habitat for migratory waterfowl, nesting habitat for wood ducks, nongame species, other bottomland hardwood wetland species, and wildlife-dependent recreation.

The Land Between the Lakes (LBL) is the largest inland peninsula in the U.S. and the second largest contiguous block of forested public land east of the Mississippi. The Land Between the Lakes has more than 1,300 plant species, over 230 bird species, and a reintroduced population of buffalo and elk. There are three state resort parks in the region. The parks and the LBL are staffed and equipped for educational outings, bird watching, retreats, hunting, swimming, and trail hiking on more than 230 miles of trails with 1,000 campsites and many other outdoor activities. The Kentucky and Barkley lakes are also widely known for fishing and boating. The LBL area serves as a magnet for tourists from all over the world that come to this unique and vast tract of land for vacationing. The area hosted 2.2 million visits from 50 states and 30 foreign countries and generated $580 million in tourism in 1996. With this input of tourism dollars and more than 12,000 hunting licenses and 90,000 fishing licenses – of which nearly half are from people outside the area – it is clear that these natural resources are important to the region. These natural resources not only provide important ecological functions, but the tourism and recreation that these resources attract are a major part of the region's economy and are a major source of jobs.

Wetlands

Wetlands provide essential watershed functions related to floodwater storage, groundwater flow moderation, sediment removal, nutrient cycling, and water purification. They also provide diverse habitats for wildlife foraging and reproduction, and refuge for a wide variety of mammals, reptiles, amphibians, and fish and great places for recreation – such as wildlife spotting, hunting, and conoeing This region of the state is rich with wetlands. However, many valuable functions of wetlands are being lost due to their being drained and filled for farmland, development, and mining.



All wetlands on this map include wetlands, streams, and riparian areas.

Forests

Forests of the Four Rivers Region provide many important watershed functions. They provide valuable habitat and refuge for wildlife. In addition to habitat, vegetation along the rivers and streams help stabilize the shore lines. This prevents the soil from eroding and helps filter out pollutants before entering the waterways. The canopy that riparian vegetation provides also helps maintain stream temperatures and reduces algae growth that can choke out other forms of aquatic life.

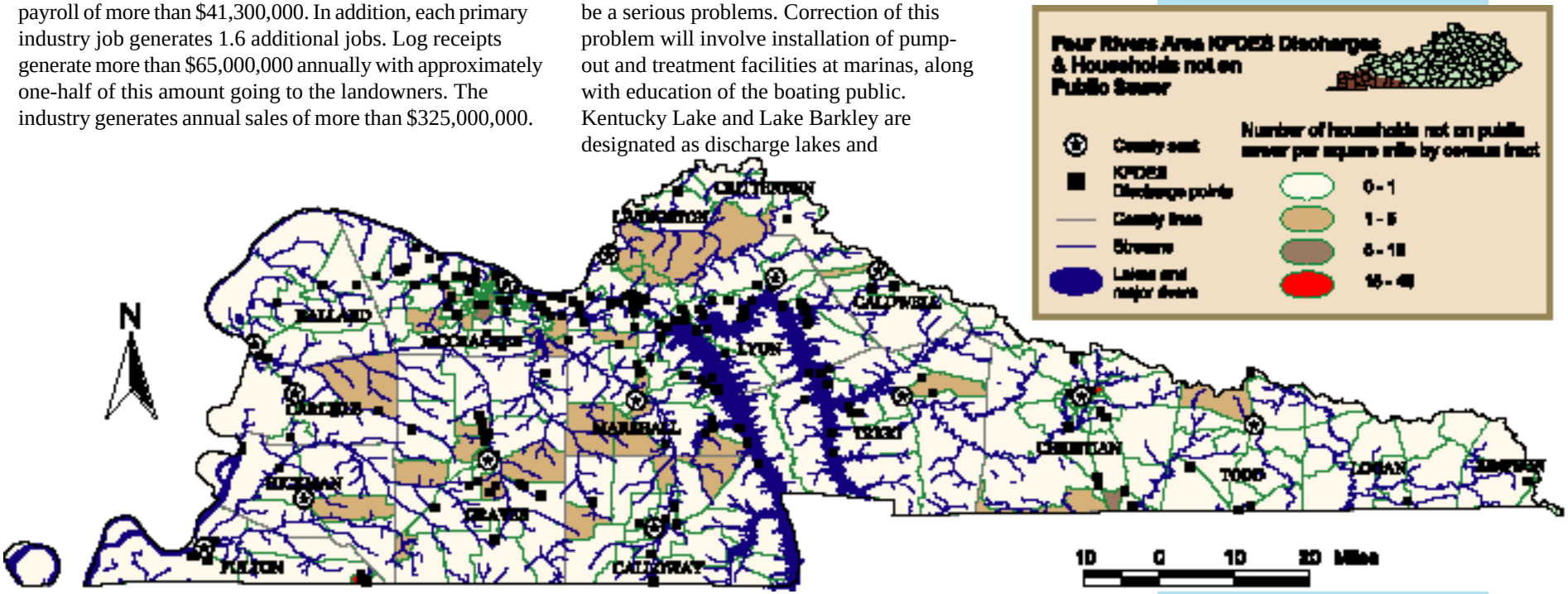
Current timber stands in the Four Rivers region are second or third generation trees, with a rather large acreage of pine, mostly loblolly, which has been planted starting in the 1930's and continuing through the present time. The counties that make up this region contain more than 50 mills that utilize roundwood for such things as veneer, sawlogs, pulpwood, handles, staves, and chips. Persons employed in this wood-using economy total more than 2,250 and enjoy an annual payroll of more than $41,300,000. In addition, each primary industry job generates 1.6 additional jobs. Log receipts generate more than $65,000,000 annually with approximately one-half of this amount going to the landowners. The industry generates annual sales of more than $325,000,000.

Wastewater

The proper disposal of wastewater is an issue in which everyone has a stake. Depending upon where you live, your home may be connected to a city-owned-and-operated public wastewater collection system through which all the wastewater goes to a centrally located and operated treatment system. A sanitary sewer treatment system and any other type of industrial or process wastewater plant must have a Kentucky Pollutant Discharge Elimination System (KPDES) permit and meet conditions on the quality of what they discharge. If you live in a more rural area, you may have what is called an "on-site" wastewater system, such as a septic tank and drain lines. Some homes, however, have no proper wastewater disposal system; these "straight pipes" release raw sewage to creeks and rivers and pose a significant health threat.

In areas where there are recreational boats, discharge and disposal of wastewater from houseboats can be a serious problems. Correction of this problem will involve installation of pump-out and treatment facilities at marinas, along with education of the boating public. Kentucky Lake and Lake Barkley are designated as discharge lakes and

Marine waste pumpout station



Riffles
Riffles are short runs of rapidly flowing water, usually over rocks, downed trees, and other objects in the stream channel. The churning waters of riffles create high-quality habitat for mussels, fish, and insects that live in the stream because of the higher levels of dissolved oxygen mixed into the water.

houseboats are required to have properly functioning marine toilets. There are 83 commercial docks on Kentucky Lake, and it is estimated that there are 4,150 resident boats on Kentucky Lake that have toilet facilities, not including transient commercial and pleasure craft.

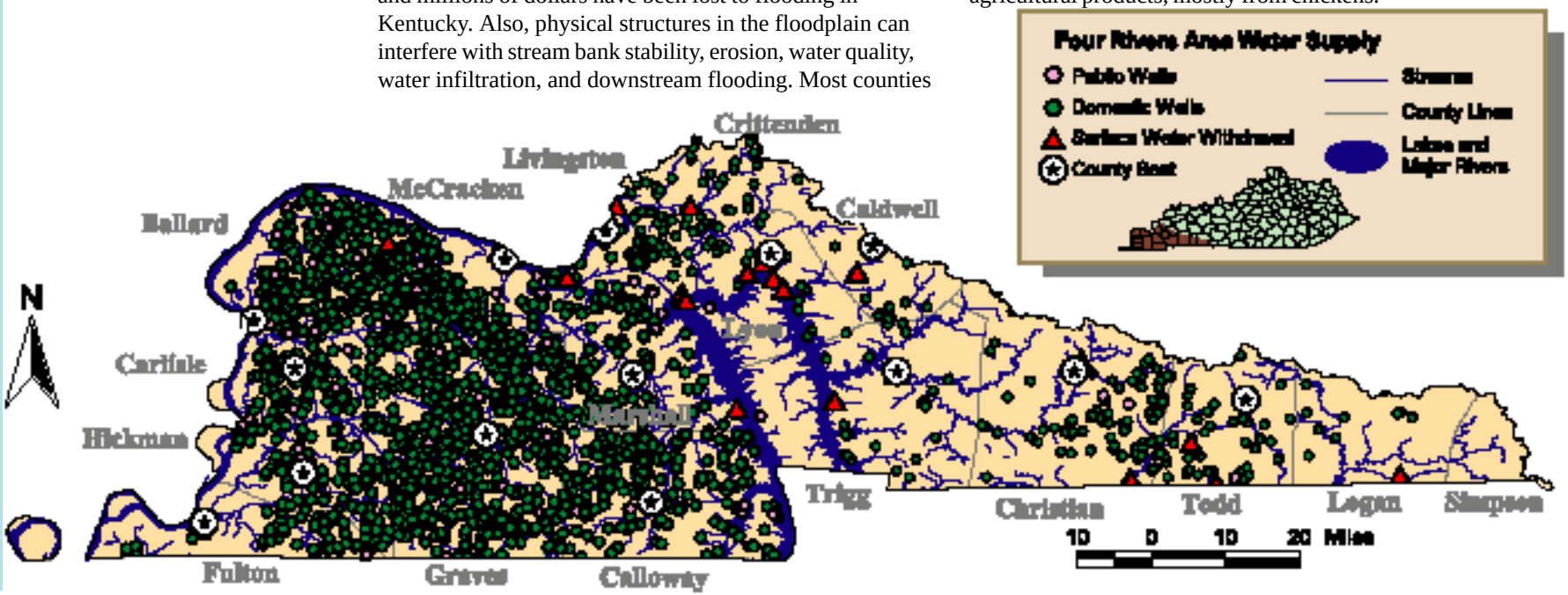
As shown on the accompanying map, public and private water withdrawal points are scattered throughout the basin. There are 100 public wells, 2,260 domestic wells and 37 surface water intakes used for water supplies. There is a growing awareness that protecting these water supplies for drinking water purposes is a high priority.

Floodplain management

As more and more development occurs, good land becomes a premium. Unfortunately, good land for farming and development is often located in the floodplain of a nearby river or stream. When development occurs in the floodplain, it poses several potential problems. First and foremost, the people and property are at risk when water rises. Many lives and millions of dollars have been lost to flooding in Kentucky. Also, physical structures in the floodplain can interfere with stream bank stability, erosion, water quality, water infiltration, and downstream flooding. Most counties in Kentucky have a floodplain management program that tries to protect the floodplain and minimize threats to people and property. All the counties in the Four Rivers region have a floodplain management program except Lyon County. One means for measuring the potential threat to your community is the dollars of property insured from flooding. More than $190 million worth of property is insured against flood damage in the region, and about $6.4 million in claims have been filed since 1978, with more than $4 million in claims in Trigg and Lyon counties alone.

Agriculture

Since much of the Lower Cumberland and Purchase Area is alluvial floodplain, with rich soils ideal for farming, it is no surprise that agriculture is a significant part of the local economy. From 1998 to 1999, the area produced almost $4 billion worth of agricultural income. Major crops include corn, soybeans, wheat, and tobacco. Livestock includes beef, dairy, swine, and broilers. By far the county with the greatest production is Graves County, generating about $168 million in agricultural products, mostly from chickens.



Four Rivers Impaired Stream Data

Stream Name	Source of Pollutants	Pollutants
Anderson Creek	Mining	Siltation
Bayou Creek	Industrial discharges	Radiation, thermal modification, pH, metals
Bayou de Chien	Agriculture	Pathogens
Beechy Creek	Unknown	Unknown
Central Creek	Municipal discharges	Chlorine
Champion Creek	Unknown	Unknown
Clarks River	Municipal discharges, agriculture, crop-related sources	Low DO, siltation, nutrients, pathogens
Island Creek	Unknown	Unknown
Jonathan Creek	Unknown	Unknown
Little Bayou Creek	Industrial discharges, flow changes	PCBs, metals, radiation
Little Bear Creek	Municipal discharges, land disposal	Nutrients, low DO
Little River	Crop-related sources, agriculture	Nutrients, siltation, pathogens
Livingston Creek	Agriculture	Nutrients, siltation
Mayfield Creek	Agriculture, flow changes	Habitat changes, siltation, pathogens
North Fork Litlle River	Agriculture, urban runoff, mining	Pathogens, nutrients, siltation
Obion Creek	Agriculture	Siltation
Ohio River	Combined sewer overflow, urban runoff, land disposal	Pathogens, priority organics, PCBs
Shawnee Creek	Municipal discharges, agriculture	Nutrients, low DO
South Fork Little River	Industrial discharges, agriculture	Nutrients, siltation
Tennessee River	Flow changes	Habitat changes

Middle Cumberland Impaired Stream Data - see centerfold

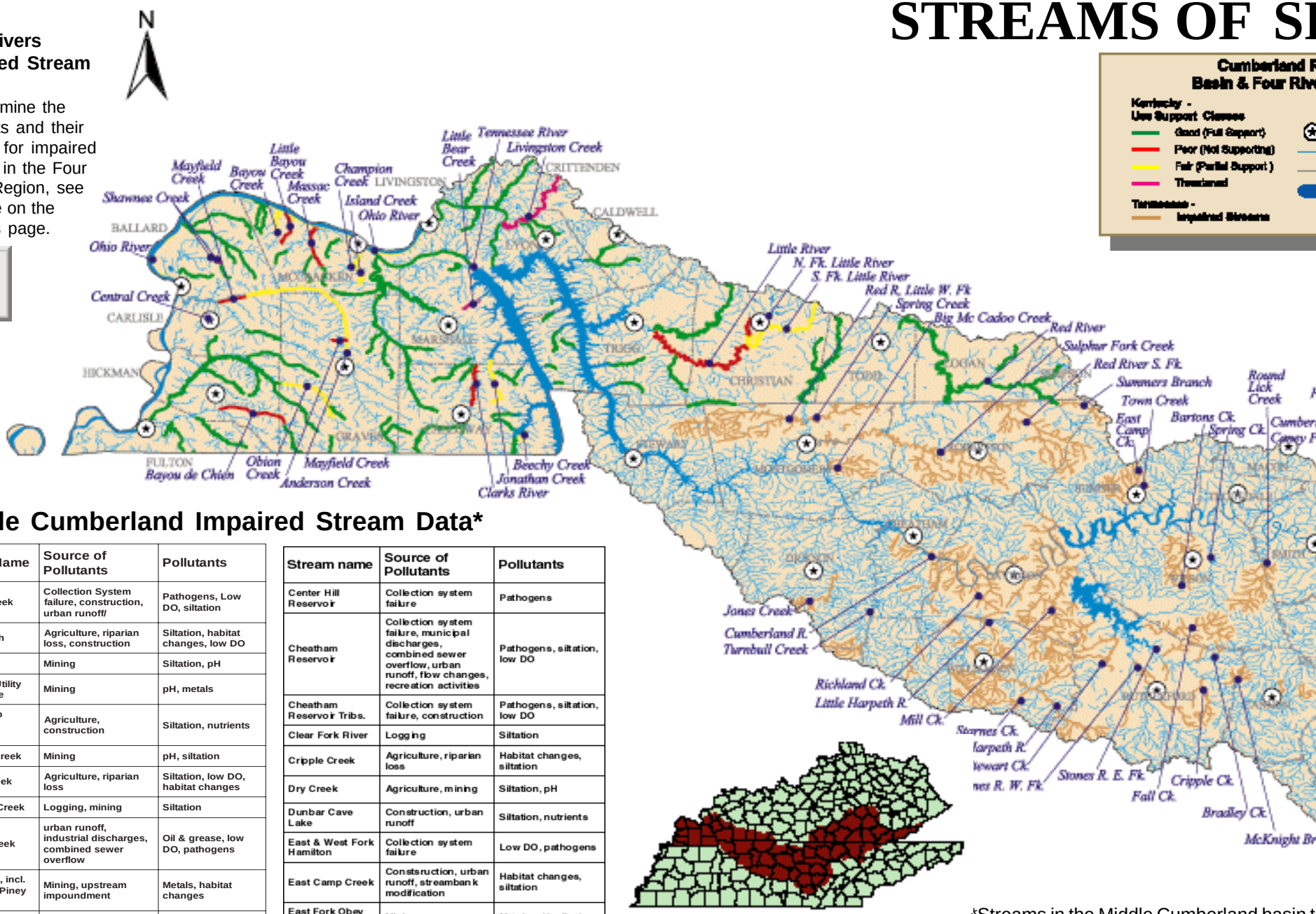
Stream name	Source of Pollutants	Pollutants
Rocky River	Mining	pH
Round Lick Creek	Municipal discharges, agriculture	Pathogens, chlorine, siltation, lead
Seven Springs Creek	Urban runoff, groundwater loadings	Nutrients, pesticides
South Fork Red River	Agriculture	Siltation
South Harpeth River	Land disposal, flow changes	Siltation, habitat changes, other inorganic, low DO
Spencer City Lake	Mining	Metals
Spring Creek	Land disposal	Habitat changes
Stewarts Creek	Urban runoff, construction	Siltation, flow changes, habitat changes
Stoners Creek	Construction, industrial discharges, spills, collection system failure	Siltation, oil & grease, pathogens
Stones River	Upstream impoundment	Other inorganic, low DO, flow changes taste & odor
Straight Fork Creek	Mining, habitat changes	pH, habitat changes
Sulphur Fork	Agriculture	Siltation
Turnbull Creek	Agriculture	Siltation, habitat changes
Wades Branch	Agriculture, habitat changes	Siltation, habitat changes
Watauga Lake	Urban runoff	Nutrients, low DO
West Fork Brown's Creek	Construction	Habitat changes
West Fork Harpeth River	Riparian loss, agriculture	Siltation, habitat changes, low DO
West Fork HarpethTribs.	Agriculture	Siltation, habitat changes, low DO
West Fork Obey River	Mining	Metals, pPH, siltation
West Fork Red River	Agriculture, riparian loss	Siltation, low DO, habitat changes
West Fork Stones Creek	Municipal discharges, construction	Low DO
Whiteoak Creek	Mining	Siltation
White's Creek	Collection system failure	Pathogens
Wolf River	Sludge	Oil & grease

Listed on this page are the streams that have been monitored and assessed for water quality. Each stream listed has been found to be impaired by one of the activities (sources) or pollutants (causes) listed. See the map at the center fold to locate each stream.
(Four Rivers data source: Ky. Division of Water 305(b) Report to Congress)

STREAMS OF SI

Four Rivers Impaired Stream Data

To determine the pollutants and their sources for impaired streams in the Four Rivers Region, see the table on the previous page.



Middle Cumberland Impaired Stream Data*

Stream Name	Source of Pollutants	Pollutants
Bartons Creek	Collection System failure, construction, urban runoff/	Pathogens, Low DO, siltation
Bear Branch	Agriculture, riparian loss, construction	Siltation, habitat changes, low DO
Bear Creek	Mining	Siltation, pH
Big Creek Utility District Lake	Mining	pH, metals
Big McAdoo Creek	Agriculture, construction	Siltation, nutrients
Big Piney Creek	Mining	pH, siltation
Bradley Creek	Agriculture, riparian loss	Siltation, low DO, habitat changes
Brimstone Creek	Logging, mining	Siltation
Brown's Creek	urban runoff, industrial discharges, combined sewer overflow	Oil & grease, low DO, pathogens
Cane Creek, incl. Dry Fork & Piney Creek	Mining, upstream impoundment	Metals, habitat changes
Caney Fork River	Upstream impoundment	Low DO, flow changes, thermal modification
Capuchin Creek	Mining	Siltation

Stream name	Source of Pollutants	Pollutants
Center Hill Reservoir	Collection system failure	Pathogens
Cheatham Reservoir	Collection system failure, municipal discharges, combined sewer overflow, urban runoff, flow changes, recreation activities	Pathogens, siltation, low DO
Cheatham Reservoir Tribs.	Collection system failure, construction	Pathogens, siltation, low DO
Clear Fork River	Logging	Siltation
Cripple Creek	Agriculture, riparian loss	Habitat changes, siltation
Dry Creek	Agriculture, mining	Siltation, pH
Dunbar Cave Lake	Construction, urban runoff	Siltation, nutrients
East & West Fork Hamilton	Collection system failure	Low DO, pathogens
East Camp Creek	Constsruction, urban runoff, streambank modification	Habitat changes, siltation
East Fork Obey River	Mining	Metals, pH, siltation
East Fork Stones	Habitat changes	Habitat changes
East Fork Stones Tribs.	Agriculture, riparian loss	Habitat changes

*Streams in the Middle Cumberland basin t
standards are not shown on map. (Middle C
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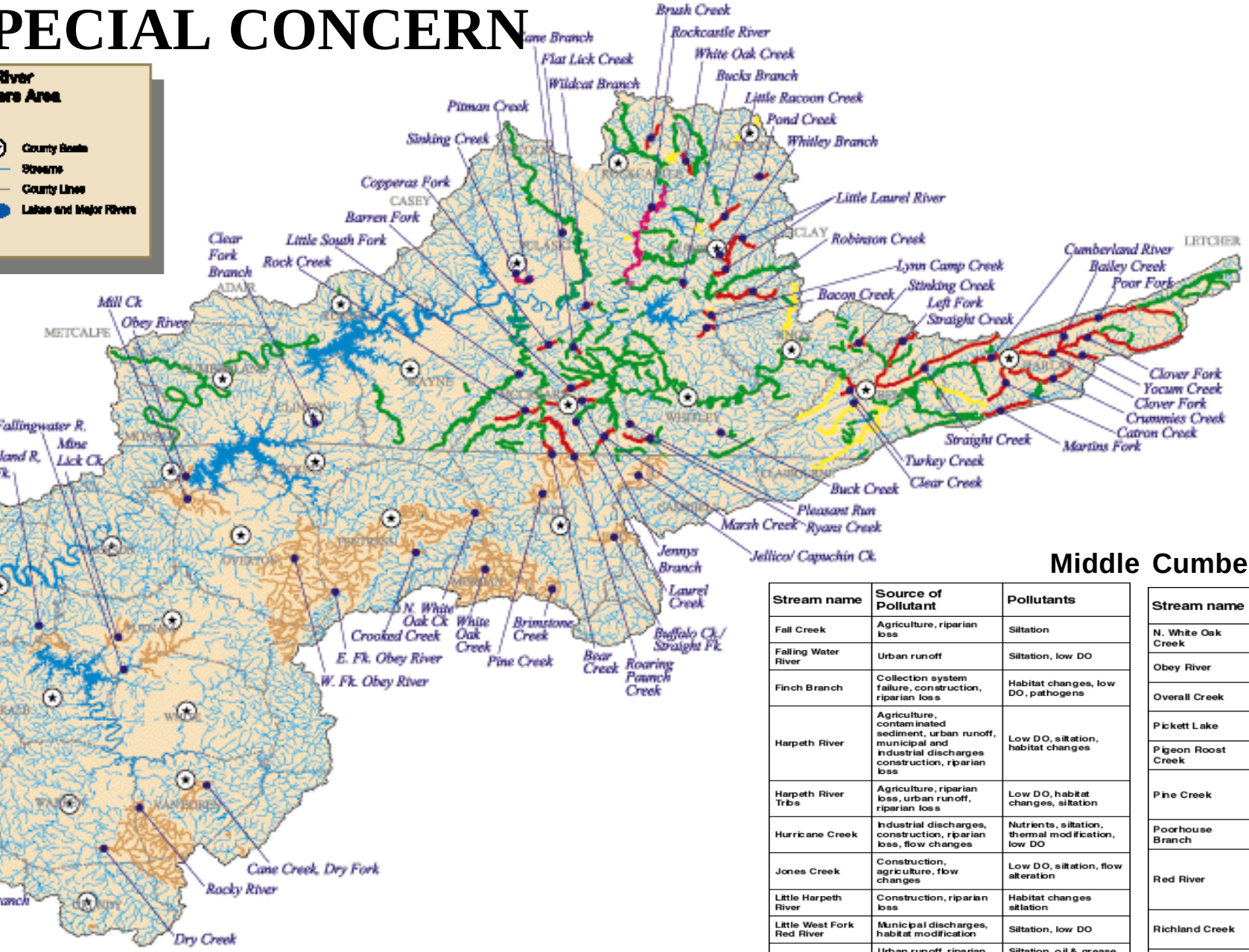


Upper Cumberland Impaired Stream Data

To determine the pollutants and their sources for impaired streams in the Upper Cumberland River Region, see the table on the following page.

hat were monitored and found to meet
Cumberland data source: Tenn. Dept. of
ort to Congress)

Middle Cumberland continued

Stream name	Source of Pollutant	Pollutants
Fall Creek	Agriculture, riparian loss	Siltation
Falling Water River	Urban runoff	Siltation, low DO
Finch Branch	Collection system failure, construction, riparian loss	Habitat changes, low DO, pathogens
Harpeth River	Agriculture, contaminated sediment, urban runoff, municipal and industrial discharges construction, riparian loss	Low DO, siltation, habitat changes
Harpeth River Tribs	Agriculture, riparian loss, urban runoff, riparian loss	Low DO, habitat changes, siltation
Hurricane Creek	Industrial discharges, construction, riparian loss, flow changes	Nutrients, siltation, thermal modification, low DO
Jones Creek	Construction, agriculture, flow changes	Low DO, siltation, flow alteration
Little Harpeth River	Construction, riparian loss	Habitat changes siltation
Little West Fork Red River	Municipal discharges, habitat modification	Siltation, low DO
Lytle Creek	Urban runoff, riparian loss	Siltation, oil & grease, habitat changes
McCrory Creek	Urban runoff/ collection system failure	Habitat changes, pathogens
Mill Creek	Flow changes, construction, upstream impoundment	Habitat changes, siltation, low DO, nonpriority organics, metals

Stream name	Source of Pollutants	Pollutants
N. White Oak Creek	Mining	pH
Obey River	Upstream impoundment	Flow changes
Overall Creek	Agriculture	Low DO, habitat changes
Pickett Lake	Flow changes	Low DO, pH, noxious aquatic plants
Pigeon Roost Creek	Municipal discharges, urban runoff	Low DO
Pine Creek	Contaminated sediments, on-site wastewater, flow changes	Priority organics, low DO, pathogens, habitat changes, siltation
Poorhouse Branch	Land disposal	Siltation
Red River	Agriculture, collection system failure, municipal discharges, urban runoff, construction	Siltation, pathogens, low DO
Richland Creek	Collection system failure, urban runoff, habitat changes	Pathogens, habitat changes
Roaring Paunch Creek	Industrial discharges	Siltation
Roaring River	Construction, urban runoff	Siltation, pathogens
Rockcastle Creek	Municipal discharges, urban runoff	Pathogens, metals, thermal modification, low DO, siltation

continued on next page

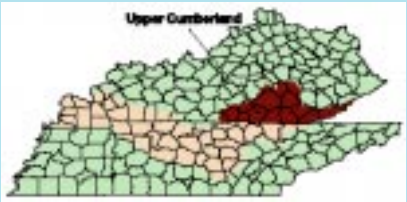
Upper Cumberland Impaired Stream Data

Listed on this page are the streams that have been monitored and assessed for water quality. Each stream listed has been found to be impaired by one of the activities (sources) or pollutants listed. See the map at the center fold to locate each stream.
(Source: Ky. Division of Water 305(b) Report to Congress)

Stream Name	Source of Pollutants	Pollutants
Bacon Creek	Flow changes	Habitat changes siltation
Bailey Creek	Collection system failure	Pathogens
Barren Fork	Mining	pH
Bear Creek	Mining	pH
Bennets Fork	Resource extraction	Habitat changes, siltation
Big Lily Creek	Municipal discharges, urban runoff	Low DO
Brush Creek	Land disposal, agriculture	Pathogens
Bucks Branch	Mining	pH
Cane Branch	Mining	pH
Catron Creek	Land disposal	Pathogens
Clear Creek	Municipal discharges	Pathogens
Clear Fork Branch	Municipal discharges	Nutrients, low DO, pathogens
Clover Fork	Municipal discharges, land disposal, collection system failure	Pathogens
Cloverlick Creek	On-site wastewater, mining	Pathogens, habitat changes, siltation
Crooked Creek	Land disposal, agriculture	Pathogens
Crummies Creek	Mining	Metals, pH, siltation
Cumberland River	Land disposal, municipal discharges, collection system failure	Pathogens
East Ridge Branch	Logging	Habitat changes
UT of Flat Lick Creek	Industrial discharges	pH
Gillis Branch	Construction, spills	Siltation, oil & grease
Greasy Creek	Unknown	Pathogens
Horse Creek	Land disposal	Oil & grease
Indian Creek	Mining, logging	pH, suspended solids, nutrients, pathogens
Jennys Branch	Construction	Siltation
Lacy Fork	Mining	pH
Laurel Creek	Municipal discharges	Siltation, chlorine
Left Fork Straight Creek	Municipal discharges, mining	Pathogens, pH, siltation

Stream Name	Source of Pollutants	Pollutants
Lick Creek	Mining	Metals, pH, habitat changes, siltation
Little Clear Creek	Mining, logging	pH, habitat changes, siltation
Little Laurel River	Municipal discharges, agriculture	Pathogens, nutrients, low DO
Little Racoon Creek	Mining	Metals, pH salinity
Copperas Fork	Mining	pH
Looney Creek	Municipal discharges	Pathogens
Lynn Camp Creek	Unknown, spills, urban runoff, flow changes	Habitat changes, pathogens, oil & grease, siltation
Marsh Creek	Mining, agriculture	Siltation, habitat changes
Martins Fork	Municipal discharges, mining	Pathogens, pH
Pitman Creek	Agriculture, municipal discharges	Nutrients, unknown toxicity
Pleasant Run	Agriculture, flow changes	Habitat changes, siltation
Pond Creek	Municipal discharges	Ammonia (unionized), low DO, pathogens, siltation
Poor Fork	Land disposal, municipal discharges	Pathogens
Puckett Creek	Unknown	Pathogens
Richland Creek	Unknown	Pathogens
Roaring Paunch Creek	Mining	pH
Rock Creek	Mining	pH
Ryans Creek	Mining	pH, suspended solids
Sinking Creek	Municipal point discharges, mining	Pathogens, oil & grease
Stinking Creek	Agriculture, logging	Habitat changes, siltation
Straight Creek	Land disposal	Pathogens
Turkey Creek	Mining	pH, habitat changes siltation
White Oak Creek	Mining	Metals, pH, habitat changes, siltation
Whitley Branch	Collection system failure	Pathogens, chlorine
Wildcat Branch	Mining	pH
Yellow Creek	Urban runoff/	Nutrients, siltation, habitat changes
Yocum Creek	Land disposal	Pathogens

What is the condition of the Upper Cumberland watersheds?



Description

The Upper Cumberland River drains approximately 5,184 square miles of eastern Kentucky. This area includes all or part of 17 counties. Cities in the basin include Hazard, Barbourville, Harlan, Pineville, Williamsburg, London, Somerset, Monticello, Jamestown, Burkesville, Albany, McKee, Middlesboro, and Corbin, plus numerous smaller communities. Major impoundments in the basin include Lake Cumberland on the mainstem river, Laurel River Lake, Martins Fork Lake, Cranks Creek Reservoir, Wood Creek Lake, Lake Linville, and Cannon Creek Reservoir.

Special Resources

Many parts of the state have been set aside and given special protection because of their natural qualities and scenic beauty. While these lands are managed for their long-term protection, many are open to the public. In addition to providing a safe haven for rare species and unique ecological systems, these areas provide outstanding scenery and recreational opportunities. Hiking, wildlife viewing, canoeing and kayaking, and other non-motorized sports can be enjoyed over much of these areas. You can contact the various agencies listed in the back of this document for more information.

The US Forest Service administers a large portion of the basin, as part of the Daniel Boone National Forest. A portion of the forest has been designated by Congress as the Beaver Creek Wilderness, one of the state's two wilderness areas. The Big South Fork National River and Recreation Area, managed by the National Park Service, protects much of the Big South Fork of the Cumberland upstream from Lake Cumberland in McCreary County. Cumberland Gap National Historical Park, in Bell and Harlan counties, covers more than 26,000 acres, including the headwaters of Cumberland River tributaries Martins Fork, Shillalah Creek, Sugar Run and Yellow Creek.

Nature Preserves within the watershed include the Bad Branch, Pine Mountain State Park, Cumberland Falls State Park, Blanton Forest, Kingdom Come, and Hi Lewis State Nature Preserves, totaling 6,293 acres. These areas are managed by the Kentucky State Nature Preserves Commission to protect resident plants and animals, including many threatened and endangered species. There are eight state parks in the basin – Cumberland Falls, Kingdom Come, Lake Cumberland, Pine Mountain, Levi Jackson, Thomas Walker State Historic Site, Dale Hollow Lake, General Burnside – and two state forests – Kentennia in Harlan County (3,624 acres) and Kentucky Ridge, in Bell County (11,363 acres). There are also numerous State Wildlife Management Areas administered by the Kentucky Department of Fish and Wildlife Resources. These include the Lake Cumberland, Mill Creek, Cane Creek, Beaver Creek, Big South Fork, Kentucky Ridge State Forest, Shillalah Creek, Martins Fork Lake, Cranks Creek, Dale Hollow Lake, and Kentennia State Forest Wildlife Management Areas.

Seven streams in the Upper Cumberland basin have been designated as state wild rivers by the Kentucky General Assembly, in recognition of their outstanding natural qualities and pristine setting. The designated streams are the highest quality, least impacted streams in the basin. These include 16.1 miles of the Cumberland, both above and below Cumberland Falls in McCreary and Whitley Counties; 10.2 miles of the Big South Fork, within the Big South Fork National River and Recreation Area in McCreary County; 4 miles of Bad Branch, within and adjacent to Bad Branch State Nature Preserve in Letcher County; 10.4 miles of the Little South Fork of the Cumberland in McCreary and Wayne Counties; 3.9 miles of Martins Fork, adjacent to Cumberland Gap National Historical Park in Harlan County;

Well pump

Threatened and Endangered Species

- Indiana bat, gray bat, Eastern small-footed bat.
  Reason for Concern: Loss and degradation of habitat types specific to each species.
- Paleozone shiner, duskytail darter, blackside dace.

Blackside dace

Also of concern: Cumberland Johnny darter, Olive darter, and Ashy darter.
Reason for Concern: Loss of spawning habitat from mining, poor forestry practices, floodplain development, gravel dredging, and flood control efforts.

- Numerous mussels: Cumberland elktoe, Cumberlandian combshell, oyster mussel, purple cat's paw pearly mussel, little wing pearly mussel, Cumberland bean pearly mussel, Northern riffle shell.
  Reason for Concern: Surface coal mining, acid mine drainage, industrial and transportation infrastructure development, water quality degradation, impoundments, channelization, and gravel mining.

18 miles of Rock Creek in McCreary County; and 15.9 miles of the Rockcastle River in Rockcastle, Laurel, and Pulaski counties. These streams are managed by the Division of Water to protect their natural features and undeveloped character. Recently, the Division of Water has begun using funds from the Kentucky Heritage Land Conservation Fund to acquire private lands within wild river corridors from willing sellers. As acquired, these properties will be managed to protect the natural features of the areas while allowing low impact recreational use where appropriate.

The Wolf Creek National Fish Hatchery is located on the Cumberland River in Russell County, Kentucky, immediately downstream from Lake Cumberland. Dale Hollow National Fish Hatchery is located on the Cumberland River in Pickett County, Tennessee, immediately downstream of Dale Hollow Lake.

Endangered and Threatened Species

There are 16 federally listed endangered species known to occur in the Upper Cumberland River basin. The sidebar on this page lists the rare species and provides a brief explanation as to why these populations are declining.

The Upper Cumberland River basin historically supported one of the most diverse native freshwater mussel fauna in the United States. More than 80 species once occurred in the Upper Cumberland River basin, and current records indicate that approximately 55 species still exist. Numerous other species, not listed in the sidebar on this page, are also experiencing declines in the Upper Cumberland. Mussels are filter feeders, siphoning algae, plankton, and organic material from the water. They also serve as a source of food for muskrat, raccoon, otter, mink, and fish. Because they feed by filtering particulates from the water column and because they tend to accumulate pollutants such as organic compounds (e.g., pesticides) and heavy metals, they can serve an important role as biological indicators of water quality.

Many streams in the Upper Cumberland River basin are also designated as Outstanding State Resource Waters (OSRW) due to the presence of federally threatened and endangered aquatic species.

Surface coal mining activities in the basin have contributed to habitat degradation and the permanent loss of some headwater streams in the Upper Cumberland Basin. Surface mining permit records in the Upper Cumberland River Basin indicate that 41.3 miles of streams were permanently lost as a result of the direct placement of overburden, coal slurry, and other wastes into stream channels over about a 10-year period. Another 28.7 miles were adversely impacted from erosion/siltation control structures built in stream channels downstream of permanent fills.

Water Quality

There are approximately 6,420 miles of streams and rivers in the Upper Cumberland basin. Only 1,387 miles (22%) have been assessed to determine whether these streams meet the water quality standards for swimming and fishing. Many of the streams in the upper watershed are relatively pristine, but others have been negatively impacted by resource extraction such as coal mining, oil and gas well development, and timber harvesting, as well as poorly planned development and other non-point source pollution.

Monitoring data in the Upper Cumberland River basin indicates that streams have documented impairments due to industrial and municipal wastewater discharges (200 miles of stream), agriculture (41 miles), urban runoff and development (34 miles), and other unknown sources (46 miles). A more detailed listing of streams and where the pollutants are coming from is provided at the end of this section (page prior to centerfold). The centerfold map depicts the location of streams and their impairment status.

As shown on the accompanying map, public and private water withdrawal points are scattered throughout the basin. There are 54 public wells, 3,143 domestic wells and 71 public surface water intakes used for water supplies. There is a growing awareness that protecting these water supplies for drinking

water purposes is a high priority. Many wells and surface waters in the Upper Cumberland are contaminated from untreated human sewage from failing septic systems and straight pipe discharges.

Drinking water intake structure

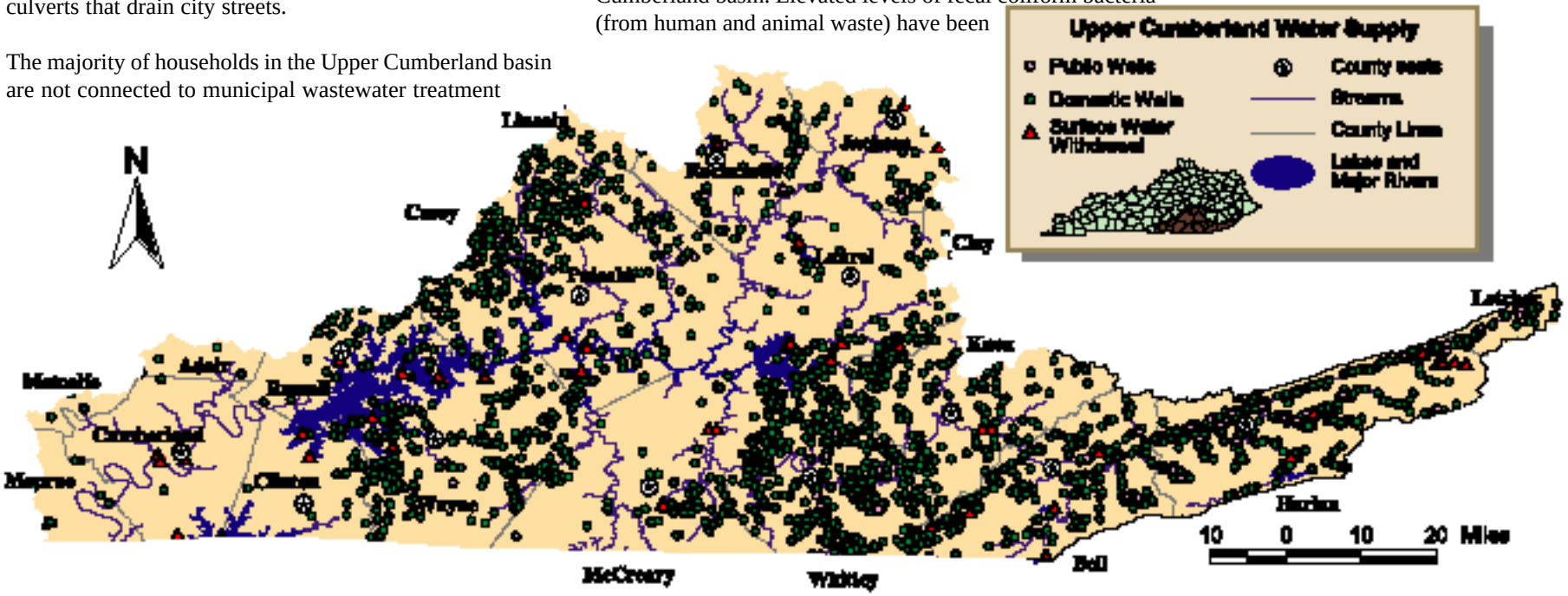
Waste and Wastewater

Proper management of wastewater is a major issue in the Upper Cumberland basin. Kentucky Pollution Discharge Elimination System (KPDES) permits, provided for under federal and state laws, allow the disposal of treated effluent in the water. This effluent can be relatively clean wastewater from properly operating municipal and industrial wastewater treatment plants, discharges from sedimentation or treatment ponds near mines or oil/gas wells, or storm water from culverts that drain city streets.

The majority of households in the Upper Cumberland basin are not connected to municipal wastewater treatment systems and therefore rely on some form of onsite treatment for wastewater. Few municipal wastewater treatment systems presently exist except in some of the larger communities. The primary onsite treatment system for households in the Upper Cumberland is a septic tank to remove solid material and a leach field to dispose of the wastewater. However, numerous households in the Upper Cumberland basin do not have any form of wastewater treatment, and the untreated wastewater from these households is discharged directly to a creek or onto the ground. This is known as a "straight-pipe" discharge.

Straight pipe wastewater discharge

The presence of straight-pipe discharges and failed septic systems has greatly impacted water quality in the Upper Cumberland basin. Elevated levels of fecal coliform bacteria (from human and animal waste) have been



Septic systems
Septic systems help clean up sewage from homes and businesses in areas not served by wastewater treatment plants. On most systems, the first stage of treatment is the septic tank, where wastewater is digested and solids settle out. After the septic tank, the liquid waste is directed to a drain field, lagoon, or wetland for further treatment. If the process is working correctly, the relatively clean wastewater then soaks into the ground. Septic tanks require periodic

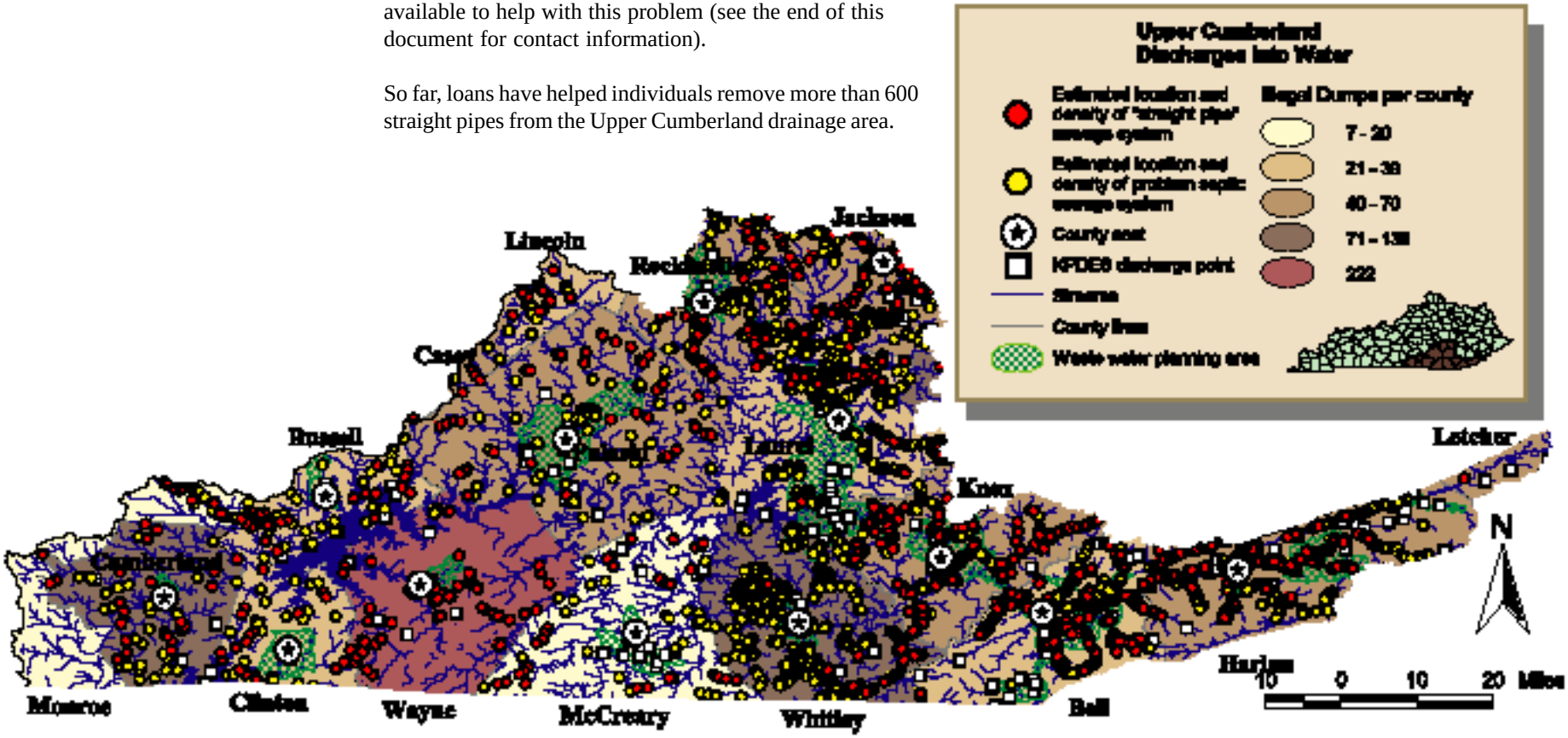
detected in numerous portions of the basin. Moreover, the levels of fecal coliform bacteria are so high that numerous streams and creeks are unsafe for swimming or any human contact, such as wading and fishing.

Although the problem of straight pipes and failed septic systems is massive, certain actions are being taken. The Personal Responsibility In a Desirable Environment (PRIDE) program is offering low-interest loans for the installation of septic systems to eliminate straight pipes or failed septic systems. The passage of Senate Bill 18 in 1998, which requires that a wastewater treatment system be approved prior to electrical hook-up, has slowed the proliferation of straight pipes. Other state and federal resources, in the form of loans and grants, are becoming available to help with this problem (see the end of this document for contact information).

So far, loans have helped individuals remove more than 600 straight pipes from the Upper Cumberland drainage area.

Some additional projects for clusters of homes – conventional extensions of existing systems and some innovative community systems - will eliminate at least that many straight pipes and failing septic systems by early 2000.

The good news is that people are working together to make a difference through the efforts of various volunteer organizations and participating local governments. During 1998 and 1999, various groups – Boy Scouts, high schools, civic organizations and others, adopted 48 streams for cleanup. In addition, 164 open dumps have been closed. These efforts have resulted in more than 4,700 appliances, 32,400 tires, and 33,100 cubic yards of trash being removed from the creek banks and drainage areas of the Upper Cumberland River basin.



How do we determine watershed health?

Healthy watersheds produce clean water – water that is fishable, swimmable and suitable as a drinking water source. Watersheds that meet these criteria support a wide variety of aquatic life and are a valuable resource. State agencies mostly follow the guidelines in the federal Clean Water Act to determine whether or not the quality of river and stream water is acceptable. Under the Clean Water Act, states set standards for the water based on how it is being used. These uses can consider the high-quality values of a wild and scenic river, a stream's importance as a drinking water source, wildlife habitat, or other uses. The standards include benchmarks for various *parameters* like dissolved oxygen, temperature, acidity, and other measurable qualities (see sidebar).

If a lake, river, or stream meets the standards for fishing, swimming, and drinking water sources, it is said to *fully support* its designated uses (see centerfold map and tables). If it falls short on a few measures, it may only *partially support* its uses. Failure on additional counts can mean that it is *not supporting* its designated uses. The condition of these waters is reported to Congress, as required by the Clean Water Act, Section 305(b). Bodies of water that do not support their designated uses must have cleanup plans that identify and quantify the problem pollutants and specify how they will be reduced. Sometimes the pollutants come from wastewater treatment plants, other times they are carried into the water by runoff from towns, farms, new developments, or other areas.

Watershed health means more than good water chemistry. In addition to chemical analyses, watershed health can be measured by observing plant and animal life. For example, certain species are *indicators*. Also, habitat is important to watershed and stream health. Vegetation in the riparian area - especially shrubs and trees - provides food and cover for terrestrial and aquatic life. Riparian vegetation also holds stream banks in place and helps to filter soil erosion and other polluted runoff. The amount and type of vegetation along a stream, lake, or sinkhole determines riparian health.

Watershed health also means having good storage and retention capabilities in the basin. That is, under ideal conditions, as rain falls upon the earth, water either evaporates, soaks into the ground, or runs off into streams, lakes, and rivers. For water to soak into the ground, the water must encounter some obstacles that slow its flow down hill, such as retention basins, trees, leaf litter in a forest, even grass. All these things cause water flow to slow down enough for it to soak into the ground. A hard-packed clay field or a parking lot will simply shed the water, forcing it to run downstream. Conversely, if the water can soak into the ground, it recharges the groundwater for wells and will slowly release it to our streams and lakes. This run-off/soak-in cycle has two effects: In times of high flow, it can cause all the water to run off so rapidly that it results in flooding. Or, in times of low flow, it can result in streams that run completely dry because there is no runoff or spring seepage to keep the rivers flowing.

During times of low stream flow, which occur more often in the late summer and early fall, streams may have less suspended silt but may be rich and green from algae growth. During times of low flow, most of the water in streams comes from groundwater inflow.

While state officials have information from samples collected on the Cumberland River, the Lower Tennessee, and the minor tributaries to the Ohio and Mississippi Rivers, much of the water in the basin has not been tested. An interagency workgroup is coordinating efforts to increase the amount of monitoring conducted in the region. By working together, tax dollars can be stretched and better information provided on the condition of the watershed. Also, citizens active in the Four Rivers and Upper Cumberland River Watershed Watch have collected data to supplement public agency information and raise public awareness. Reducing concentrations of pollutants that exceed state standards will require a considerable amount of cooperative action and analysis.

Organisms as indicators

Healthy streams have low levels of contaminants and contain a diversity of plants and animals. Certain mussels and insect larvae (caddisfly, stonefly, mayfly) are often used as indicators of good water quality, similar to the coal mine canaries used to detect poisonous gases. Since these mussels and larva can live only in relatively clean water, their presence usually indicates that problems are few in that section of the stream.

Water quality indicator: Aquatic insects

Kentucky Water Quality Standards

The following parameters, or measurable criteria, are only a few of those used to define Kentucky's water quality standards. The standards and units for each parameter are listed below. For example, if a water sample shows more than 400 fecal coliform CFUs in a 100 milliliter sample, the water would be considered contaminated.

- Dissolved Oxygen: >4.0 Milligrams per liter
- pH (measures acidity): 6-9 Standard units (7.0-neutral)
- Fecal coliform: 400 Colony-Forming Units per 100 milliliters of water
- Temperature: 89 Deg. Fahrenheit

Nearly one-quarter of Kentuckians surveyed named water pollution as the most important environmental problem in Kentucky.

- University of Kentucky Survey Research Center, March 1999

"While it is essential that young people become environmentally literate, adults make the lifestyle decisions that affect Kentucky's environment."

- *Land, Legacy and Learning: Making Education Pay for Kentucky's Environment*

Septic system installation

What can I do to help?

A variety of actions are needed to improve water quality in the Four Rivers region and the Cumberland River basin. Everyone who lives in the watershed can help. Support, encouragement, and financial assistance will be required to motivate farmers, loggers, and developers to adopt erosion and sediment controls. Farmers, homeowners, and golf course managers need to reduce the amount of fertilizers and chemicals they apply to their lands. People who own property along the creeks and rivers must recognize the importance of trees, shrubs, and tall grasses along the banks and in the floodplains.

Farm demonstration project

Better dissemination and use of educational materials and technical information are needed to help people understand the importance of leaving streams alone – avoiding the temptation to channelize them, clearing their vegetation, straightening them out, digging up their gravel bars, and controlling their flows. People who dump trash along creeks or toss litter from their vehicles also need to be educated about how they are hurting their environment.

Several new initiatives are underway to address water pollution caused by activities on the land. The 1998 *Forest Conservation Act* requires trained Master Loggers to be present where timber is being cut, skidded, and loaded to ensure that proper measures are taken to preserve streamside trees, minimize road-building impacts, and reduce erosion. The *Kentucky Agricultural Water Quality Ac*t provides that farmers must develop soil and water conservation plans to address impacts from plowing, fertilizing, chemical applications, livestock production, and other activities.

But progress cannot be realized just by passing laws – people have to get involved if improvements are to be made. Some people may want to help collect water quality information by becoming a monitoring volunteer, while others might

Land activities that can impact water quality

Activity	Impacts
Row cropping	Siltation, erosion, chemical and fertilizer runoff.
Livestock production	Manure runoff (excessive nutrients and bacteria), damage to streamside vegetation, bank erosion.
Logging	Loss of streamside trees, bank erosion, siltation from roads, increased runoff.
Mining	Acidity and sulfates from iron sulfide rocks, sediment, runoff surges.
Oil and gas drilling	Brine from drilling, sediments, oily runoff.
Residential yards	Lawn and garden chemical and fertilizer runoff, higher runoff velocities.
Urban development	Siltation from land clearing, runoff surges (oils and metals) from roofs, roads, parking lots.
Industrial facilities	Chemical runoff from material storage areas, soot deposits, runoff surges, spills.
Commercial development	Runoff surges (oils and metals) from parking lots, roofs; sediment from land clearing.
Stream clearing	Sedimentation, loss of wildlife/mussel habitat, loss of shading (increased temp.), flooding.
Channelization	Increased flooding, sedimentation, loss of fish/insect habitat, loss of mussel beds.
Construction in floodplains	Increased flooding, siltation, danger to life and property.
Boating	Metals, oils, and pathogens from discharge of sanitary waste.
All terrain vehicles (ATVs)	Erosion, loss of habitat.

spread the word that trees and native vegetation should be preserved, especially in new development tracts and along streams in our towns and cities. Those who care about the impacts of trash and other debris may wish to participate in cleanup projects to remove these eyesores from the river and its tributaries. We are beginning to have a better understanding of how we should treat the land and its waters in order to maintain a high level of water quality in our Commonwealth.

Silt fence at construction site

All of us can become more involved in protecting water quality in our communities simply by paying more attention to activities occurring around us. What is the status of water quality in your community? What industries, mining, or logging activities are currently in existence? What new ones may be coming to your area? How do - or will - any of these impact water quality?

If you would like more information, please contact the Kentucky Division of Water or other members of the Four Rivers or Upper Cumberland River Teams listed in the back of this booklet - or check out the Internet. Thank you for your interest and your support of healthy watersheds in Kentucky and Tennessee!

Practices that reduce impacts from land activities

Activity	Management practices
Row cropping	Use conservation tillage, targeted chemical use, strip cropping, and streamside buffers.
Livestock production	Move facilities uphill, install waste treatment systems, stream fencing, and setbacks.
Logging	Skid on the contour, avoid streams, preserve streamside trees, and install water bars.
Mining	Reclaim mined areas, mix acid and alkaline material, add erosion/sediment controls.
Oil and gas drilling	Store or treat wastes from drilling, control sediments and oils.
Residential yards	Reduce/eliminate lawn/garden chemical use, preserve streamside vegetation.
Urban development	Sediment/erosion/stormwater controls, minimize land clearing and pavement, preserve existing trees.
Industrial facilities	Cover stored materials, control/treat runoff, minimize air/water discharges.
Commercial development	Minimize land clearing, control/treat runoff, reduce parking lots/road sizes.
Stream clearing	Minimize clearing, preserve vegetation, promote greenways/buffers.
Channelization	Decrease flooding by reducing or slowing runoff, restore streamside wetlands.
Construction in floodplains	Limit or eliminate development in floodplains.
Boating	Use marine sanitation devices and pumpout facilities.
ATVs	Use ATVs only in designated areas and maintained trails.

What is Watershed Watch?

Watershed Watch is a citizen-led effort organized to get people down to the river and raise their awareness of watershed issues. The Upper Cumberland and Four Rivers Watershed Watch groups have lead volunteers through extensive training on water quality issues, assessment data, and monitoring method — and have a good time while doing it. Several hundreds of volunteers have visited stream sites all over the basin, collecting field observations on habitat and land use, and collecting water samples for pesticides, nutrients, metals, and conventional parameters. Data are analyzed with the assistance of professionals and incorporated into maps. Each fall the public is invited to attend a watershed conference held in each basin to discuss the results and other watershed issues.

Get connected

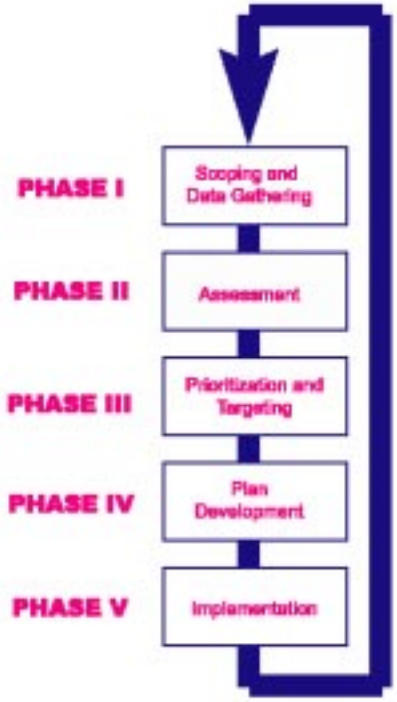
Web links

There is a lot of information on the Internet about the Four Rivers area, Cumberland River, watershed health, and related matters. Check out these sites to learn more about the science and practice of watershed management in Kentucky and the nation.

- Statewide context for Kentucky's watershed initiative and other watershed links - http://water.nr.state.ky.us/dow/watrshd.htm
- Ky Division of Water, Water Watch volunteer monitoring - http://state.ky.us/nrepc/water/wwhomepg.htm
- Kentucky Division of Water - http://water.nr.state.ky.us/dow/
- Four Rivers and Upper Cumberland River Watershed Watch volunteer monitoring projects - http://water.nr.state.ky.us/watch/
- Kentucky Division of Forestry - http://www.state.ky.us/agencies/nrepc/dnr/forestry/dnrdof.html
- Kentucky Division of Conservation (agric. and water) - http://www.state.ky.us/agencies/nrepc/drn/FAC_flyer.html
- Kentucky list of priority impaired ("TMDL") streams - http://water.nr.state.ky.us/303d/
- Kentucky district of the US Geological Survey - http://130.11.24.1
- Conservation Technology – good source for agricultural practice recommendations - http://ctic.purdue.edu/
- Stream corridor restoration guide - http://www.usda/gov/stream_restoration/newtofc.html

Kentucky Watershed Management Framework

This report has been produced as part of Kentucky's Watershed Management Framework, which is a new approach to improving the health of the state's watersheds. 1999 is the first year of a five-year planning and management cycle for the Four Rivers region and Cumberland River basin. During the second year, several agencies and organizations will conduct extensive monitoring in the region. During the third year, people throughout the region will confer to decide which small watersheds should receive intensified attention during years four and five of the cycle. In year four, improvement plans will be made for the small watersheds selected, and in year five, many agencies and organizations will implement those plans. The cycle then begins again in 2003, with a new evaluation and a new Status Report. Contributors to this document include members of Four Rivers and Upper Cumberland River Basin Teams under the Watershed Framework (see names and organizations below).



Phone numbers for assistance

Four Rivers and Upper Cumberland Watershed Watch (volunteer monitoring): (800) 928 - 0045
Ohio River Valley Sanitation Commission (volunteer monitoring): (800) 359 - 3977
Water Watch (water body adoption and river cleanups): (502) 564 – 3410
Ohio River Sweep (Ohio River Valley Sanitation Commission (cleanups): (800) 359 - 3977
Illegal dumping (Kentucky Division of Waste Management): (502) 564 – 6716
Dead animal removal reports (Ky Dept. of Agriculture): (502) 564 - 3956
Kentucky Waterways Alliance (river protection groups): (502) 524 – 1774
Forest Conservation Act (Kentucky Division of Forestry): (502) 564 - 4496
Kentucky Agricultural Water Quality Act: (502) 564 – 3080
Kentucky Department of Fish and Wildlife Resources: (502) 564 – 5448

Also to find your local:

District Health Department (cleanup days, septic problems and illegal dumping): (502) 564-4856
Conservation District office (agricultural practices) (502) 564-3080
RC & D Office (agricultural practices) (606) 224-7403
County Solid Waste Coordinator (illegal dumping) (502) 564-6716

Upper Cumberland River Basin Team

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Rodney Hendrickson, Cumberland Valley RC&D
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Margo Farnsworth, Cumberland River Compact
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Rob Miller, Cooperative Extension Service
Cheryl Witt, Cooperative Extension Service
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Steve Bakaletz, Big South Fork Nat. River & Rec. Area
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Bob Sneed, U.S. Army Corps of Engineers
Gene Zirkle, Fort Campbell
Margo Farnsworth, Cumberland River Compact
Kevin Murphy, Paducah-McCracken Joint Sewer Agency
Donald Swearingen, Elf Atochem North America, Inc

More web sites

- North Carolina water quality research center – especially for agriculture - http://www.bae.ncsu.edu/bae/programs/extension/wqg/
- Photos of recommended resource management practices - http://earthl.epa.gov/owow/nps/ex-bmps.html
- Volunteer monitoring information - http://www.epa.gov/owow/monitoring/vol.html
- Nonpoint source information for local officials - http://www.lib.uconn.edu/canr/ces/nemo/nsmodule/nsdetail.html
- Center for Watershed Protection - http://www.pipeline.com/~mrrunoff/
- US EPA nonpoint source pollution - http://www.epa.gov/owow/nps/
- US EPA wetlands information - http://www.epa.gov/owow/wetlands/
- EPA's Watershed Information Network for data, help, and lots of other useful watershed information - http://www.epa.gov/win/
- Information about small-quantity wastewater treatment options - http://www.estd.wvu.edu/nsfc/
- American Rivers, a river protection organization - http://www.amrivers.org/
- River Network, a river protection organization - http://www.rivernetwork.org/
- Cumberland River Compact and Watershed Education Organization - http://www.cumberlandrivercompact.com

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On request, this material can be made available in alternate formats for individuals with disabilities. To request alternate formats or additional copies, contact Lee Colten, Kentucky Division of Water, 14 Reilly Road, Frankfort, KY 40601, or call (502) 564-3410.