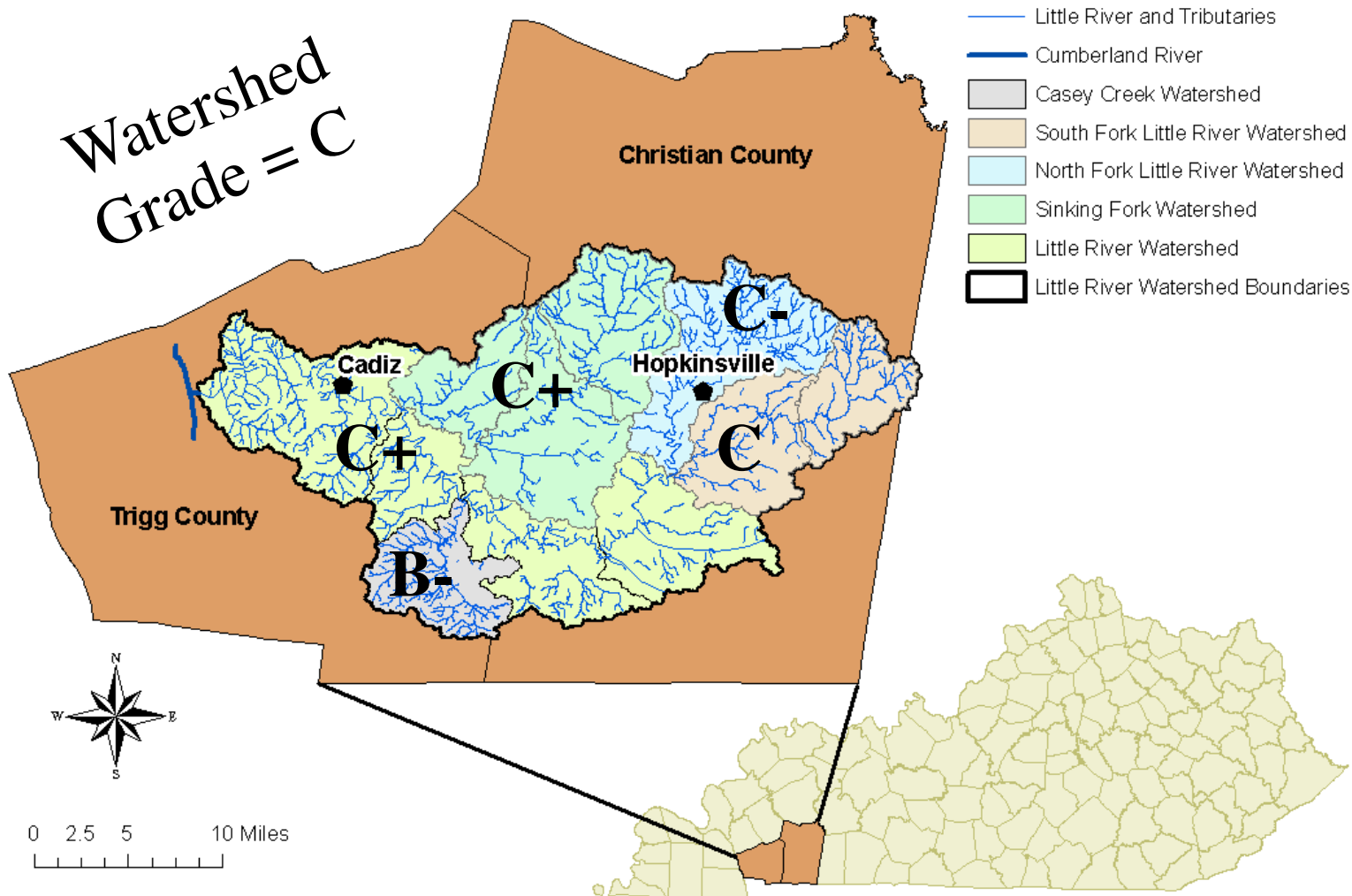


Little River Watershed Health Report

Department for Environmental Protection - Division of Water



The Kentucky Division of Water (DOW) is the state agency responsible for carrying out the requirements of the Clean Water Act to reach the goal of making all waters in Kentucky safe for swimming and fishing (called **designated uses**).

DOW has developed this health report to inform the residents of Trigg and Christian counties of efforts to examine the health of the Little River Watershed. A **watershed** is an area of land where runoff flows to a common stream. When streams come together, the two streams' watersheds combine to make a larger watershed. This report discusses North and South Fork of the Little River, Casey Creek, Sinking Fork and Little River, all of which combine to form the Little River Watershed.

Upon initial evaluation it was determined that many stream segments within the Little River Watershed do not support the **uses** required by the Clean Water Act. The U.S. Environmental Protec-

tion Agency (EPA) requires that states conduct watershed studies on all such non-supporting waters to calculate the maximum amount of pollutant(s) a creek can receive and still be healthy. This amount is known as a **Total Maximum Daily Load**, or TMDL.

From 2000 through 2002 and again in 2009, DOW biologists conducted studies in each of the watersheds shown in the map above to gather scientific information. Based on this information, DOW has given a "report card grade" of a **C+** to **Little River**, a **B-** to **Casey Creek**, a **C+** to **Sinking Fork**, a **C** to **South Fork Little River**, a **C-** to **North Fork Little River**, and a **C** to the entire **Little River Watershed**. This health report explains where the impaired segments are located, describes the signs of health that went into assigning the grades for each watershed and provides information on how the grades can be improved.

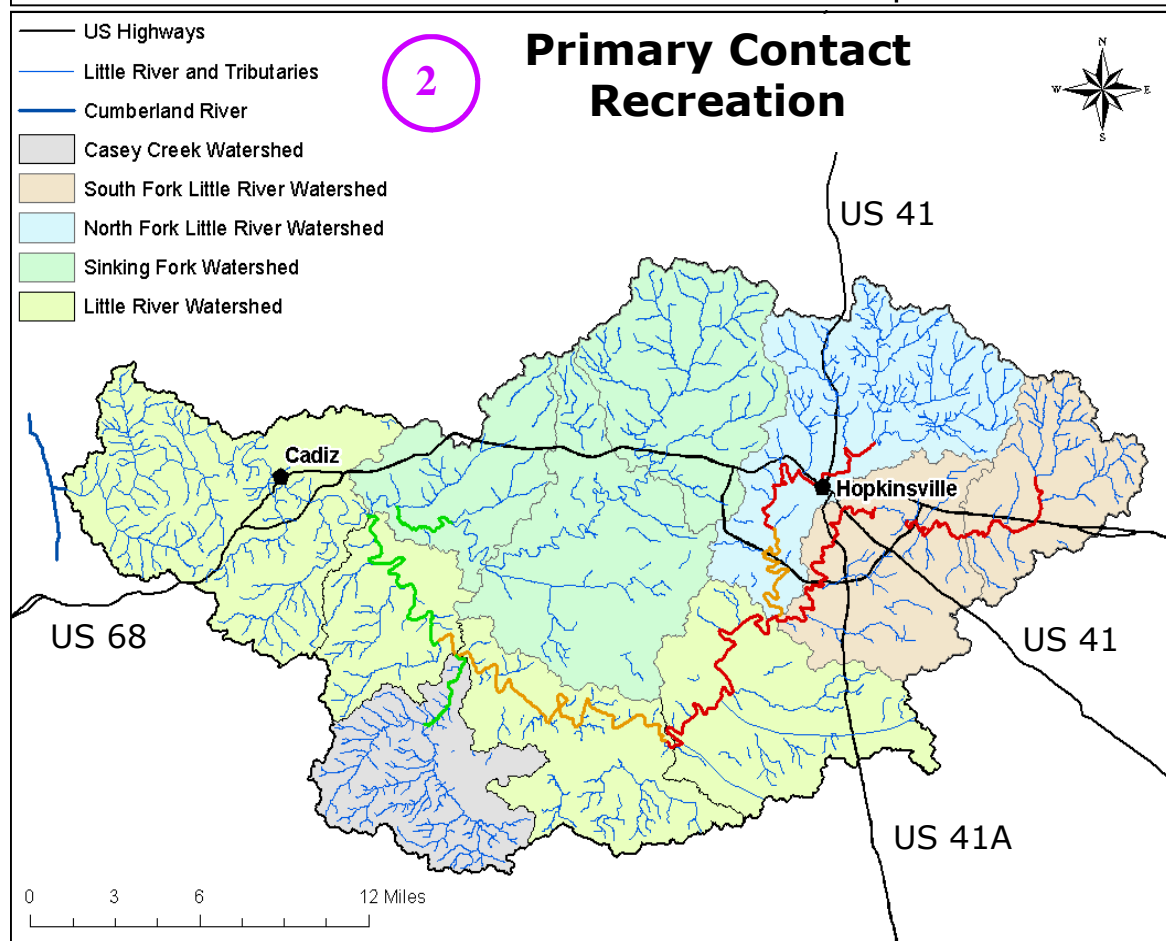
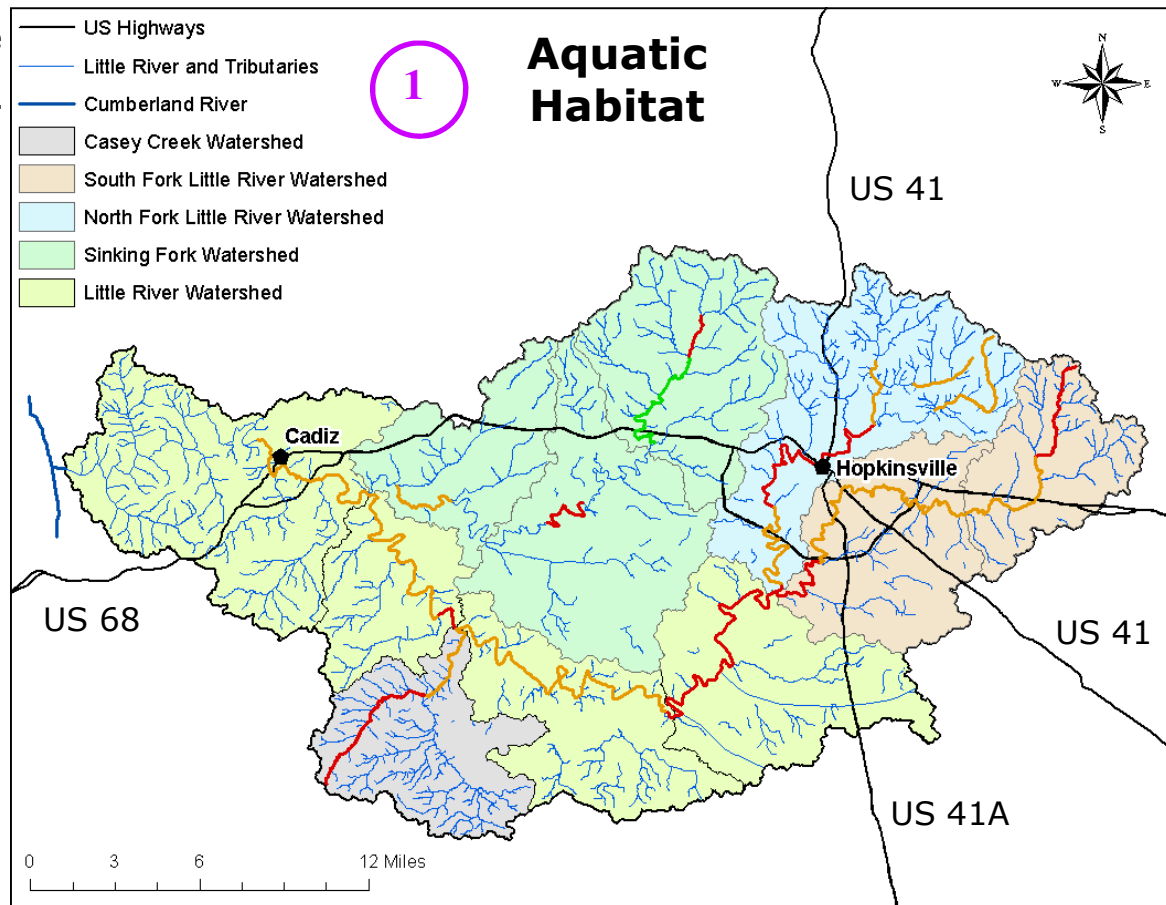
Designated Uses for the Little River Watershed are **Aquatic Habitat (map 1)** - water quality promotes a healthy population of plants and animals that live in the water and **Primary Contact Recreation (map 2)** - water is safe for human swimming. In the maps on this page, segments that have been assessed are highlighted in **(1) green** if the water quality is good and the use is supported, **(2) orange** if the water quality is fair and the use is only partially supported and **(3) red** if the water quality is poor and the use is not supported. If a segment is blue, its uses have not yet been assessed.

Impaired waters are those that are highlighted in **orange** or **red** since the **designated use** is not fully supported. To be impaired for Aquatic Habitat, the fish and aquatic bug populations have reduced numbers or types. To be impaired for Primary Contact Recreation, bacteria concentrations exceeded the level considered safe for swimming at least 20 percent of the time from May through October.

When it is determined that a waterbody is impaired, the pollutant that is causing the impairment is identified. Impaired waters are required to have a **Total Maximum Daily Load (TMDL)** calculated for each pollutant identified. A TMDL calculation is the total amount of pollutant(s) a waterbody can receive and still meet its **designated use(s)**.

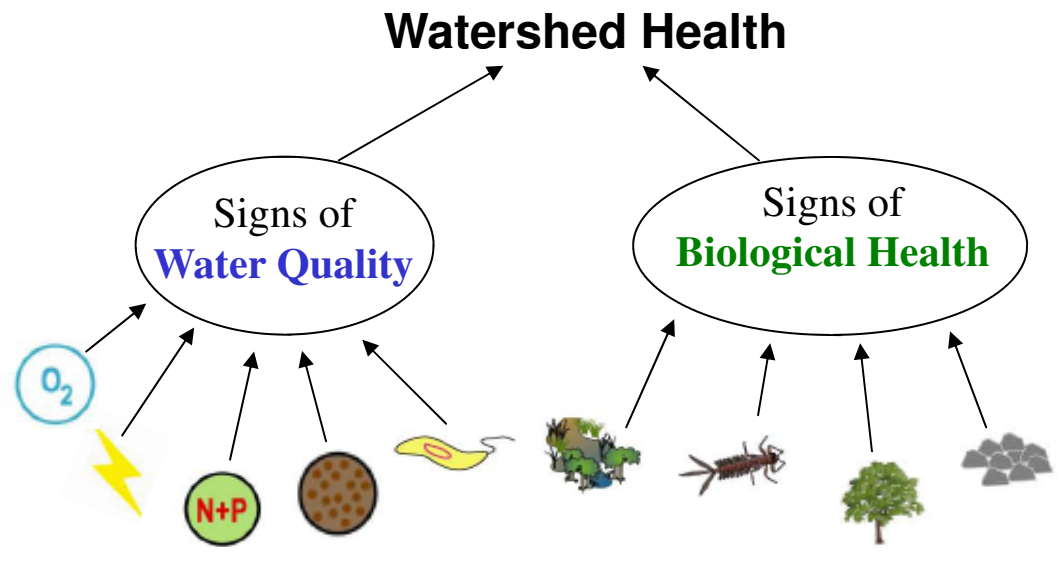
A watershed study is performed to collect the data required to calculate a TMDL. The watershed study focuses on collecting information that relates to signs of water quality and signs of biological health, which are described on the next page.

The North and South Fork of the Little River, Casey Creek, Sinking Fork and Little River are listed as impaired and were therefore studied from 2000-02 and then again in 2009. A bacteria TMDL report was written as a result of the 2000-2002 study, which has been made available to the public with the goal of improving water quality.



Grading System

1. Information collected was divided into signs of **water quality** or signs of **biological health**.
2. Each sign received a grade, A through F, according to the results of our study, which were compared to health and science requirements and DOW scientific information.
3. The grades from each biological health sign were averaged to achieve a biological health score.
4. Similarly, each sign of water quality was averaged to achieve a water quality score.
5. These two scores were averaged to achieve a **watershed health grade**.



The grades can also be used to compare **sites** or **signs**. For example, one site within a watershed may receive a higher grade than the other sites in that watershed, demonstrating its quality. Or, one sign may receive a higher grade than the other signs, demonstrating that aspect of watershed health is doing well.

Signs of Water Quality



Dissolved Oxygen (DO): Concentration of oxygen dissolved in water and readily available to fish and other aquatic organisms.



Specific Conductivity: A measure of the ability of water to conduct an electrical current, which is used for approximating the total dissolved solids content of water. Low specific conductivity is desired, and increasing specific conductivity negatively impacts fish and aquatic bugs.



Nitrogen and Phosphorus (Nutrients): Although natural sources of nutrients exist, human activity is a major source of nutrient pollution, including municipal sewage treatment plants, industrial outflows, commercial fertilizers and animal waste.



Fecal Coliform: A type of bacteria that lives in the intestinal tract of humans and other warm-blooded animals. It is used as an indicator of other fecal pathogens. For a site to receive an F, the fecal coliform concentration was above the level considered safe for swimming 80 to 100 percent of the time. Elevated concentrations indicate an increased risk of gastrointestinal illness if the water is swallowed or infection if contact is made with an open sore or wound.



Total Suspended Solids (TSS): A measure of the suspended solids in waterbodies. Suspended solids are small particles of solid pollutants that are suspended in water. As TSS increase, fish and aquatic bugs experience stress and altered behavior.

Signs of Biological Health



Total Habitat: Stream habitat is assessed by scoring 10 habitat signs, which are both living and nonliving parts of the surroundings that support an organism, population or community.



Aquatic Macroinvertebrates (bugs): An animal without a backbone, large enough to be seen with the naked eye. They are often the immature forms of insects that live on land as adults and are an important food source for fish. Different species prefer different habitats, and some are more tolerant of pollution than others.












Riparian Zone: A component of total habitat that is defined by the land adjacent to a stream that has distinct soil types and plant communities, which aid in absorbing water and shading the stream. To receive an A, the riparian zone must be at least 18 yards wide on each side of the stream.



Available Cover: A component of total habitat, which looks at the quantity and variety of structures in the creek that provide fish and bugs a place to hide, feed, reproduce and raise young. Examples include cobble and boulders, fallen trees, logs, branches, root mats, undercut banks and aquatic vegetation.

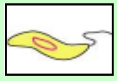
Sinking Fork

Site #	Creek Name										Site Grade
1	Sinking Fork	B+	D	C	A	B-	C	D	B	C	C+
2	Sinking Fork							D	C	B	C
3	Sinking Fork						D	B	B	D	C
	Sign Grade	B+	D	C	A	B-	D+	C-	B-	C	

Positives



DO levels were almost always suitable for aquatic fish and bugs throughout the Sinking Fork Watershed.



At the one site where fecal coliform was collected within the Sinking Fork Watershed, the concentrations never exceeded the standard considered safe for swimming. Therefore, Sinking Fork is not impaired for Primary Contact Recreation.



TSS levels were low a majority of the time throughout the Sinking Fork Watershed. A few spikes that occurred after storm events caused the overall grade to shift from an A to a low B.



Available cover received two Bs and a C within the Sinking Fork Watershed. Currently, the available cover is not degraded enough to have it score below a B average, but the available cover that is present should be protected to ensure that this sign of biological health continues to score in the positive range.

Gray Area



For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff or failing septic systems.



Habitat received two Ds and a B, indicating shifting habitat throughout the Sinking Fork Watershed. In some areas it was suitable, while in others it was lacking or absent. The poor bug grades reflect these shifting levels of habitat, demonstrating the importance of habitat in biological health.



Similar to habitat, the width of the riparian zone varied throughout the watershed, scoring a B, C and D. Riparian zones are important for filtering runoff, stream shading and bank stability, and when trees are cut and banks are cleared, these benefits are reduced or eliminated.

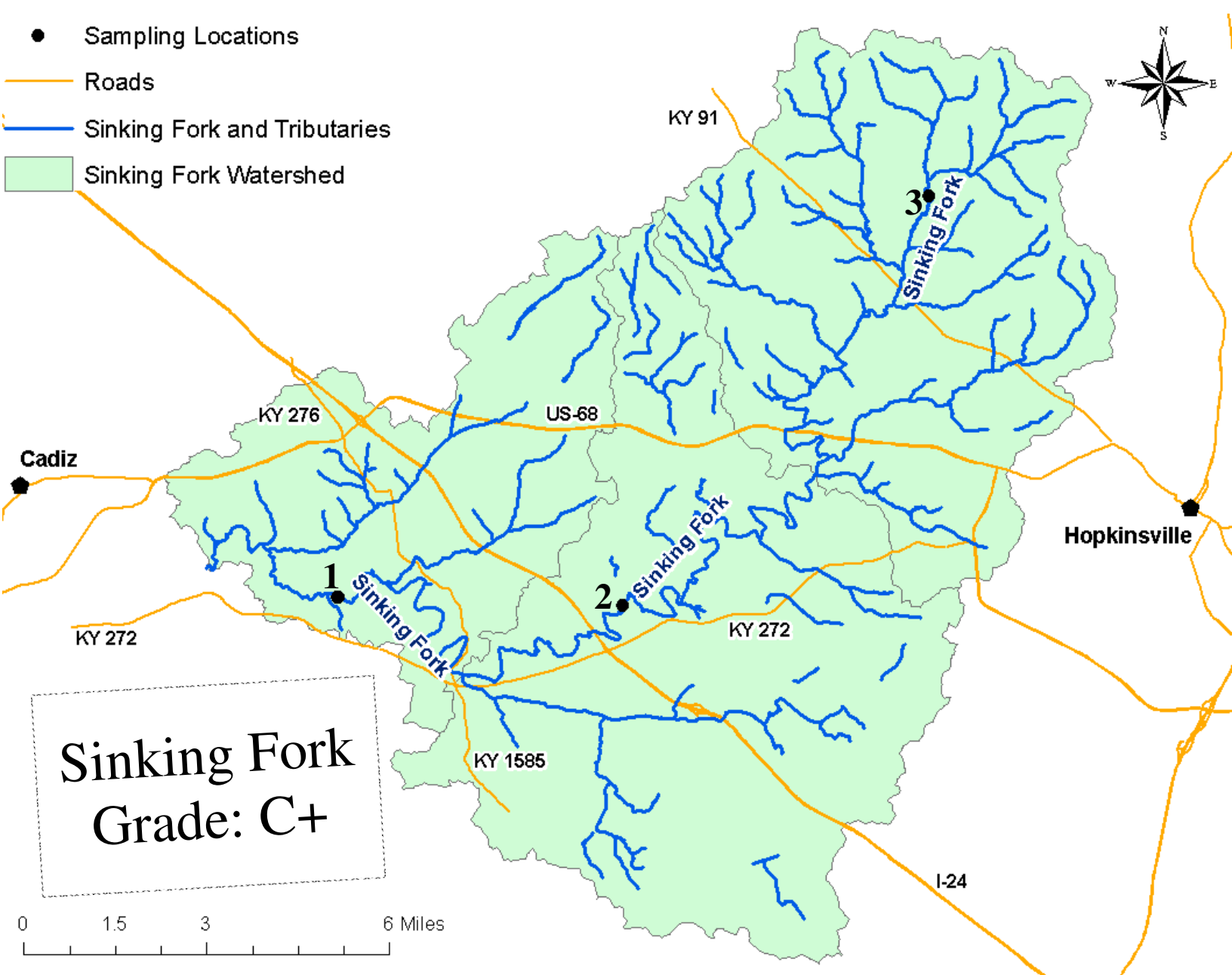
Negatives



Specific conductivity levels were well outside their optimal ranges, demonstrating high levels of dissolved solids in the water. These dissolved solids have been shown to negatively impact aquatic bug communities, which, when coupled with shifting habitat availability, may explain the reduced bug populations observed in the Sinking Fork Watershed.



Without bugs to eat, many fish will leave the watershed in search of food elsewhere.












Farm Facts

- The **Agricultural Water Quality Act** seeks to protect ground and surface water from pollution that results from agricultural activities.
 - To learn more about the Act visit the Division of Conservation's website at <http://conservation.ky.gov/Pages/AgricultureWaterQuality.aspx>
- All landowners with 10 or more acres of agricultural activity should have a **Water Quality Plan**.
 - To create your plan, visit the KY Agricultural Water Quality Planning Tool at <http://warehouse.ca.uky.edu/AWQP2000/index.html>
- A list of **Best Management Practices** can be found at <http://warehouse.ca.uky.edu/AWQP2000/allBMP.html>
- KY's Department of Agriculture **free** farm chemical collections: <http://www.kyagr.com/consumer/>


Land Use


Land use is the best way to understand how humans may potentially pollute the watershed in which they live. Cities and towns tend to have more point sources due to the number of facilities required to clean the water used in households and businesses, and may also have an increase in nonpoint sources due to impervious surfaces such as roads, parking lots and sidewalks. Rural areas tend to have more nonpoint source pollution associated with agriculture. Animal waste, fertilizers, pesticides and loose soil, which is exposed when trees are cut down, may enter the stream during rain events. What type of area do you live in and how does it affect water quality?


Casey Creek


Site #	Creek Name										Site Grade
1	Casey Creek	A	B	C	A	C-	D	A	C	A	B
2	Tributary of Casey Creek							D	C	C	C-
	Sign Grade	A	B	C	A	C-	D	C+	C	B	

Positives

 DO levels were always suitable for aquatic fish and bugs throughout the Casey Creek Watershed.

 Specific conductivity was fairly good, indicating reasonably low dissolved solids throughout Casey Creek.

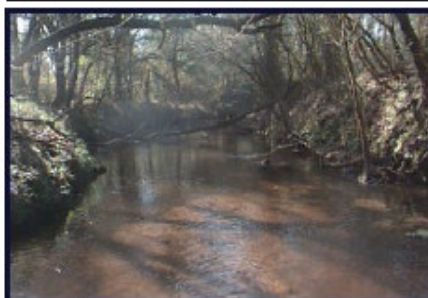
 The riparian zone width scored an A and a C, placing it in the positive category. Riparian zones are very important to the overall health of a watershed, and these areas should be protected.

 At the one site fecal coliform was collected within the Casey Creek Watershed, the concentrations exceeded the standard considered safe for swimming only 15% of the time. Therefore, Casey Creek is not impaired for Primary Contact Recreation.

Habitat 101

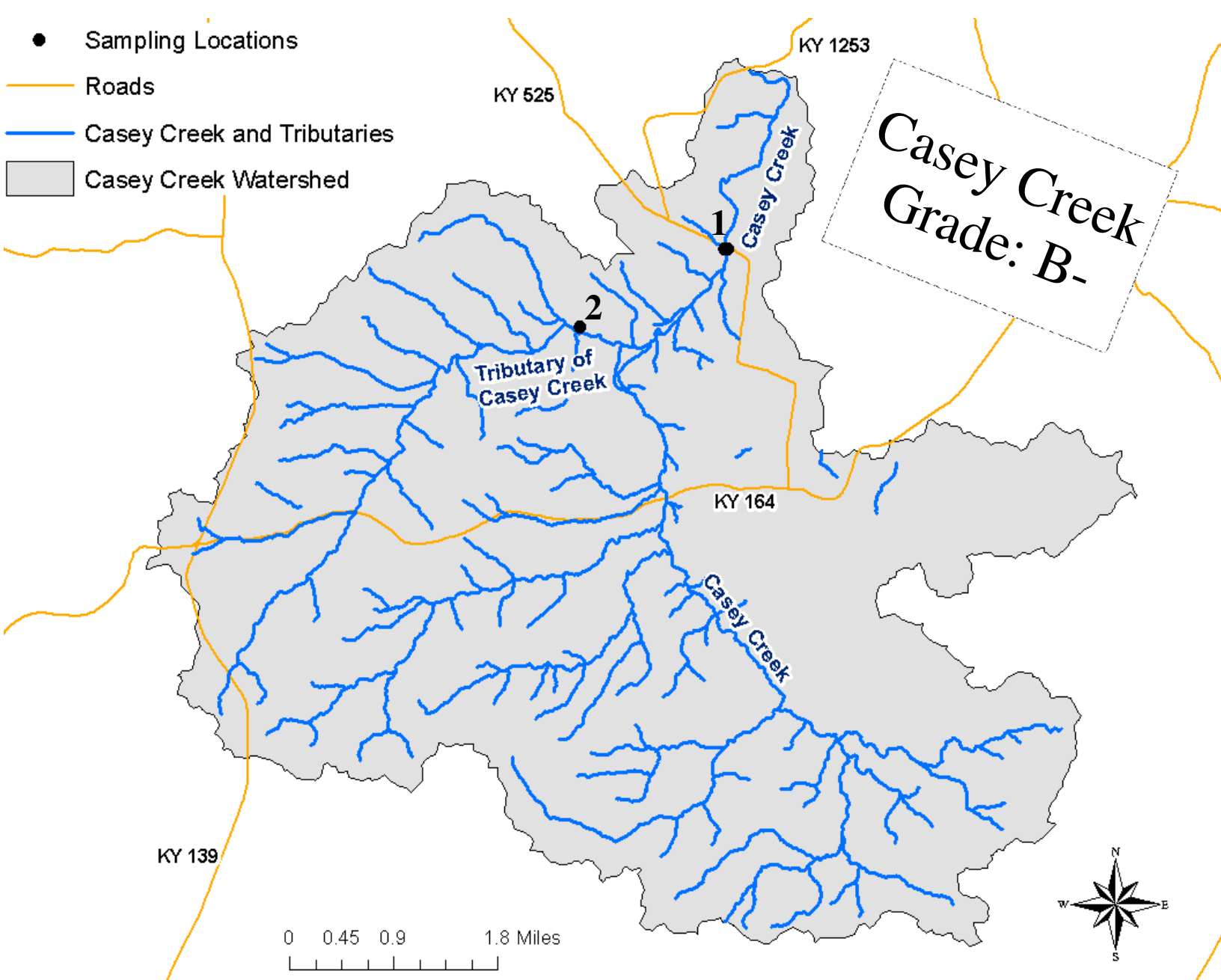
- Compare the amount of instream material for aquatic bugs and fish to utilize for colonization, hiding and feeding.
- Compare the amount of food sources.
- Compare the amount of stream shading.
- Compare the number of stream bends, which slow water and reduce its energy, thereby reducing flood potential.
- Compare the stability of the banks.
- Compare the potential for sediment from the banks to erode when vegetative protection is lacking.

Optimal Range



Poor Range

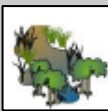




Gray Area



For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff or failing septic systems.



Habitat received an A and a D, indicating shifting habitat throughout the Casey Creek Watershed. In some areas it was suitable, while in others it was lacking or absent. Those areas that have good habitat should be protected and are very important to the overall health of the Casey Creek Watershed.



Available cover received two Cs in the Casey Creek Watershed, demonstrating that available cover is beginning to degrade for fish and aquatic bugs. Available cover is especially important because it provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.












TSS levels rose following rain events due to a lack of vegetation and streamside grazing, which destabilizes stream banks, and development, which exposes sediment that can then be washed away.

Negatives



Due to reduced available cover and elevated levels of nutrients and total suspended solids, the aquatic bug communities were poor within the Casey Creek Watershed.

North Fork Little River

Site #	Creek Name										Site Grade
1	Lower Branch North Fork Little River						F	C	A	D	C
2	Middle Branch North Fork Little River						D	B	B	A	B
3	North Fork Little River	C+	B	D+	C	D	D	D	D	D	D+
4	North Fork Little River	B	D	F+	B	D+					C
5	North Fork Little River							D	C	C	C-
6	North Fork Little River						D	F	D	B	D+
7	Northside Waste Water Treatment Plant	A	F+	F		B-					C-
8	North Fork Little River						D	D	D	B	D+
9	Hammond Wood Waste Water Treatment Plant	B	D-	F		B-					C-
	Sign Grade	B	D	F+	B-	C	D	D+	C	C+	

Positives

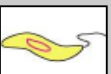


DO levels were almost always suitable for aquatic fish and bugs throughout the North Fork Little River Watershed.

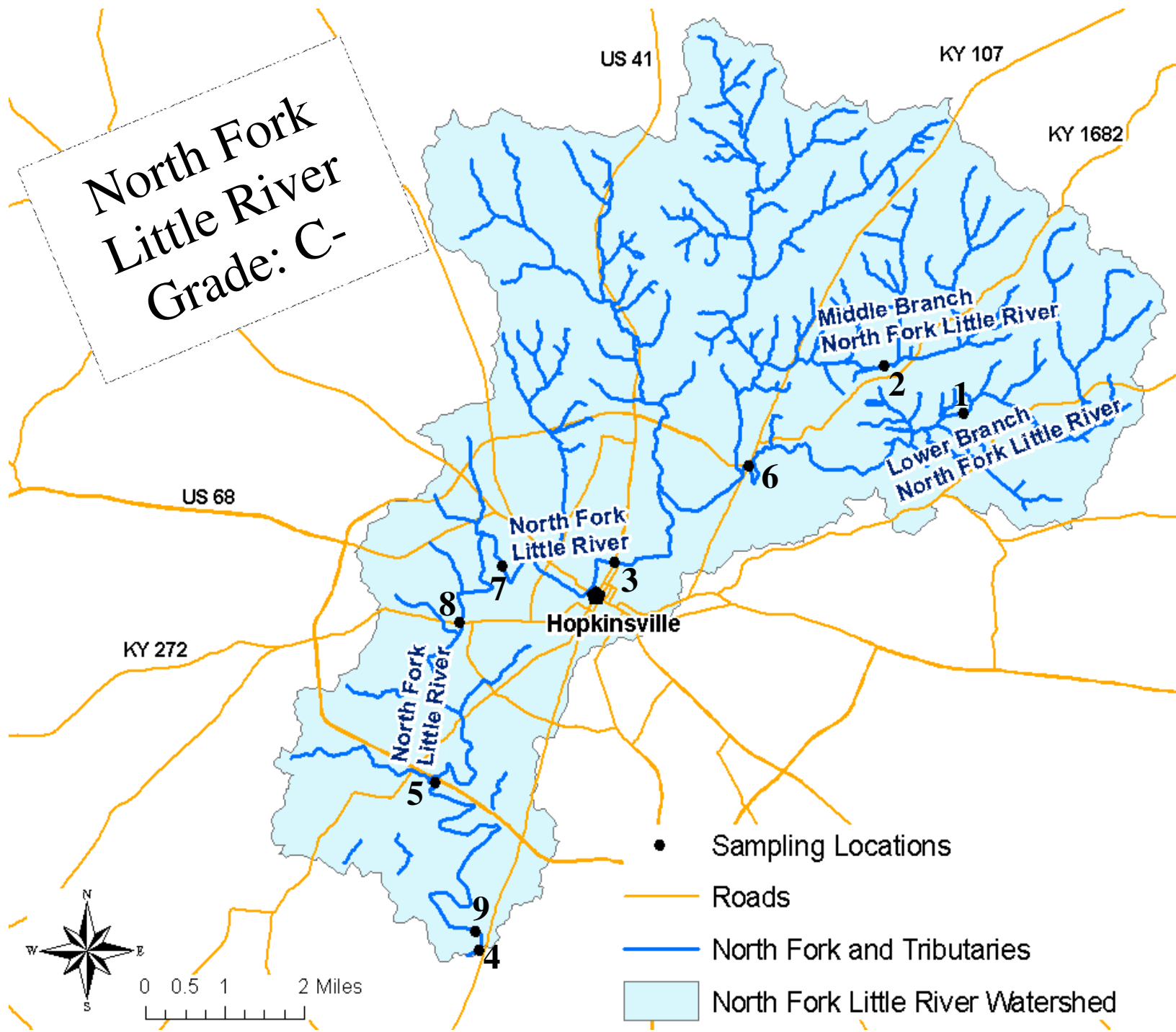
Gray Area



TSS levels rose following rain events due to a lack of vegetation and streamside grazing, which destabilizes stream banks, and development, which exposes sediment that can then be washed away.



Fecal coliform levels exceeded the level considered safe for swimming 20 to 40% of the time if the grade was a B and 40 to 60% of the time if the grade was a C. On average, the fecal coliform levels exceeded this level 41% of the time making North Fork Little River impaired for Primary Contact Recreation.



Gray Area continued



Available cover scores ranged from an A to a D, demonstrating that available cover is beginning to degrade for fish and aquatic bugs. Available cover is especially important because it provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.



The width of the riparian zone varied greatly throughout the watershed. Riparian zones are important for filtering runoff, stream shading and bank stability, and when trees are cut and banks are cleared, these benefits are reduced or eliminated.

Negatives



Specific conductivity levels were high throughout the North Fork Little River Watershed, with the exception of site 3. Elevated specific conductivity has been shown to reduce aquatic bug communities and may partly explain the poor bug communities observed.



Nutrient levels were greatly elevated throughout the North Fork Little River Watershed. Excess nutrients can contribute to overgrowth of algae, which can consume the available oxygen, alter hydrology and impair biological communities.

North Fork Little River continued

North Fork Little River Negatives continued












Habitat, which provides the building blocks for diverse groups of fish and bugs, was reduced throughout the North Fork Little River Watershed, with D being the most common grade.



As a result of elevated specific conductivity, nutrient and TSS levels combined with reduced available cover, riparian zones and habitat, the aquatic bug communities were poor throughout the North Fork Little River Watershed.

South Fork Little River

Site #	Creek Name										Site Grade
1	South Fork Little River	B-	C	D	B	D					C
2	South Fork Little River	B-	C	D	F	D	D	D	B	C	C-
3	South Fork Little River	B	D+	C-	B	C-	D	D	B	B	C
4	South Fork Little River						C	A	A	A	A-
	Sign Grade	B-	C	D+	C	D	D+	C	B+	B	

Positives



DO levels were almost always suitable for aquatic fish and bugs throughout the South Fork Little River Watershed.



Available cover scored well at all sites where it was assessed. This is important because if water quality were to improve in the watershed, the aquatic bug and fish communities would have a place to colonize, making their improvement more likely.



The riparian zone scored an A, B and C, meaning its width was always greater than 6 yards on both sides of the stream. Riparian zones are important for filtering runoff, bank stability and stream shading, which keeps water temperatures cool and algal communities reduced.

Gray Area

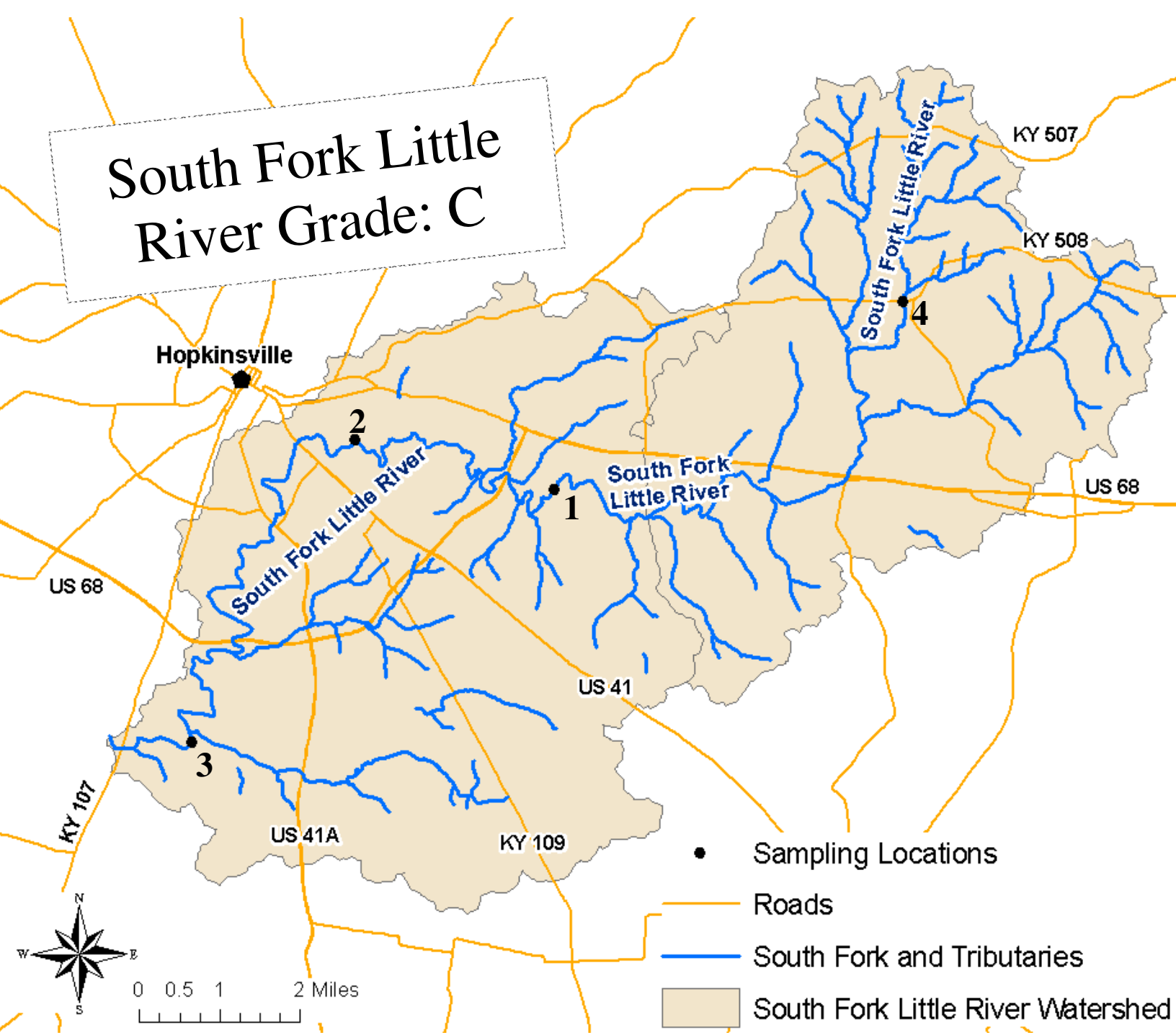


Specific conductivity levels were outside their optimal ranges, which could negatively impact fish and aquatic bug communities since dissolved solids can damage organisms and interfere with normal behavior.



Fecal coliform levels were below the standard considered safe for swimming 63% of the time at sites 1 and 3. However, at site 2, fecal coliform levels were below the standard only 12% of the time.

South Fork Little River Grade: C



Gray Area continued



Habitat received an A and two Ds, indicating shifting habitat throughout the South Fork Little River Watershed. In some areas it was suitable, while in others it was lacking or absent. Those areas that have good habitat should be protected and are very important to the overall health of the South Fork Little River Watershed.

Negatives



Nutrient levels were greatly elevated throughout the South Fork Little River Watershed. Excess nutrients can alter biological communities due to an overgrowth of algae and the associated changes in water quality.












TSS levels were also greatly elevated throughout the South Fork Little River Watershed. Turbid water can stress aquatic bug and fish populations. Mortality may result if the TSS remain high for long periods of time or if the events occur frequently enough that the populations do not have a chance to recover.



As a result of elevated specific conductivity, nutrients and TSS in addition to reduced habitat, the bug communities were poor throughout South Fork Little River.

Little River

Site #	Creek Name										Site Grade
1	Little River	B-	C	C	C	D					C
2	Little River	B	D-		C						C
3	Little River	B+	C	D	B	D	C	A	A	A	B
4	Little River	A-	C-	C-	A	D+		D	C	D	C
5	Little River							D	B	A	B-
6	Little River						D	A	A	C	B
	Sign Grade	B	C-	C-	B-	D	C+	B-	B+	B	

Positives



DO levels were almost always suitable for aquatic fish and bugs throughout the Little River Watershed.



Habitat received two A's, a C and a D, and therefore scored a B on average. Although habitat averaged well enough to be placed in the positive category, the scores were inconsistent throughout the watershed. In some areas it was suitable, while in others it was lacking or absent. Those areas that have good habitat should be protected and are very important to the overall health of the Little River Watershed.

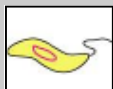


Available cover scored well at all sites where it was assessed, with the exception of site 4. This is important because if water quality were to improve in the watershed, the aquatic bug and fish communities would have a place to colonize, making their improvement more likely.



The riparian zone scored two A's, a C and a D. At the sites that received A's, the riparian zone is stabilizing the stream bank, providing shade and filtering runoff before it enters the stream. As the width of the riparian zone is reduced, these benefits are also reduced.

Gray Area



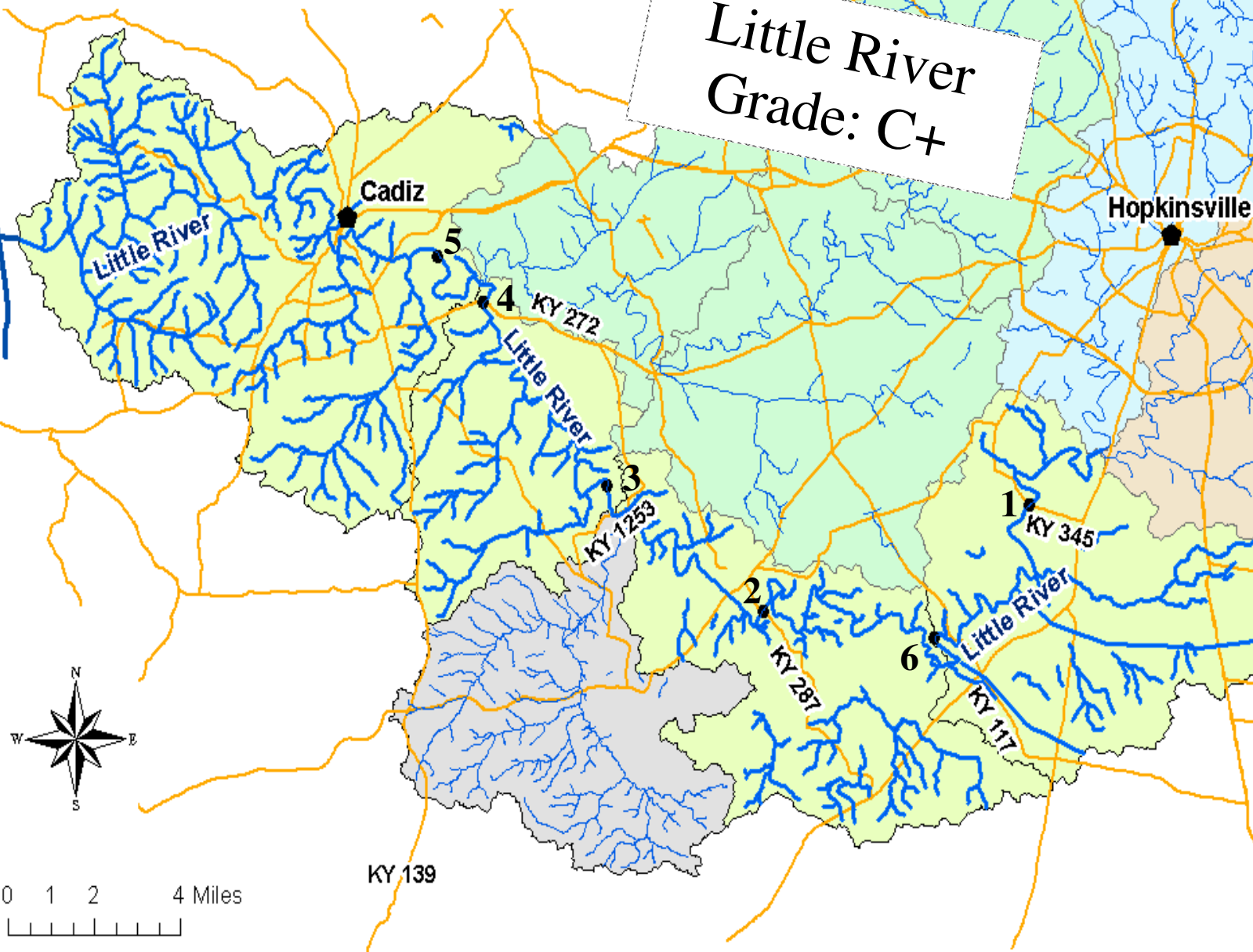
On average, fecal coliform levels were above the standard considered safe for swimming 32% of the time and therefore scored a B-. This percentage does make Little River impaired for Primary Contact Recreation. To receive an A, and therefore not be impaired for Primary Contact Recreation, the fecal coliform levels can only exceed the standard 20% of the time or less.



Specific conductivity levels were outside their optimal ranges, which could negatively impact fish and aquatic bug communities since dissolved solids can damage organisms and interfere with normal behavior.

- Sampling Locations
- Roads
- Tributaries of Little River
- Little River
- Cumberland River
- Casey Creek Watershed
- South Fork Little River Watershed
- North Fork Little River Watershed
- Sinking Fork Watershed
- Little River Watershed

**Little River
Grade: C+**



Gray Area
For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff or failing septic systems.



As a result of increased specific conductivity, nutrients and TSS, bug communities are reduced throughout the Little River Watershed. However, the biological integrity of the watershed is relatively good, as all indicators of biological health, except for bugs, were placed in the positive category. Therefore, if the water quality is improved, the recovery of aquatic bug communities is more likely.



Negatives
TSS levels were greatly elevated throughout the Little River Watershed. Turbid water can stress aquatic bug and fish populations. Mortality may result if the TSS remain high for long periods of time or if the events occur frequently enough that the populations do not have a chance to recover.

Summary: Room for improvement, but some have more work to do than others

Best Site: South Fork Little River site 4 located off KY 508, where the bugs received a C and all other signs of biological health received A's. However, water quality data was not collected at this site, and it may be that reduced water quality is contributing to the poor bug populations, which would lower the overall score at this site.

Best Watershed: Casey Creek Watershed was the healthiest of those studied, receiving a B-, and it is also the watershed with the highest percentage of forested area. However, Casey Creek has room for improvement in both the water quality and biological health categories if it is to support a healthy aquatic bug population once again.

Best Sign: Dissolved Oxygen (DO) was the sign of watershed health that consistently received the highest grade, demonstrating that the DO of Little River's waterways was at normal levels.

Worst Site: North Fork Little River site 3 located off US 41, which received all D's in signs of biological health and ranged from a B to C's and D's in signs of water quality.

Worst Watershed: North Fork Little River Watershed, which scored a C- and had a majority of its signs of watershed health being listed as gray areas or as negatives. This watershed has more challenges when compared to the other watersheds in this study because of its mix of urban and rural development.

Worst Sign: The aquatic bugs consistently received the lowest grade, placing it in the negative category in 4 out of 5 watersheds. Aquatic bugs are sensitive to habitat alteration or removal, clearing stream banks of trees and vegetation, and pollutants in the water such as elevated nutrients and TSS. Therefore, their populations were reduced for different reasons depending upon the watershed.

What can you do?

- Make every effort to **protect the good** that remains. Work with local government and land owners to protect areas that are less degraded and improve land management to minimize further degradation.
- **Trees are the best way to protect and restore water quality and biological health.**
 - ◊ Leave in place or establish vegetation alongside streams to provide natural filters that stabilize stream banks, minimize erosion, regulate water flow, provide shade, retain sediment and absorb excess nutrients.
 - ◊ Plant trees and do not mow within 18 yards of the stream bank.
- **To keep water safe for swimming,** keep animals out of the streams, which will limit the amount of animal waste entering the waterways, reduce excess nutrients and protect habitat.
- **To improve habitat,** allow fallen trees, logs, leaves, gravel, cobble and boulders to remain in the stream to create habitat for fish and bugs to feed, find refuge and reproduce.
- **To reduce TSS,** maintain streamside vegetation, plant cover crops, install settling ponds, reduce animal access to streamside grazing and guard waterways during construction activities.
- **To reduce nutrients**
 - ◊ Use chemicals and pesticides according to labels and fertilizers based on soil test results. Limit uses and store and dispose of properly.
 - ◊ Maintain functional septic systems and replace failing septic systems.
 - ◊ Reduce runoff by increasing pervious surfaces and by installing filter strips, rain barrels or rain gardens.
 - ◊ Properly dispose of pet waste.
 - ◊ Keep animals out of the stream.
- Keep grass clippings, petroleum products, trash, and litter out of storm drains; this material enters the stream directly without treatment.
- Service your vehicle regularly to prevent oil and antifreeze leaks and reduce noxious emissions.
- Become a certified citizen **volunteer** water quality monitor or establish a program in your local community or watershed.

Where to go for more information

Making changes at home and work

- Bluegrass PRIDE at www.bgpride.org/gallery1.htm

Volunteering

- Watershed Watch in Kentucky at water.ky.gov/wsw/Pages/default.aspx or contact Jo Ann Palmer at 800-928-0045 or JoAnn.Palmer@ky.gov

What are other watersheds doing?

- Hinkston Creek Watershed Protection Project at <http://www.hinkstoncreek.org/index.html>
- Strodes Creek Conservancy at <http://www.strodescreek.org>
- Friends of Stoner Creek at <http://www.stoner creek.us/>

Grants and Programs

- KY's Nonpoint Source (Runoff) Pollution program: water.ky.gov/nsp/Pages/default.aspx
- KY's Natural Resource Conservation Service: www.ky.nrcs.usda.gov/
- KY's 319 Grant program: water.ky.gov/Funding/Pages/NonpointSource.aspx or contact James Roe at 502-564-3410 or James.Roe@ky.gov

Purchasing or planting native trees and plants

- Division of Forestry: forestry.ky.gov/Pages/default.aspx
- Kentucky Native Plant Society: www.knps.org/plant_resources.html