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Red River Watershed Health Report

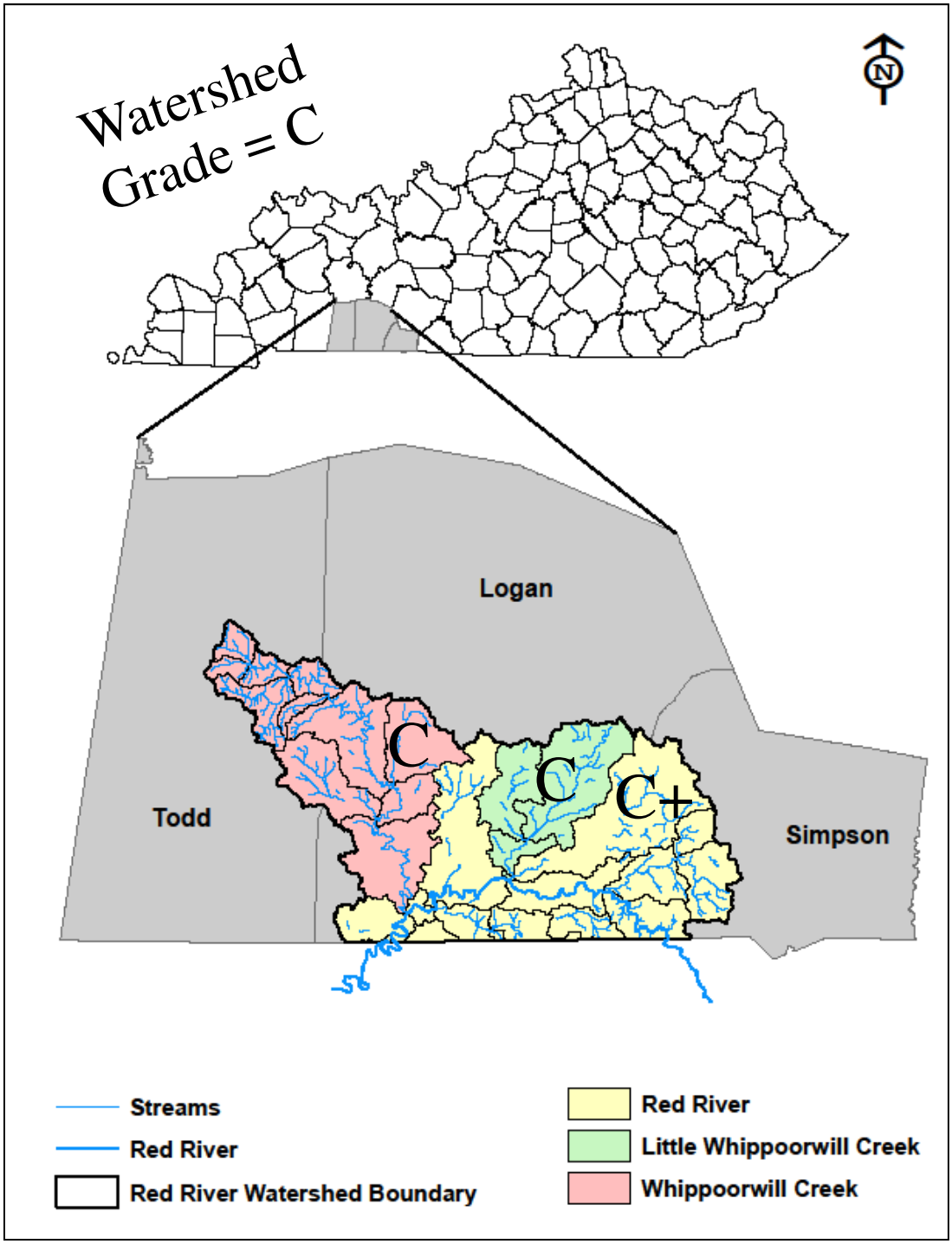
Department for Environmental Protection - Division of Water

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 Todd, Logan, and Simpson counties of efforts to examine the health of the Red 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. In this report Red River, Whippoorwill Creek, and Little Whippoorwill Creek, all of which form the Red River Watershed, will be discussed.

Upon initial evaluation, it was determined that many stream segments within the Red River Watershed do not support the **uses** required by the Clean Water Act.

The U.S. Environmental Protection Agency (EPA) requires that states conduct watershed studies on all such waters to calculate the maximum amount of pollutant a creek can receive and still support a healthy watershed. This amount is known as a **Total Maximum Daily Load**, or TMDL.



In 2010, DOW biologists conducted a year-long study in each of the watersheds shown in the map above to gather scientific information. Based on this information, the Division has given a "report card grade" of a **C+** to **Red River**, a **C** to **Whippoorwill Creek**, a **C** to **Little Whippoorwill Creek**, and a **C** to the entire **Red River Watershed**. This health report explains where the impaired segments are located, the signs of health that went into assigning the grades for each watershed and provides information on how the grades can be improved.

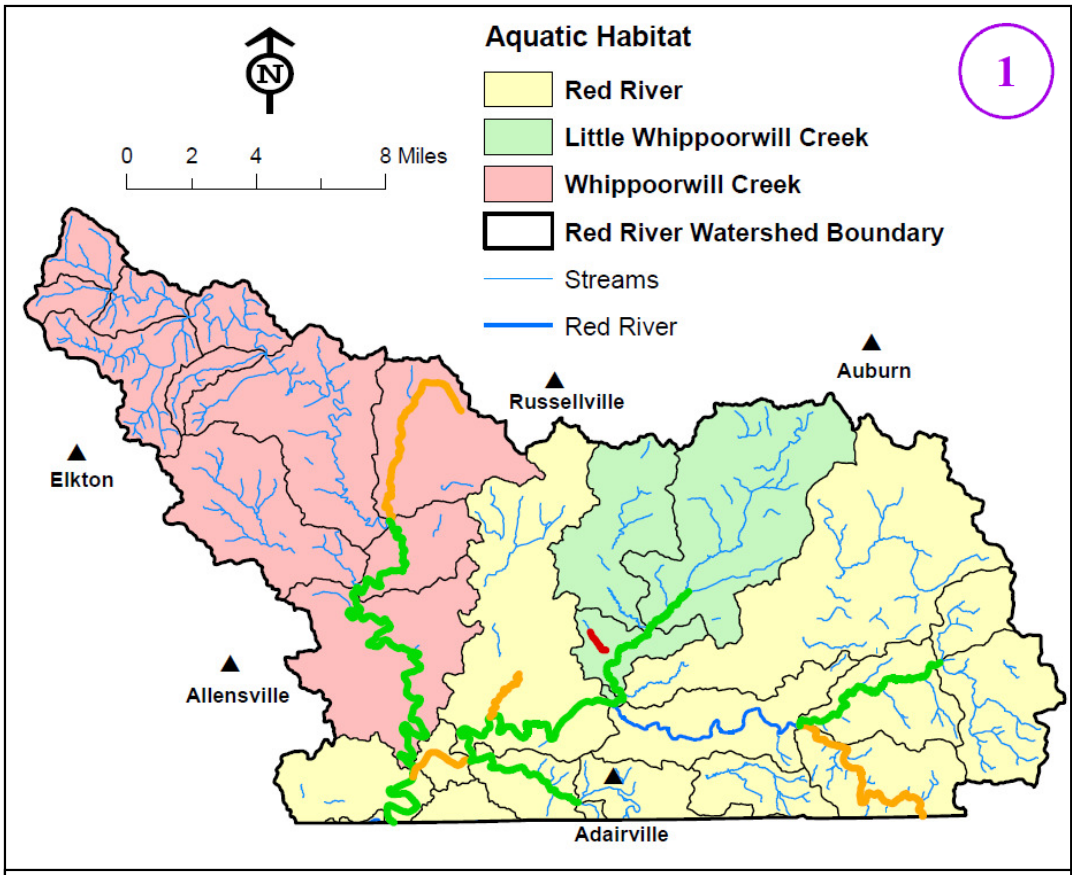
Impaired Waters

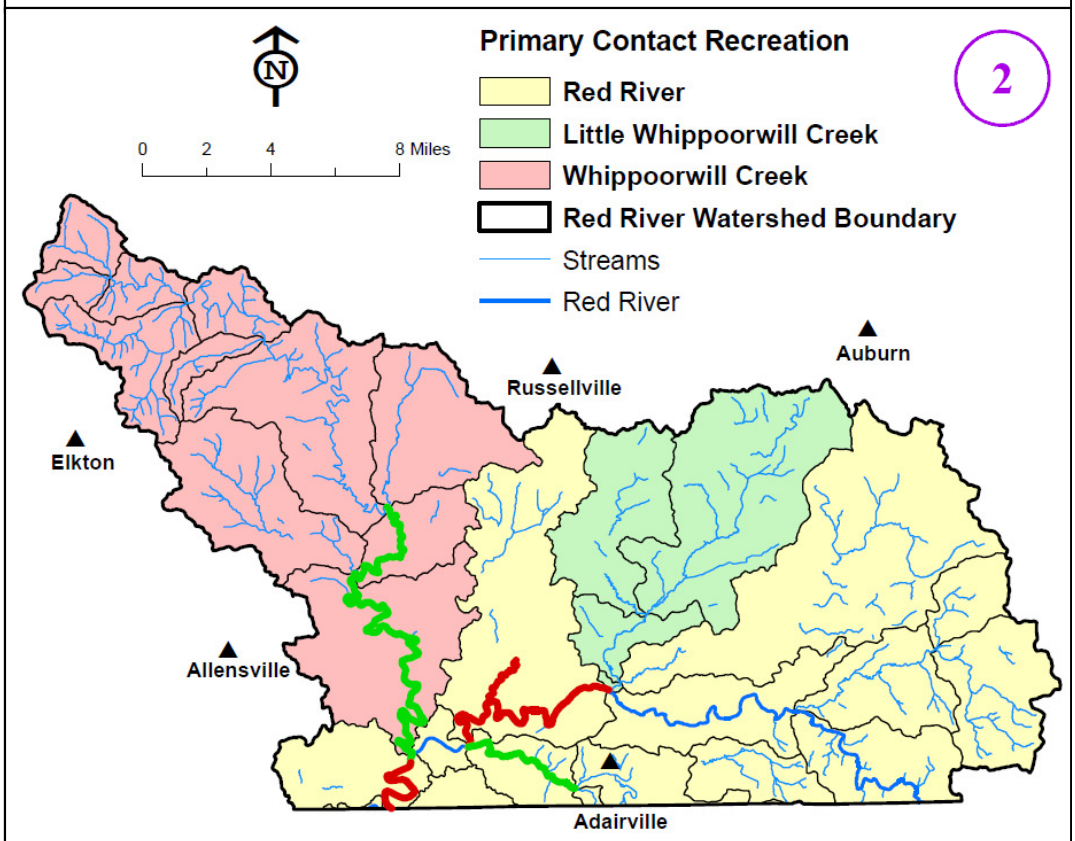
Designated Uses for Red River Watershed are **Aquatic Habitat (map 1)** - water quality promotes a healthy population of plants and animals that live in the water and **Primary Contact Recreation (map 2)** - water is safe for human swimming. In the maps on this page, segments that have been assessed 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 communities 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 year long water quality study is performed to collect the data required to calculate a TMDL. The water quality study focuses on collecting data that relates to signs of water quality and signs of biological health, which are described on the next page.



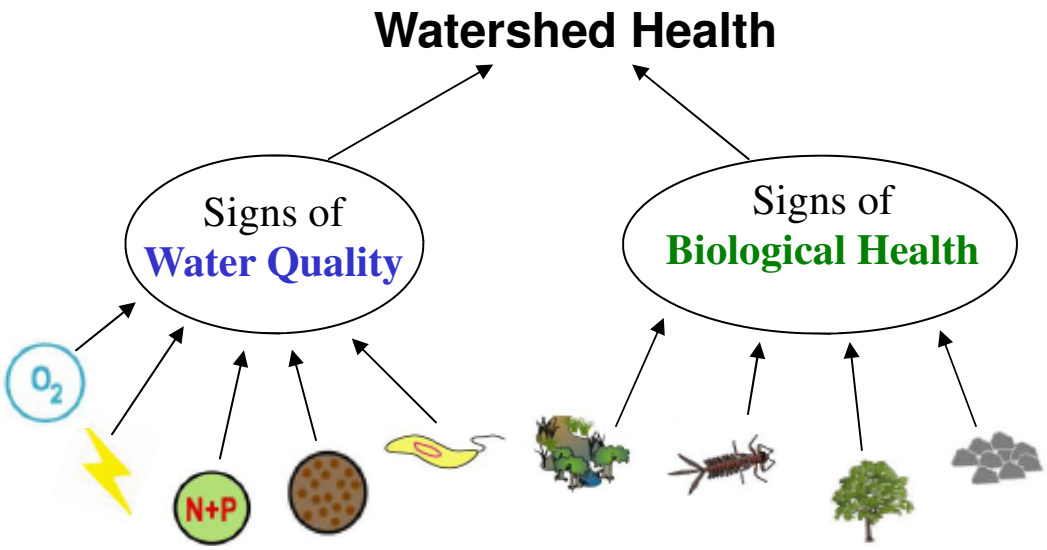


* Broken blue lines indicate sinking streams.

Red River, Pleasant Grove Creek, UT to Little Whippoorwill Creek, and Dry Fork are listed as impaired and were therefore studied in 2010. In addition, streams that had not been assessed were studied to determine if impairments are present. Streams that had been assessed but were determined to be supporting were also reassessed as part of the 2010 study. A TMDL report for each watershed will be written as a result of these studies, which will be made available to the public with the goal of improving water quality.

Grading System

1. Data collected were 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 particular 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, major sources of nutrient pollution are typically caused by man's activities and include municipal sewage-treatment plants, industrial outflows, commercial fertilizers and animal waste.

E. Coli: A type of bacteria that lives in the intestinal tract of man and other warm-blooded animals. For a site to receive an F, the *E. coli* concentration was above the level considered safe for swimming 80 to 100 percent of the time. Elevated concentrations of *E. coli* increase the 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.

Red River Watershed

Site #	Creek Name	O_2		N+P							Site Grade
1	South Fork Red River	A-	C	B-	C	C					**B-**
2	Pleasant Grove Creek	A-	D+	B-	F	C					**C**
3	Red River	B	C	D+	F	F					**D+**
4	Sinking Creek	A	C	C	F	C	D	A	A	D	**C**
5	Sulphur Spring Creek	B+	C-	B-	B	B-					**B-**
6	Neely Branch	A	B-	B-	B	A-	D	D	C	B	**C+**
7	Red River	B	C	B-	C	B					**B-**
8	Red River	A	C	C+	B	C-					**B-**
9	Red River	A	C	C+	C	D					**C+**
10	Red River	A-	C	C+	B	D+					**B-**
11	Red River	B	C	B-	A	C+					**B**
12	Red River	B	C+	B-	C	C					**B-**
	Sign Grade	**B+**	**C**	**C+**	**C**	**C**	**D**	**B-**	**B**	**C**	**C+**

Positives

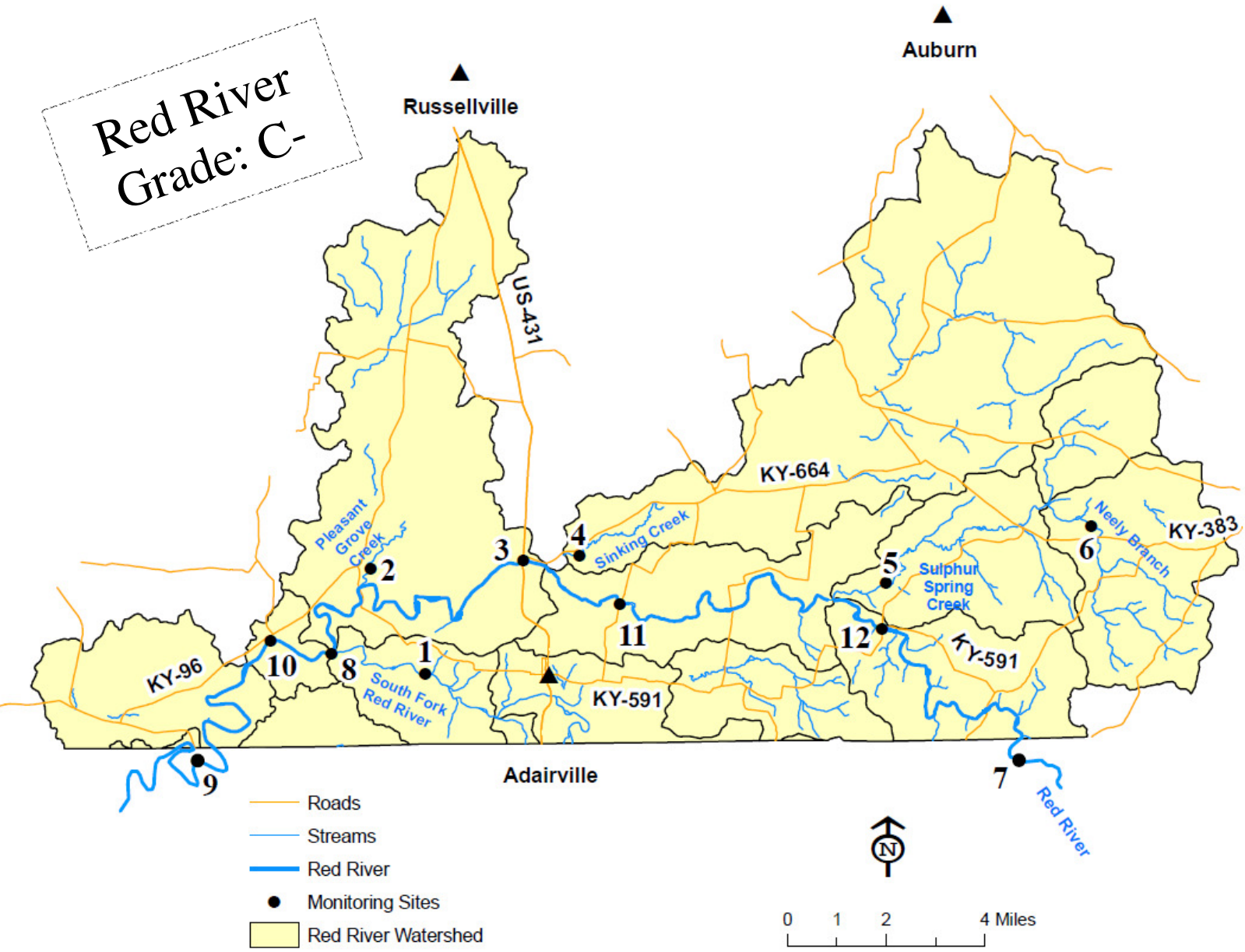
O_2 DO levels were suitable for fish and bugs.

Habitat, which provides the building blocks for diverse groups of fish and bugs, was very good at Sinking Creek but could use improvement at Neely Branch.

Available cover at sites that were sampled within the Red River Watershed averaged a B. 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

Specific conductivity was outside its optimal range, which could negatively impact fish and aquatic bug communities.



Gray Area continued

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

E. coli levels were above the standard considered safe for swimming 80 to 100% of the time if the grade was an F, 40 to 60% of the time if the grade was a C, 20 to 40% of the time if the grade was a B and 0 to 20% of the time if the grade was an A.

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

Negatives

The width of the riparian zone was less than 6 yards if the site received an F and between 6 to 12 yards if the site received a D. When trees are cut and banks are cleared, algal communities bloom and water temperatures increase due to a lack of shade. Banks become less stable, which increases erosion, and habitat for fish and bugs is reduced.

As a result of increased nutrients and TSS, shifting available cover and habitat, and a reduced riparian zone, the bug communities were poor throughout the watershed. Without bugs to eat, many fish will search for food in other streams.

Whippoorwill Creek Watershed

Site #	Creek Name	O_2		N+P							Site Grade
1	Dry Fork	B+	C	C+		C					**C+**
2	Whippoorwill Creek	A-	C	C+	B	C-					**B-**
3	North Fork Whippoorwill Creek	B+	A	C		C					**B-**
4	Whippoorwill Creek	B+	A	C		C-					**B-**
5	Whippoorwill Creek	B+	A	C		C-	D	D	B	F	**C**
6	UT to Whippoorwill Creek	B+	C	B		C+	D	C	A	D	**C+**
7	Whippoorwill Creek	A	B	C		C					**B-**
	Sign Grade	**B+**	**B**	**C+**	**B**	**C**	**D**	**C-**	**A-**	**D+**	**C**

Positives

O_2 DO levels were suitable for fish and aquatic bugs.

Within the main channel of Whippoorwill Creek, specific conductivity levels were within an optimal range. Specific conductivity levels were outside their optimal ranges in the tributaries to Whippoorwill Creek (sites 1 and 3) and above the mouth to Red River (site 2), which could negatively impact aquatic bug communities.

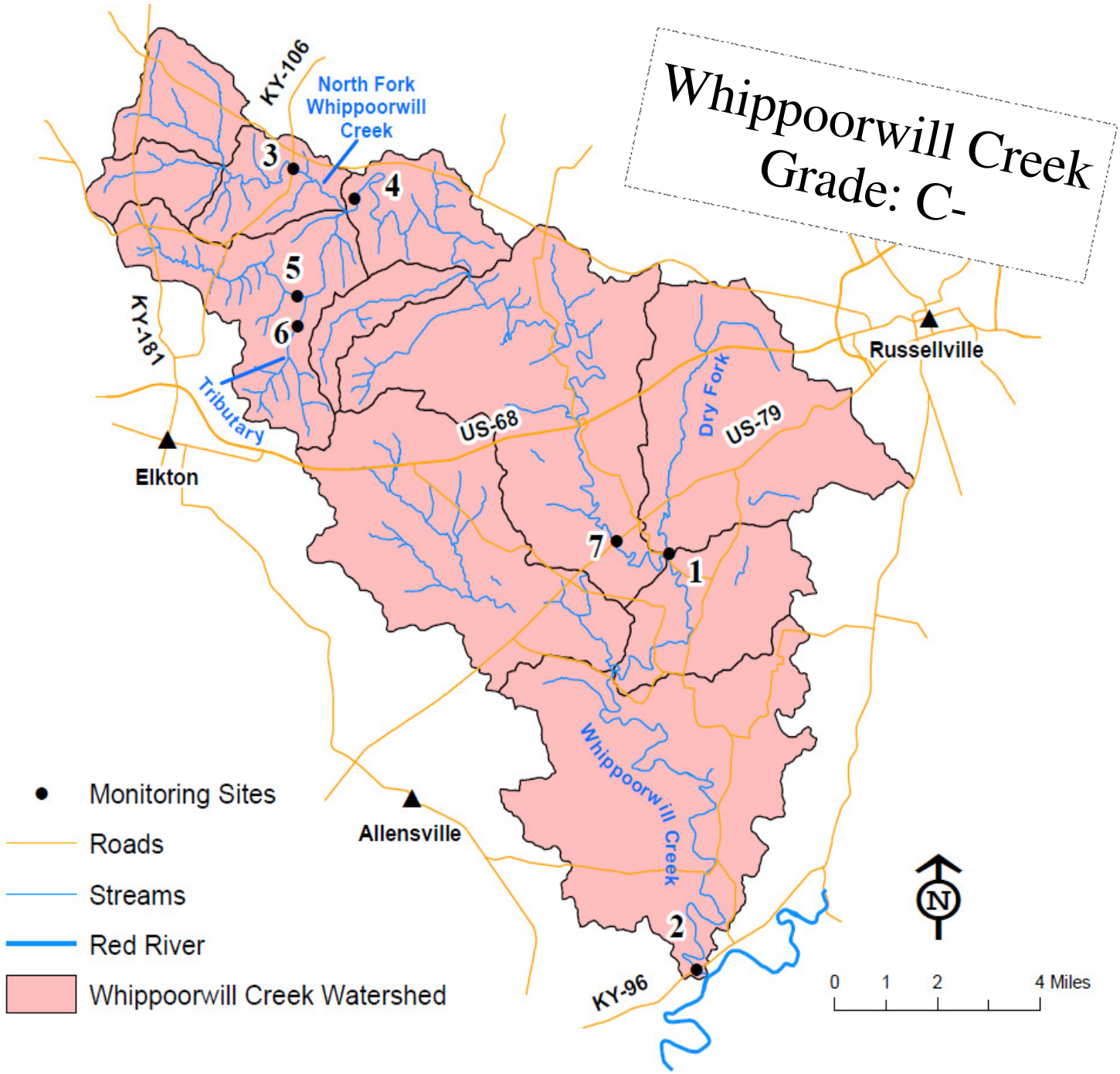
E. coli levels were considered safe for swimming 73% of the time at site 2.

Available cover was good at the two sites where it was collected within the Whippoorwill Creek Watershed. Not only is available cover an important place for fish and bugs to live, feed, hide from predators and reproduce, it also provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.

Gray Area

N+P For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff.

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



Gray Area continued

Habitat, which provides the building blocks for diverse groups of fish and bugs, was only collected at two sites within the watershed. Habitat collected at the tributary to Whippoorwill Creek was fair and provided only partial support. Habitat collected from the main channel of Whippoorwill Creek was poor and provided little support.

Negatives

At the two sites where riparian zone was measured within the Whippoorwill Creek Watershed, the sites received a D and F. When trees are cut and banks are cleared algal communities bloom and water temperatures increase due to a lack of shade, banks become less stable, which increases erosion, and habitat for fish and bugs is reduced.

The bug communities were poor throughout the watershed. Heavy sediment deposits, lack of riparian vegetation, and fair to poor habitat likely provided a poor environment for bug populations.

Little Whippoorwill Creek Watershed

Site #	Creek Name	O_2		N+P							Site Grade
1	Pleasant Run	A	C+	B-	D	D+					**C**
2	Little Whippoorwill Creek	B	C	C	F	C					**C**
3	Little Whippoorwill Creek	B	D+	C+	C	C+					**C+**
	Sign Grade	**B+**	**C**	**C+**	**D**	**C**					**C**

Positives

DO levels were suitable for fish and bugs.

Negatives

On average, *E. coli* levels were above the standard considered safe for swimming 63% of the time throughout the Little Whippoorwill Creek Watershed.

Habitat 101

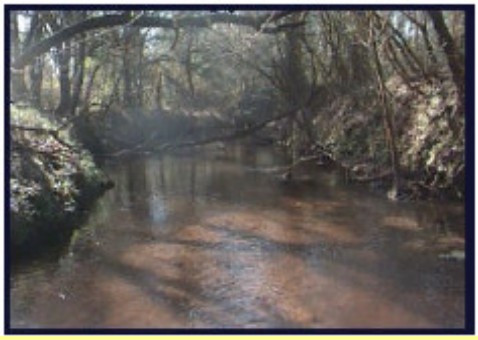
- Compare the amount of instream material for aquatic bugs and fish to utilize for colonization, hiding and feeding.
- Compare the amount of food sources.

- 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.

Photos from Barbour et al. 1999

Optimal Range



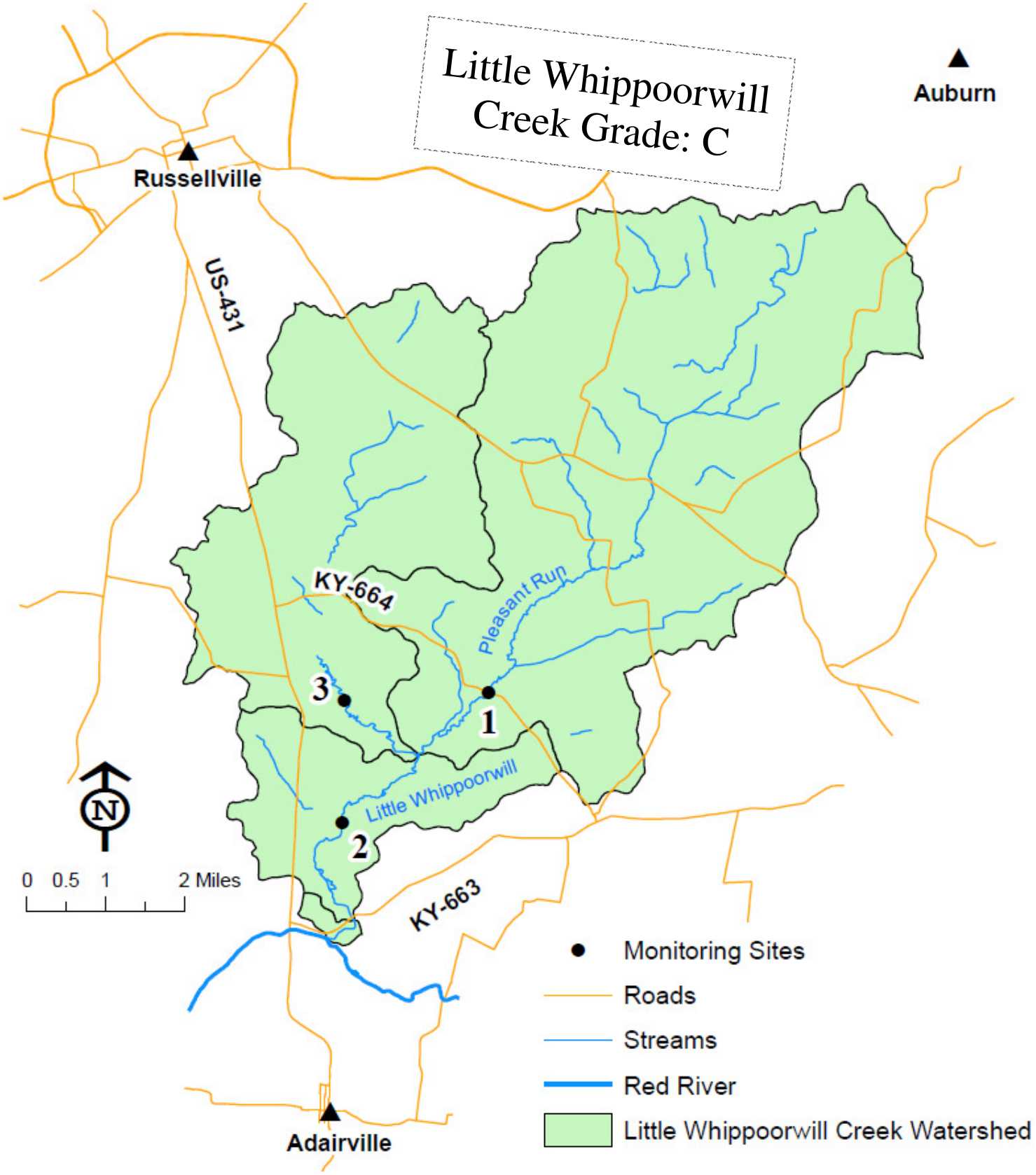
Poor Range

Gray Area

Specific conductivity was outside its optimal range, which could negatively impact fish and aquatic bug communities.

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

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



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

Best Site: Red River's site 11 off KY-1308 was the best site mainly because of its low *E.coli* levels. However, biology was not collected at this site.

Best Watershed: Red River was the healthiest watershed, receiving a C+. However, the watershed has room for improvement, especially when it comes to the *E. coli* and TSS scores.

Best Sign: Dissolved oxygen was the sign of watershed health that consistently received the highest grade, demonstrating that the concentration of oxygen dissolved in the water was near normal levels.

Worst Site: Red River's site 3 off US-431 received a D+ based on water quality data. Nutrient, TSS and *E. coli* levels were all high at this site.

Worst Watershed: Little Whippoorwill Creek was the most unhealthy watershed, consistently scoring poorest in water quality categories.

Worst Sign: Aquatic macroinvertebrates (or bugs) was the worst sign of watershed health, never receiving a passing score at any site. Macroinvertebrates are an important indicator of watershed health. When water quality and habitat degrade, bug pollutions shift to more tolerant groups.

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

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

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
- KY's Department of Agriculture **free** farm chemical collections: http://www.kyagr.com/consumer/envsvs/technical/FarmChemicals.htm

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