GEOLOGICAL SURVEY OF ALABAMA

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EVALUATION OF SEDIMENTATION RISK AND HABITAT THREAT SEVERITY FOR STREAM CROSSINGS AND CRITICAL HABITAT IN THE NORTH RIVER STRATEGIC HABITAT UNIT, ALABAMA

VOLUME 1: REPORT

Open-File Report 1502

by

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Daphne Ecological Services Field Office

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ABSTRACT

The North River Strategic Habitat Unit (SHU) in Fayette and Tuscaloosa Counties, Alabama, is one of 51 SHUs being evaluated to focus conservation activities for managing, recovering, and restoring populations of rare fishes, mussels, snails, and crayfishes. This study presents the results of an evaluation of the North River SHU to determine the sedimentation risk posed to streams of selected unpaved and paved roads and to determine the habitat threat severity in selected reaches of designated mussel critical habitat.

Of 135 evaluations of paved and unpaved roads in the North River SHU, 35 sites (25.9 percent) were considered at high risk for sedimentation, 49 sites (36.3 percent) at moderate risk, and 51 sites (37.8 percent) at low risk for sedimentation effects. Fayette County had 32 sites at high risk while Tuscaloosa County only had three sites at high risk. Unpaved roads generally presented a higher risk of instream sedimentation effects most often related to the engineered ditches and their outlets to the stream and the poor condition of the bridge fill material. Crossing fill material that was not properly stabilized was a significant source of sediment at several sites; bare or unprotected ditches were also sources of sediment in addition to that eroded from poorly constructed/bare ditch outlets. Paved crossings were not without sedimentation issues as well. For the eight paved sites that scored high risk for sedimentation, bridge fill condition and condition of the inlet/outlet structure generally scored low as did upstream and downstream channel

morphology and alteration of the downstream channel and banks. The issue of greatest need was to institute best management practices (BMPs) by installing small sediment retention basins, in all ditches, upstream of the outlets. The next most frequent issue was fish migration barriers caused by culverts that were perched above the downstream water surface during low flow times of the year and culvert openings that were blocked by debris and snags. Over 100 tons of sediment have been captured since November 2011 by 17 sediment control structures installed in Fayette and Tuscaloosa Counties. Results of these investigations into sedimentation risk from paved and unpaved roads, habitat threat severity in critical mussel habitat, and evaluation of simple, low-cost structures for controlling road-born sediment will have long term positive implications for management of mussel populations in the North River SHU. Similar sediment control structures will need to be installed throughout the critical habitat reaches in Clear Creek and in other tributaries of Binion Creek before significant volumes of sediment reduction will be realized.

INTRODUCTION

Open-File Report 1501 is published as two separate volumes. Volume 1 is the report and discusses results of stream-road crossing investigations highlighting where sedimentation issues may be occurring in the North River watershed. Volume 2 is a supplemental data appendix with detailed descriptions of (1) individual stream-road crossing sites, (2) sites where habitat threat severity evaluations were conducted, and (3) sites where sediment basin control structures have been installed in the upper North River watershed.

Stream sedimentation has been identified as one of the most significant threats to water quality in the United States with road-stream crossings acting as major conduits of bed sediment to aquatic systems. Excessive stream sedimentation is detrimental to aquatic habitat and organisms through the physical covering of the stream bed thereby removing a stream’s unique physical habitat attributes needed for feeding, cover, and reproduction which results in an impaired and less productive aquatic community. This habitat degradation process can lead to the loss of species

with narrow ecological and habitat requirements and increase the populations of species tolerant to sedimentation. Restoration and remediation of sedimentation threats in a stream can have a substantial positive impact on habitat quality if implemented systematically on a watershed basis. A preliminary watershed assessment of the North River has been conducted (O'Neil and others, 2011) and served as the guide for this report which presents the results of an evaluation of the sedimentation risk posed by stream-road crossings and an evaluation of habitat threat severity along selected reaches of designated mussel critical habitat within the North River watershed in Alabama.

The U.S. Fish and Wildlife Service (USFWS) in conjunction with the Alabama Department of Conservation and Natural Resources-Alabama Aquatic Biodiversity Center (AABC) and the Geological Survey of Alabama (GSA) have selected watersheds and river segments from the five major HUC 4 subregions in Alabama (fig. 1) to serve as aquatic species conservation priority areas. These areas have been designated as Strategic Habitat Units (SHUs) and Strategic River Reach Units (SRRUs) in which to focus activities for managing, recovering, and restoring populations of rare fishes, mussels, snails, and crayfishes (Wynn and others, 2012). These SHUs and SRRUs include a substantial part of Alabama's remaining high-quality water courses and reflect the variety of aquatic habitats occupied by these species historically and presently.

The SHUs were selected based on the presence of federally listed and state imperiled species, potential threats to the species, designation of critical habitat, and the best available information about the essential habitat components required by these aquatic species to survive. This includes areas with (1) geomorphically stable stream and river channels; (2) stream flow regimes that support normal behavior, growth, and survival of the animals; (3) acceptable water-quality conditions necessary for normal behavior, growth, and viability of all life stages of the animals; (4) a diversity of channel substrate types, with minimal amounts of fine sediment and filamentous algae; (5) for mussels, the presence of fish hosts with adequate living, foraging, and spawning areas; and (6) few or no competitive or predaceous nonnative species. The SRRUs were selected based on habitat features listed above and the presence of imperiled species

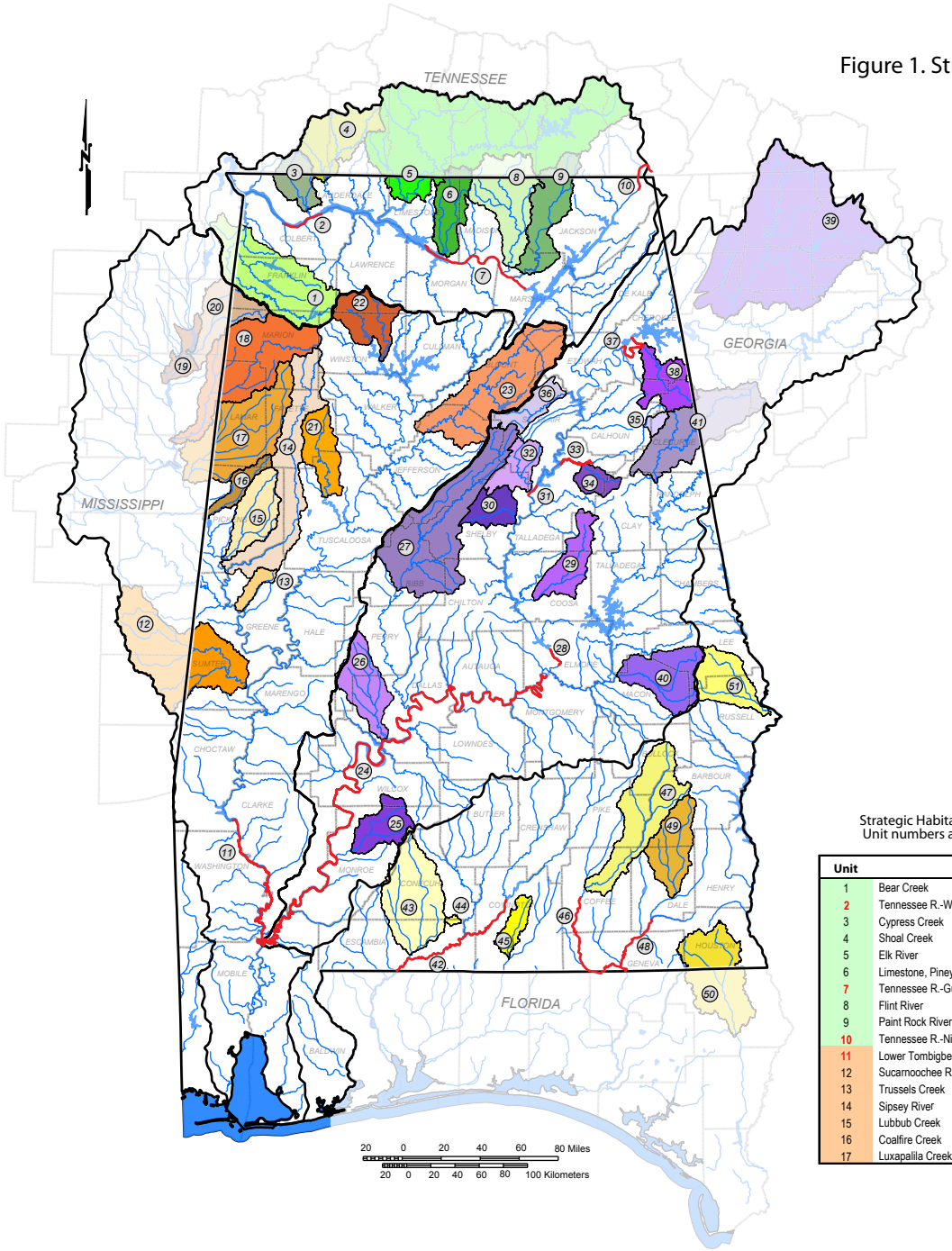


Figure 1. Strategic habitat and river reach units for aquatic species of conservation concern in Alabama.

Explanation

- Rivers and streams
- Open water
- County lines
- Hydrologic Unit Code (HUC) subregion boundary
- Strategic Habitat Unit (SHU)
- Strategic River Reach Unit (SRRU)

National Hydrologic Dataset HUC 4 Subregions in Alabama

Index map of HUC4 subregions in Alabama and neighboring states

- Middle Tennessee - Elk (0603) strategic units no. 1 - 10
- Mobile-Tombigbee (0316) strategic units no. 11 - 23
- Alabama River (0315) strategic units no. 24 - 41
- Choctawhatchee-Escambia (0314) and Apalachicola (0313) strategic units no. 42 - 51

Strategic Habitat Units (SHUs) and Strategic River Reach Units (SRRUs) in Alabama and associated HUC subregions. Unit numbers are grouped by the color of the HUC subregion in which they are located. Units in red font are SRRUs.

Unit	Name	Unit	Name	Unit	Name
1	Bear Creek	18	Buttahatchee River	35	Shoal Creek
2	Tennessee R.-Wilson dam tailwater	19	East Fork Tombigbee River	36	Big Canoe Creek
3	Cypress Creek	20	Bull Mountain Creek	37	Weiss Lake bypass (Dead River)
4	Shoal Creek	21	North River	38	Terrapin Creek
5	Elk River	22	Upper Sipsey Fork	39	Upper Coosa River tributaries
6	Limestone, Piney, Beaverdam Creeks	23	Locust Fork	40	Uphapee Creek
7	Tennessee R.-Guntersville dam tailwater	24	Lower Alabama River	41	Tallapoosa River
8	Flint River	25	Big Flat Creek	42	Conecuh River
9	Paint Rock River	26	Bogue Chitto Creek	43	Murder Creek
10	Tennessee R.-Nickajack dam tailwater	27	Upper Cahaba River	44	Amos Mill Creek
11	Lower Tombigbee River	28	Coosa R.-Jordan dam tailwater	45	Five Runs Creek
12	Sucarnoochee River	29	Hatchet Creek	46	Pea River
13	Trussels Creek	30	Yellowleaf Creek	47	Upper Pea River
14	Sipsey River	31	Coosa R.-Logan Martin dam tailwater	48	Choctawhatchee River
15	Lubbub Creek	32	Kelly Creek	49	West Fork Choctawhatchee River
16	Coalfire Creek	33	Lower Choccolocco Creek	50	Chipola River
17	Luxapalila Creek	34	Cheaha Creek	51	Uchee Creek

and include river reaches where species restoration and recovery actions are planned or already underway.

The basis for restoration and recovery within a designated SHU is the development of SHU-specific watershed information. For species recovery to proceed systematically and with some reasonable expectation of success, watersheds must be understood from a biological, water quality, land use, and habitat threat perspective. The type of watershed information developed for each SHU is unique and depends on the type and intensity of threats that listed species face. This information can include, but is not limited to, additional biological surveys to refine species distributions; surveys to determine water-quality and habitat threats that may affect listed species; a landscape analysis to determine land cover and land use patterns, SHU watershed characteristics, and land cover changes through time; studies to elucidate poorly understood biological phenomena (reproduction periods, migration routes, breeding habitats, etc.) that are important for managing and recovering species; hydrogeologic studies to determine groundwater characteristics and recharge areas for spring and cave-dwelling species; and biomonitoring studies using the Index of Biotic integrity (IBI) for identifying impaired stream reaches.

Broad understanding of threats and species distributions is important but additional information is necessary for recovery purposes. The next step is to use data developed during the threat analysis and watershed assessments to identify stream reaches that need protection, management, or restoration. Linking the location of critically imperiled species with habitat threats is a critical part of this process and can only be done by conducting SHU-specific studies.

Once habitat threats are linked with species and an action plan for recovery has been developed, then species restoration can begin. This takes place through a cooperative partnership of local landowners, organizations, and agencies including watershed partnerships, local and county governments, local businesses and farmers, state and federal agencies, and other interested parties using a variety of means, including protection of stream habitat through land purchase or landowner conservation agreements; management of habitat and water quality by eliminating polluted runoff

sources and by reducing pollutant loads through more aggressive best management practice (BMP) implementation; conducting actual riparian improvement or physically restoring a substantially degraded stream reach; and restoration of biodiversity with culture-raised species.

The USFWS, AABC, and GSA have teamed with the Alabama Clean Water Partnership (ACWP) and other local water stakeholders to create the Alabama Rivers and Streams Network (ARSN) which has a mission to study, manage, and develop our water resources in a scientific and comprehensive way to minimize their degradation, maximize their availability for all users, and restore and recover aquatic species.

ACKNOWLEDGMENTS

Several individuals have participated in watershed studies in the North River SHU and we wish to acknowledge their contributions herein. The Fayette County Commission provided support for the North River project and committed county resources to assist in the installation and maintenance of best management practices. Jeff Powell, Dan Everson, and Chris Metcalf with U.S. Fish and Wildlife Service provided technical training for habitat assessment techniques. Kellie Johnston of the Black Warrior River Clean Water Partnership provided administrative support and encouragement for this project. And finally, Norm Blakey and Patti Hurley with the Alabama Department of Environmental Management have provided support through the EPA 319 nonpoint source pollution program to the North River project.

STUDY AREA

The North River watershed (fig. 2) is approximately 418 mi^2 (square miles) in area upstream of the Lake Tuscaloosa dam and 425 mi^2 at its junction with the Black Warrior River. The watershed is about 40 miles long from the dam to the headwaters and 14 miles wide at its greatest dimension. North River flows through two physiographic sections, the Cumberland Plateau and the East Gulf Coastal Plain. The

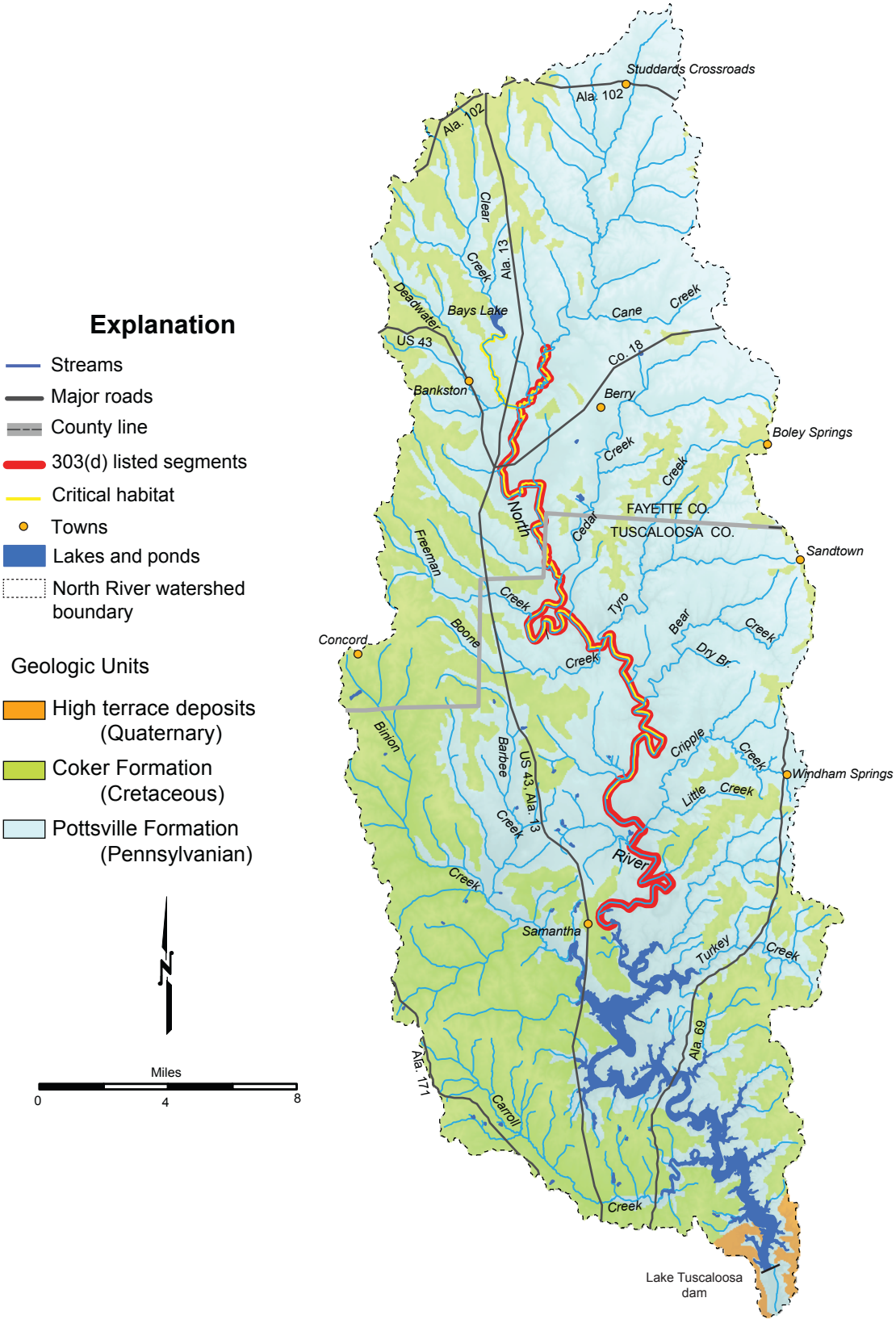


Figure 2. Geologic map of the North River watershed (modified from Geological Survey of Alabama, 2006).

northern and eastern parts of the watershed drain land in the Warrior Basin District (underlain by the Pottsville Formation of Pennsylvanian age) of the Cumberland Plateau while the western lake region drains land in the Fall Line Hills District (underlain by the Coker Formation of Cretaceous age) of the East Gulf Coastal Plain (figs. 2, 3).

The Warrior Basin is a broad, dissected plateau about 80 miles wide underlain primarily by sandstone and shale and lying mainly in Winston, Cullman, Walker, Jefferson, and Tuscaloosa Counties. The upper Black Warrior River and its tributaries - the Locust Fork, Mulberry Fork, Sipsey Fork, and North River - are dominant drainage features in the district with streams occurring in steep-sided valleys, many of which are gorge-like in their lower reaches.

The Fall Line Hills District is a wide crescent-shaped band extending from the Tennessee River in northwest Alabama through the middle portion of the Mobile River basin to the Chattahoochee River drainage in east Alabama. The Fall Line Hills district forms the southwestern and southern boundary to the Highland Rim, Cumberland Plateau, Alabama Valley and Ridge, and the Piedmont Upland physiographic provinces (fig. 3). Topography can be fairly rugged with steep slopes occurring near streams. In the western portion of the district around Lake Tuscaloosa, the Fall Line exists as an irregularly shaped transition belt where rocks of the Pottsville Formation dip below the land surface and are overlain by the sands and gravels of the Coker Formation in the Fall Line Hills (fig. 2).

The drainage pattern in North River is dendritic with frequent stream adjustments attributable to the joint and fracture system in the Pottsville Formation. Flow in larger streams of the Warrior Basin upstream of the Fall Line is usually sustained during summer months but many headwater tributaries go dry in late summer and fall because of low to no recharge from Pottsville shale. Streams draining the Fall Line Hills are well sustained, even in the driest years, because of extensive sand and gravel aquifers. Average annual discharge for the North River at Samantha (USGS site 02464000, 223 mi^2) is 373 ft^3/s (cubic feet per second) or 1.67 $ft^3/s/mi^2$ (cubic feet per second per square mile). Average daily discharge extremes for the period of record (1939-54, and

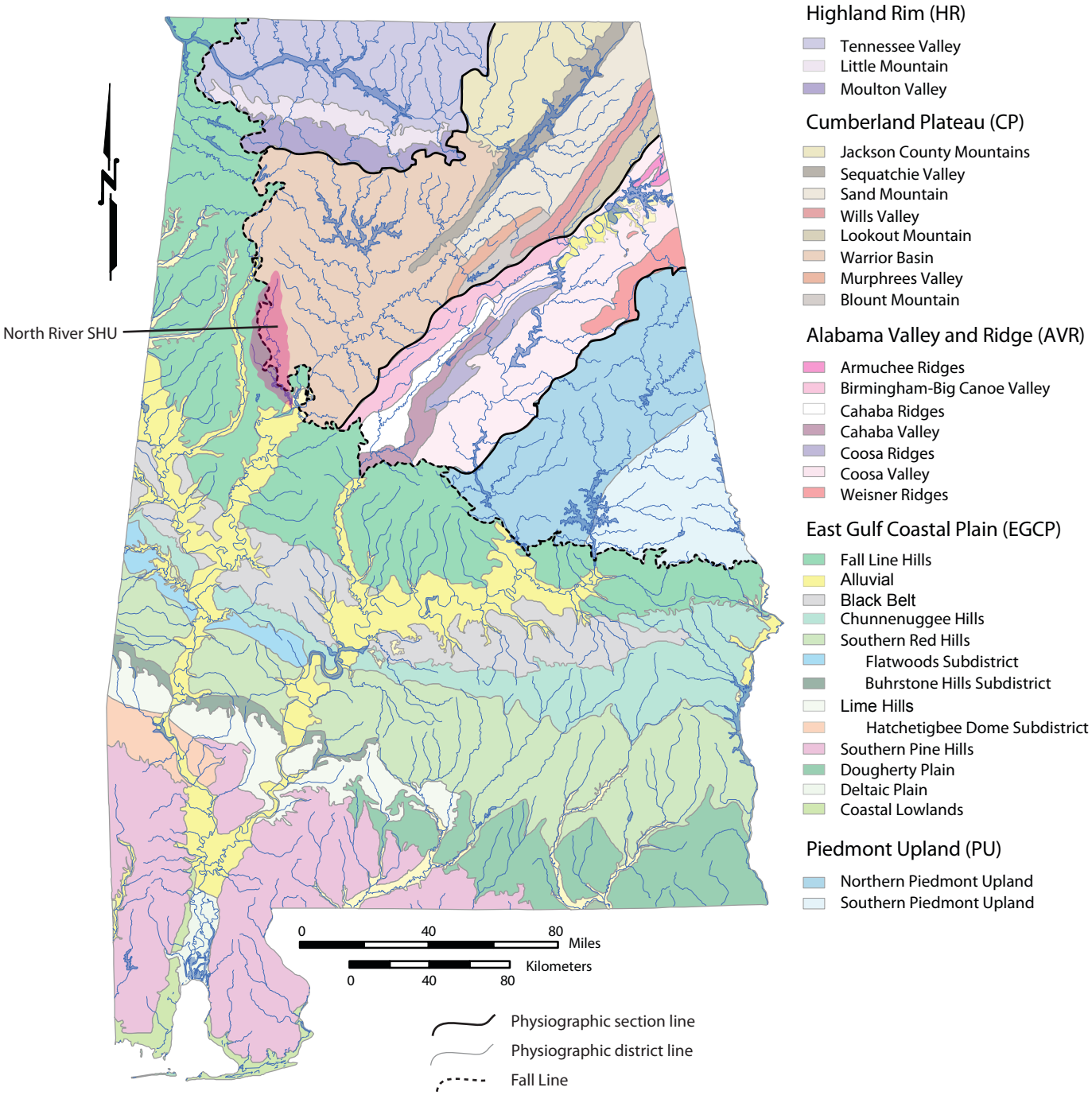


Figure 3. Physiography of Alabama. Districts in each section have been arranged decending from north to south. Alluvial deposits, which parallel the major river channels in the East Gulf Coastal Plain section, also occur in the Alabama Valley and Ridge section (modified from Sapp and Emplaincourt, 1975).

1969-2008) are 22,600 ft^3/s on March 20, 1970 (25,500 ft^3/s peak instantaneous discharge) and several days of near zero flow–0.1 ft^3/s–on September 5-15, 1954. The distribution of average daily flows per month for the period of record reveals that September has on average the lowest flows and February the highest.

Created in 1970 (gates closed June 1969 with spillover in March 1970), Lake Tuscaloosa is one of the largest water supply reservoirs in Alabama with a surface area of 5,885 acres and a shoreline of 177 miles (Parker, 1962). Impounded waters extend upstream for about 28 miles from the dam. Maximum depth of the reservoir is 110 feet at the dam and the useable storage volume in the reservoir is 40 billion gallons yielding a safe maximum withdrawal rate of 200 mgd (million gallons per day).

Based on the Samantha gage, Slack (1987) reported that about 59 percent of the total flow entering the lake during wet years is from the North River above Lake Tuscaloosa, 13 percent from Binion Creek, 6 percent was from Cripple Creek, 4 percent from Carroll Creek, 3 percent from Turkey Creek, 2 percent from Dry Creek, and about 13 percent from smaller ungaged tributaries (fig 2). During dry years, about 59 percent of the total flow comes from the North River above Lake Tuscaloosa, 20 percent from Binion Creek, 3 percent from Cripple Creek, 3 percent from Carroll Creek, 2 percent from Turkey Creek, 2 percent from Dry Creek, and about 11 percent from smaller ungaged tributaries.

Unlike many other areas of the state that have suffered from insufficient water supplies during the recent droughts of 2000 and 2007, or are likely to do so in the near future, Tuscaloosa and the surrounding areas should enjoy a reliable, excellent water supply source from Lake Tuscaloosa. Sustained economic growth requires adequate infrastructure, and water supply is one of the critical infrastructure components. Lake Tuscaloosa fills this infrastructure role in the region and is an instrumental resource to the growing economy of West Alabama.

Another small water supply impoundment is located in the North River watershed. Bays Lake is a small water supply and recreational impoundment on Clear Creek about 4.5 miles northwest of Berry in Fayette County. The town of Berry has recently constructed a new water treatment plant for this water source and a new

lagoon treatment system for the town's domestic wastewater. Bays Lake is significant because it marks the upstream limit of critical mussel habitat for the North River and it influences the stream flow and water quality of Clear Creek downstream of the dam.

METHODS

SEDIMENTATION RISK INDEX

Sedimentation risk at stream crossings are evaluated using the sedimentation risk index (SRI) methodology developed by Witmer and others (2009). The SRI is an index calculated from 12 unique measurements (metrics) that consider the condition of the stream channel upstream and downstream of the crossing structure, condition of the crossing structure, potential volume of road sediment that may become available for transport to the stream, and the condition of ditches and outlets draining the road and entering the stream near the crossing structure (table 1). A field worksheet (table 2) is used to score a stream's SRI on-site using the metrics identified by Witmer and others (2009).

Each metric is scored either 1 (poor condition), 3 (fair condition), or 5 (good condition) based on a specified set of criteria for each metric (tab. 1). The 12 metric scores are then added together to yield the SRI. Sites with SRI scores from 46 to 60 are at low risk for sedimentation, from 37 to 45 at moderate risk, and from 12 to 36 are at high risk for sedimentation. Although Witmer and others (2009) created the SRI tool for unpaved roads, we have applied it universally to paved roads as well to capture stream crossing and ditch/outlet features that may be contributing sediment to the receiving stream. A standard set of digital photos are taken at each crossing to visually document stream and crossing conditions at the time of evaluation.

WATERWAY METRICS

The upstream and downstream channel morphology (metrics 1 and 2) are characterized using the Rosgen Level I stream classification (Rosgen, 1996) to classify channels visually as either stable or not stable. Stream classes A, B, C, and E are

Table 1. Sedimentation Risk Index (SRI) metrics.

SRI evaluation categories	SRI metric
Waterway condition	1. Upstream (u/s) channel morphology
	2. Downstream (d/s) channel morphology
	3. Downstream channel/bank alteration
Crossing structure condition	4. Upstream culvert skew angle
	5. Crossing fill condition
	6. Crossing inlet/outlet condition
Road approaches I	7. Potential eroded volume of sediment from the road surface
	8. Soil type and erodibility
	9. Road approach slope
	10. Road approach surface material
Road approaches II	11. Condition of the four drainage ditch outlets to streams
	12. Condition of the four ditches draining to streams

Table 2. Road-stream crossing SRI field work sheet.

Date: Time: Start End	PHOTOS	1	Upstream channel from crossing
Field ID: (SHU#,yymmdd,1,seq.no.) ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___		2	Downstream channel from crossing
Watershed/Drainage:		3	Right road approach from crossing
Location: Upland=1 Lowland=2		4	Left road approach from crossing
Surveyor(s):		5	Crossing structure from upstream
State: County: Owner of GPS, camera:		6	Crossing structure from downstream
Latitude (DD): Note taker:		7	Right road approach from 150 ft
Longitude(DD):		8	Left road approach from 150 ft

WATERWAY	**5**	**3**	**1**	**Score**
Upstream channel morphology	A B C E Wetland	DA Beaver dam	D F G Ponded	
Downstream channel morphology	A B C E Wetland	DA Beaver dam	D F G Ponded	
Downstream channel/bank alteration	Natural	Minor or Partial	High	
Comments:			**TOTAL:**	

CROSSING STRUCTURE	**Crossing type**: Culvert Bridge Ford	**Number of culverts:**
Culvert type: Round Pipe elliptical Open arch Box Trough box Open box Other:		
Structure materials:	Metal (corrugated) PVC Synthetic Reinforced concrete Wood Native soil Clay Rock Other:	
Dimensions: Length/Span (ft):	Diameter/Width (ft):	Culvert outfall drop (ft):

	5	**3**	**1**	**Score**
Upstream culvert skew angle (worst):	< 5º	5º to 30º	> 30º	
Crossing fill condition (dominant)	Good Vegetated	Fair Riprap	Poor Bare soil	
Crossing inlet/outlet condition:	No impairment	Sediment islands Scouring	Blocked	
Comments:			**TOTAL:**	

ROAD APPROACHES I — **Right = right road approach when facing downstream**

Dimensions (right): Length (mi): Width (ft): Road prism fill (in): Slope (%):

Potential eroded volume (right): Length x Width x Road prism fill x 16.3 = c.y.

Dimensions (left): Length (mi): Width (ft): Road prism fill (in): Slope (%):

Potential eroded volume (left): Length x Width x Road prism fill x 16.3 = c.y.

	5		**3**		**1**		
	Upland	Lowland	Upland	Lowland	Upland	Lowland	
Potential eroded volume (mean)	< 15 c. y.	< 21 c.y.	16-30 c.y.	21-40 c.y.	> 30 c.y.	> 40 c.y.	
Soil type: K-factor:	≤ .15	≤ 0.20	0.16-0.30	0.21-0.40	> .30	> 0.40	
Road approach slope (mean %)	≤ 1.5 %	≤ 2.0 %	1.6-3.0 %	2.1-4.0 %	> 3.0%	> 4.0 %	
Road approach surface material	All Aggregate or 1 APR: Aggregate 1 APR: Sand/Clay		All Sand/Clay or 1 APR: Aggregate 1 APR: Native Soil		All Native Soil or 1 APR: Native Soil 1 APR: Sand/Clay		

Slope calculation

Right (º)	Left (º)
1._____	1._____
2._____	2._____
3._____	3._____
4._____	4._____
5._____	5._____
Avg. _____	Avg. _____

Present weather		Past 24 hrs	
Heavy rain	□	Heavy rain	□
Steady rain	□	Steady rain	□
Scat. Showers	□	Scat. Showers	□
Clear/sunny	□	Clear/sunny	□
% Cloud cover			

NOTES

If use metric units, please specify

Table 2. Road-stream crossing SRI field work sheet.

ROAD APPROACHES II									
DOWNSTREAM									
Left outlet	Vegetated	Riprap	Synthetic	+1	**Left ditch**	Vegetated	Riprap	Synthetic	+1
(pick one):	Bare soil	Concrete	Other:	+0	**(pick one):**	Bare soil	Concrete	Other:	+0
Right outlet	Vegetated	Riprap	Synthetic	+1	**Right ditch**	Vegetated	Riprap	Synthetic	+1
(pick one):	Bare soil	Concrete	Other:	+0	**(pick one):**	Bare soil	Concrete	Other:	+0
UPSTREAM									
Left outlet	Vegetated	Riprap	Synthetic	+1	**Left ditch**	Vegetated	Riprap	Synthetic	+1
(pick one):	Bare soil	Concrete	Other:	+0	**(pick one):**	Bare soil	Concrete	Other:	+0
Right outlet	Vegetated	Riprap	Synthetic	+1	**Right ditch**	Vegetated	Riprap	Synthetic	+1
(pick one):	Bare soil	Concrete	Other:	+0	**(pick one):**	Bare soil	Concrete	Other:	+0
			SUM:					**SUM:**	
			If SUM = 4,2, or 0, then add	+1				**If SUM = 4,2, or 0, then add**	+1
			If SUM = 1, then add	+2				**If SUM = 1, then add**	+2
			If SUM = 3, then add	+0				**If SUM = 3, then add**	+0
			TOTAL:					**TOTAL:**	

SEDIMENTATION RISK INDEX (SRI)				**TOTAL SRI SCORE:**
Narrative risk rank:	**Low risk**	**Moderate risk**	**High risk**	
SRI score:	**46 - 60**	**37 - 45**	**12 - 36**	

NOTES

	SHU #	YearMonthDate	1=RoadCrossingForm	Daily site #
Field ID: (SHU#,yymmdd,1,seq.no.) Example	08	120806	1	03

If use metric units, please specify

considered indicative of stable channels (score 5) not severely impacted by road crossings. Waterways that are dammed by beavers or a class DA are moderately stable and scored 3, while waterways that are ponded or have unstable channels (classes D, F, or G) are scored 1. Downstream channel/bank alteration (metric 3) is scored 5 if little evidence of bank erosion or channel alteration is present, 3 if only minor or partial alterations are evident, and 1 if stream channels are highly modified. Altered channels can be highly incised and lack significant vegetative cover.

CROSSING STRUCTURE METRICS

Upstream culvert skew angle (metric 4) is a measurement of the degree of misalignment between the crossing span and the direction of flow in the culvert. Improperly aligned culverts contribute to scour and erosion around the structure. Culverts offset at an angle >30° were scored 1, angles between 5° and 30° were scored 3, and angles <5° were scored 5. If no culverts are present, this metric is scored 5. Condition of the crossing fill (metric 5) characterizes the fill material that supports and surrounds the crossing structure. For culverts, the fill material encompasses most of the crossing, while for bridges and box culverts the fill encompasses primarily wing walls and abutments. Good fill conditions (score 5) show little to no erosion, are well vegetated, or contain well maintained riprap. Fill conditions showing signs of erosion, poorly maintained riprap, and incomplete vegetation are scored 3, while fill that is bare soil with no vegetation, has significant erosion taking place, or undercutting of the structure are scored 1. The crossing inlet/outlet condition (metric 6) evaluates impacts to the crossing structure in the immediate reach both up and downstream of the structure. If the inlet/outlet is blocked 80 percent or greater due to crushing or accumulated debris, this metric is scored 1. Inlet/outlets with sediment islands or structure-induced scouring are scored 3, while structures with little flow reduction or blockage are scored 5.

ROAD APPROACHES I METRICS - POTENTIAL ROAD SEDIMENT

Potential eroded volume of sediment from the road surface (metric 7) is an estimate of the road prism that may be transported during a rain event. The basic formula for calculation of one approach is as follows:

(Length of approach to topographic divide) x (road width x prism depth) x 16.3 = cubic yards of sediment

This calculation is performed for each approach and is scored 1 if the average volume is >40 c.y.(cubic yards), scored 3 if the volume is 21 - 40 c.y., and scored 5 if the volume is ≤ 20 c.y. These criteria were derived for the Coastal Plain region of south Alabama and may need to be recalibrated for roads in the Cumberland Plateau and other northern regions of the state.

Soil type (metric 8) is a measure of the soil erodability (K factor) on the road approaches and is determined using the Natural Resources Conservation Survey (NRCS) soil survey. Soil types with a K factor ≤ 0.20 are scored 5, 0.21 - 0.40 are scored 3, and <0.40 are scored 1. The road approach slope (metric 9) is the mean slope of both road approaches. Steep slopes (>4%) have a greater potential for erosion and are scored 1, moderate slopes 2.1% - 4.0% are scored 3, and shallow slopes ≤ 2.0% are scored 5. The road surface material (metric 10) is identified for each approach. Roads composed of native soils receive a score of 1, roads with all sand or clay, or mixed with aggregate and native soils receive a score of 3, and roads that are all aggregate or aggregate mixed with sand and clay or paved receive a score of 5.

ROAD APPROACHES II METRICS - OUTLETS AND DITCHES

The condition of the ditches paralleling road approaches and the outlets of these ditches to the stream are important sources and conduits of sediment to streams. Each outlet (metric 11) is scored either 1 (vegetated, riprap, or synthetic cover) or 0 (bare soil, concrete, or other poor covering material). The four outlets are added together and if the total equals 4, 2, or 0, then 1 point is added to the total; if the total equals 1, then 2 points are added; if the total is 3, then no points are added. This procedure results in

scores of 5 (good condition), 3 (moderate), or 1 (poor condition). The procedure for ditches (metric 12) is identical as for outlets and scored in the same manner.

HABITAT THREAT SEVERITY INDEX

The habitat threat severity index is a method for evaluating site specific habitat quality that considers 11 habitat metrics associated with general stream conditions, riparian cover, bank erosion potential, and fish passage barriers. These metrics are listed below:

1. Water odors
2. Channel stability
3. Channel alteration
4. Shoring structures
5. Fish passage barriers
6. Riparian buffer width
7. Local nonpoint source pollution
8. Flood plain access
9. Bank erosion
10. Pipe discharges
11. Bank erosion hazard index (BEHI)

The 11 metrics or “risk factors” are each assigned a severity score based on observed and measured habitat characteristics at a site (table 3) (Herrington and others, 2010). The index is calculated by scoring the metrics on a scale ranging from 0 (excellent) to 1.5 (poor). The sum of metric scores ranges from 0 to 16.5, with risk categories assigned as follows: Low Risk from 0 to 4.00, Moderate Risk from 4.25 to 7.25, and High Risk from 7.50 to 16.50. Part of this assessment involves measurement of stream geomorphic channel features including bankfull width, bankfull depth, flood prone width, bank height, bank angle, instream cover, water clarity, and substrate composition (fig. 4). Bankfull refers to the water surface elevation that occurs during a flood with a hydrologic return interval of approximately 1.5 years.

Metric 1, water odors, is a qualitative assessment of any discharges or unusual water quality conditions that may be present at a site. It is scored 0 for normal odors and 1.5 if the water has any other type of odor (sewage, petroleum, chemicals, anaerobic). Metric 2, channel stability, indicates if the stream channel is incising (bank

Table 3. Habitat threat severity work sheet.

Date:	Time: Start End	State: County:	
Field ID: (SHU#,yymmdd,1,seq.no.) ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___		**Present weather**	**Past 24 hrs**
Watershed/Drainage:		Heavy rain □	Heavy rain □
Location:	Upland=1 Lowland=2	Steady rain □	Steady rain □
Surveyor(s):		Scat. Showers □	Scat. Showers □
Latitude (DD):	Owner of GPS,camera:	Clear/sunny □	Clear/sunny □
Longitude (DD):	Note taker:	% Cloud cover	

Instream Features (Quantitative)

Bankfull Width: _____ ft	**Depths for W/D Ratio**	**Water Temp:** _____ °C	
Bankfull Depth at thalweg: _____ ft	1.	**Dissolved Oxygen:**	**Water Surface Oils**
	2.	_____ mg/L	None □
Flood Prone Width (2 x Bkf Depth) _____ ft	3.	_____ % saturation	Slight □
Bank Height: _____ ft	4.	**Conductivity:**	Profuse □
% Macrophyte Cover: _____	5.	**pH:**	Other □
% Canopy Cover: _____	avg.		
Surface Velocity (ft/sec at thalweg):			
0-0.5 □ 0.5-1.0 □ >1.0 □	**Bank Angle (°)**		
Wetted Width: _____ ft			
Water Depth (at thalweg): _____ ft			
Reach Length: ft			

Water Quality

1. Water Odors	**Water Clarity**
□ **0** Normal	□ Clear
□ **1.5** Sewage	□ Slightly turbid
□ **1.5** Petroleum	□ Turbid
□ **1.5** Chemical	□ Opaque
□ **1.5** Anaerobic	
□ **1.5** Other	
Describe:	

Instream Features (Qualitative)

2. Channel Stability (Entrenchment Ratio-ER = Flood prone width/Bankfull width _____)
Highly entrenched (ER= 1.0-1.4) Moderately entrenched (ER= 1.41-2.2) Slightly entrenched (ER>=2.2)

Check one box	Deposition/Aggradation	Incision/Degradation
Excellent - 0	Large, fresh deposits ***absent;*** Some localized deposition along top of low bank; High number of deep pools □	***No*** significant erosion of banks or mass wasting; Channel slightly entrenched; High number of deep pools □
Good - 0.5	Large, fresh deposits ***uncommon*** ; Some localized deposition along top of low bank Moderate number of deep pools □	***Some*** bank erosion apparent, ***no*** mass wasting; Channel slightly to moderately entrenched; Moderate number of deep pools □
Fair - 1	Large, fresh deposits ***common*** ; Some localized deposition along top of low bank; Low-moderate number of deep pools □	***Active*** bank erosion, ***potential*** mass-wasting; Channel moderately to highly entrenched; Low-moderate number of deep pools □
Poor - 1.5	Large, fresh deposits ***very common*** in channel; Moderately heavy sand deposition along over bank area; Few, if any, deep pools □	***Active*** bank erosion, ***frequent*** mass-wasting; Channel moderately to highly entrenched; Few, if any, deep pools □

Upland (1): Instream cover

□	Poor	<10% mix of boulder, cobble, gravel; lack of habitat obvious
□	Marginal	10-30% mix of boulder, cobble, gravel; habitat availability less than desirable
□	Suboptimal	30-50% mix of boulder, cobble, gravel; adequate habitat
□	Optimal	>50% mix of boulder, cobble, submerged logs, undercut banks

Lowland (2): Stream Channel Woody Material

□	None	Minor amounts of small, floatable woody material
□	Infrequent	Woody material consists of small, easily moved, floatable material (leaves, needles, twigs, small limbs)
□	Moderate	Small-medium sized woody material that affect 10% or less of active channel cross section
□	Numerous	Build up of medium-large sized materials that occupy 10-30% of the active channel cross section
□	Extensive	Woody material "dams" of predominantly large size occupying 30-50% of active channel cross section
□	Dominating	Large, somewhat continuous woody material "dams" occupying > 50% of active channel cross-section

Impoundments (check all that apply)	**Substrate composition (%-sum to 100)**	
□ None	_____ Silt	_____ Cobble
□ Beaver dams, few (normal streamflow between dams)	_____ Clay	_____ Boulder
□ Beaver dams, frequent (backwater conditions between dams)	_____ Clay-Marl	_____ Bedrock
□ Woody material jams	_____ Sand	_____ CPOM
□ Manmade impoundments (Describe)	_____ Gravel	

3. Channel Alteration	**4. Shoring Structures**	**Flow Regime**
□ **0** No artificial channelization or dredging	□ **0** None □ **1.5** Limerock	□ Perennial
□ **1.5** Old channelization (>20 yrs), mostly recovered	□ **1.5** Riprap □ **1.5** Other	□ Ephemeral/Intermittent
□ **1.5** Channelized, in recovery, habitat still degraded	□ **1.5** Gabion	□ Subterranean
□ **1.5** Recent channelization, no recovery, poor habitat	□ **1.5** Concrete **Extent:**	

Notes

If using metric units, please specify

Table 3. Habitat threat severity work sheet.

5. Fish Passage Blocked

	Yes	No
At time of survey?	□	□
At lower stage?	□	□

Any, yes=1.5 **Both, no=0**

Reason:

Pipe culvert □
Box culvert □
Ford □
Dam □

Culvert Description

How many?
blocked?
Downstream drop-off? □ Yes □ No
Distance: ft

Fish Presence

□ Absent
□ Rare
□ Common
□ Abundant

Riparian Features (Quantitative)

6. Buffer width:

	Right	Left
0-29 ft	□ **0.75**	□ **0.75**
30-49 ft	□ **0.50**	□ **0.50**
50-99 ft	□ **0.25**	□ **0.25**
>=100 ft	□ **0**	□ **0**

Rt Floodplain width:

_____ ft

Lt Floodplain width:

_____ ft

Landuse Characterization (%)

(100% each bank)	Rt Bk	Lt Bk
Natural Forest		
Silviculture		
Pasture		
Agricultural		
Residential		
Commercial		
Industrial		
Transportation		
Other (Specify)		

Riparian Features (Qualitative)

7. Local NPSP Potential

□ **0** No evidence
□ **0.5** Slight
□ **1.0** Moderate potential
□ **1.5** Obvious sources
Describe:

8. Floodplain Access

	Rt	Lt
None	□ **0.75**	□ **0.75**
Partial	□ **0.25**	□ **0.25**
Full	□ **0**	□ **0**

Livestock
□ Yes
□ No

Stream Access
□ Yes
□ No

9. Bank Erosion

□ **0** Non-eroding
□ **0.5** Historic/Natural
□ **1.0** Active Erosion
□ **1.5** Mass-wasting

Other Site Features

10. Pipe Discharge
Yes=1.5, No=0

		US	DS
None	□		
Rt		□	□
Lt		□	□

Describe:

Trash Debris
□ Present
□ Not Present
Describe:

Embeddedness

Vertical Stability

Lateral Stability

11. Bank Erosion Hazard Index (BEHI)

Lowest Bank Height:

_____ ft

Bankfull Height:

(Bkf Depth at thalweg):

_____ ft

Bank/Bankfull Height: Score ____

Bank Root Density (%): Score ____

Bank Angle (º): Score ____

Total BEHI Score _____

BEHI score	Risk rating	Severity score
3 - 5.7	Very low	**0**
6 - 11.7	Low	**0**
12 - 17.7	Moderate	**0.5**
18 - 23.7	High	**1.0**
24 - 27	Very high	**1.5**
28 - 30	Extreme	**1.5**

Habitat Threat Severity Index

Severity scores

1. Water odors _____
2. Channel stability _____
3. Channel alteration _____
4. Shoring structures _____
5. Fish passage barriers _____
6. Riparian buffer width
(add both banks) _____
7. Local nonpoint pollution _____
8. Floodplain access
(add both banks) _____
9. Bank erosion _____
10. Pipe discharges _____
11. BEHI _____

Total score _____

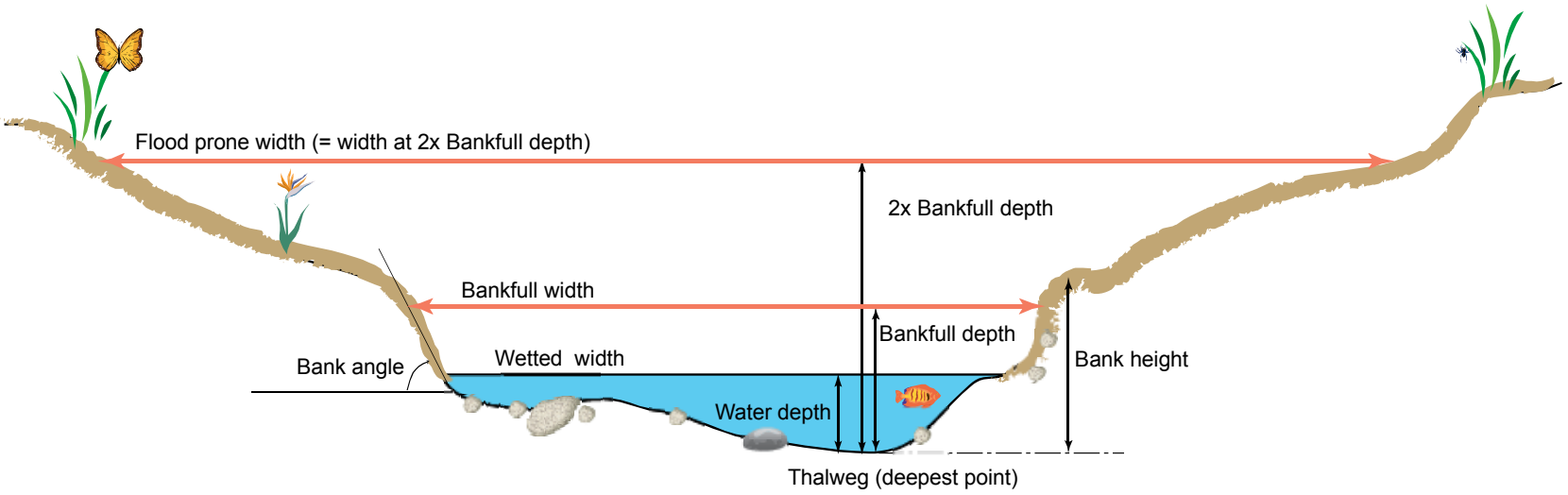
□	Low severity risk	0 - 4.00
□	Moderate severity risk	4.25 - 7.25
□	High severity risk	7.50 - 16.50

Photos

Notes

	SHU #	YearMonthDate	2=HabitatForm	Daily site #
Field ID: (SHU#,yymmdd,1,seq.no.) Example	08	120806	2	03

If using metric units, please specify



(Bankfull refers to the water surface elevation that occurs during a flood with a hydrologic return interval of approximately 1.5 years)

Figure 4. Stream cross section illustrating standard channel morphology measurements.

erosion) or aggrading (depositing sediments). Metric 3, channel alteration, is scored either 0 for no channelization/dredging, to 1.5 for old, recovering, or new channelizations. Metric 4, shoring structures, evaluates the presence of hardened structures along shorelines. This metric is scored 0 if no structures are present and 1.5 if the shorelines are armored with riprap, gabion, lime rock, or concrete. Metric 5, fish passage blockages, evaluates if fish passage is blocked by perched culverts, fords, dams, or beaver dams. Any incidences of blockage at normal or low flows is scored 1.5, and unblocked stream sites score 0. Metric 6, riparian buffer width, refers to the width of each riparian zone (left and right), with narrower zones receiving progressively higher scores. The right and left zones are scored independently then added together for the metric score. Scores for this metric are as follows: 0 - 29 feet buffer (0.75), 30 – 49 feet (0.50), 50 - 99 feet (0.25), and ≥ 100 feet (0).

Metric 7, local nonpoint source (NPS) pollution potential, is a qualitative determination that is scored 0 if no evidence of NPS is present, 0.5 for slight evidence, 1.0 for moderate potential, and 1.5 for obvious NPS pollution. Metric 8, flood plain access, scores the ability of a stream to gain access to the flood plain during flood events. Flood plain access is important for removing sediment from the channel during flood events and to refurbish/restore flood plain habitat. Left and right flood plains are scored separately and then combined for the metric score. Channels with blocked upper banks with no flood plain access score 0.75, channels partially blocked score 0.25, and channels with full access to the flood plain score 0. Metric 9, bank erosion, is an estimate of the severity of bank erosion activity in the reach. It scores 0 if the bank is non-eroding, 0.5 if historic or natural erosion is visible, 1.0 if active erosion is observed, and 1.5 if banks are mass wasting into the stream channel. Metric 10, pipe discharge, evaluates the presence of any pipes actively discharging to the stream. This metric is scored 0 if no pipes are present in the reach and 1.5 if pipes are present.

Metric 11 is the bank erosion hazard index (BEHI) modified from Rosgen (1996). Only three of the original five BEHI measures are incorporated into this metric: bank/bankfull height ratio, bank root density, and bank angle (table 4). Table 4 is a

Table 4. Modified BEHI metric scoring table

BEHI metric

Bank ht.÷ Bankfull ht.	1.00	1.03	1.05	1.08	1.10	1.11	1.13	1.15	1.17	1.19	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.30	2.50	2.80	>2.8
BEHI score	1.0	1.2	1.4	1.7	1.9	2.0	2.5	3.0	3.4	3.9	4.0	4.6	5.3	5.9	6.0	6.5	6.9	7.4	7.9	8.0	8.3	8.7	9.0	10.0
Severity risk category	Very Low					Low					Moderate				High					Very High				Ex

Root density (%)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	<5
BEHI score	1.0	1.2	1.4	1.6	1.9	2.3	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.5	5.9	6.5	7.2	7.9	8.4	9.0	10.0
Severity risk category	Very Low					Low					Moderate					High			Very High		Ex

Bank angle (°)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	>120
BEHI score	1.0	1.2	1.4	1.6	1.9	2.2	2.4	2.6	2.8	3.1	3.3	3.6	3.9	4.4	4.9	5.4	5.9	6.8	7.9	8.1	8.3	8.5	8.7	8.9	9.0	10.0
Severity risk category	Very Low					Low								Moderate				High		Very High						Ex

conversion table for these bank measures to BEHI scores. The three BEHI metric scores are summed to yield a total BEHI score which is converted to a habitat threat severity score as follows: 3 - 11.7 (0), 12 - 17.7 (0.5), 18 - 23.7 (1.0), and >23.7 (1.5).

RESULTS AND DISCUSSION

SEDIMENTATION RISK INDEX

Sedimentation risk index (SRI) evaluations were conducted from March to October 2012. The surveys were prioritized in the northern and western regions of the watershed where a significant number of unpaved road crossings are located. A total of 135 stream crossing structures (appendix A, fig. 5) were evaluated in 2012, with 73 evaluations of paved road crossings (fig. 6) and 62 evaluations of unpaved road crossings (fig. 7). More evaluations were made in Fayette County (36 paved, 46 unpaved) compared to Tuscaloosa County (37 paved, 16 unpaved) (fig. 8).

Considering all 135 evaluations, 35 sites (25.9 percent) were at high risk for sedimentation, 49 sites (36.3 percent) at moderate risk, and 51 sites (37.8 percent) at low risk (appendix B, fig. 8). Fayette County had 32 sites at high risk while Tuscaloosa County only had three sites at high risk.

Unpaved roads generally presented a higher risk of instream sedimentation effects compared to paved roads (figs. 9, 10). The unpaved road prism was generally composed predominantly of native aggregate (gravel) mixed with some sand, which in most instances was a stable paving material with less tendency to migrate into streams (compared to roads and crossings dominated by a sand or sandy loam prism). Sedimentation issues identified for unpaved roads were related to the engineered ditches and their outlets to the stream and the poor condition of the bridge fill material. Crossing fill material that was not properly stabilized was a significant source of sediment at several sites, bare soil and(or) unprotected ditches were also sources of sediment in addition to that eroded from poorly constructed/bare soil ditch outlets.

Paved crossings also had sedimentation issues. For the eight paved sites that scored high risk for sedimentation, bridge fill condition and condition of the inlet/outlet

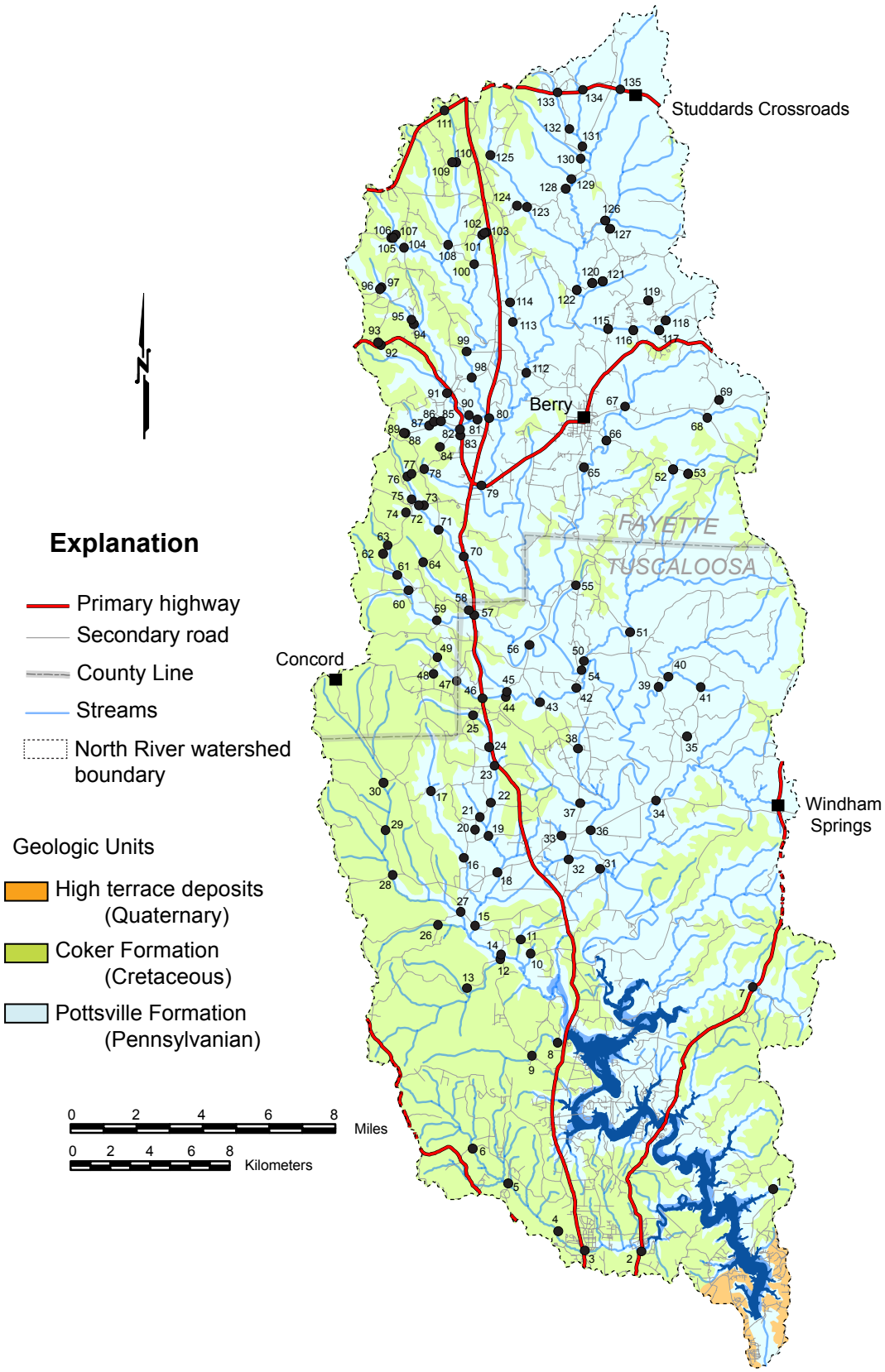


Figure 5. Stream crossing evaluation sites in the North River watershed.

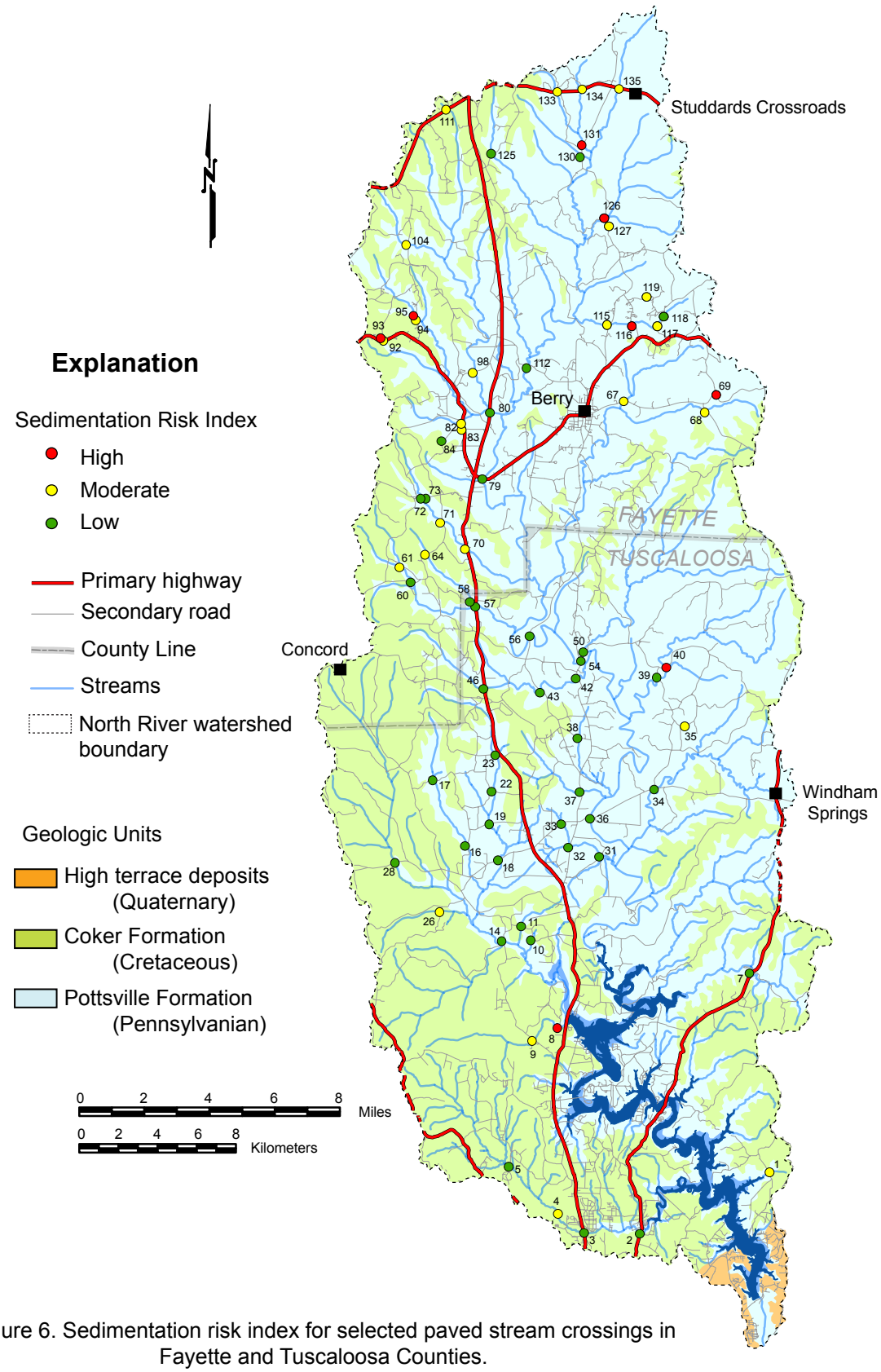


Figure 6. Sedimentation risk index for selected paved stream crossings in Fayette and Tuscaloosa Counties.

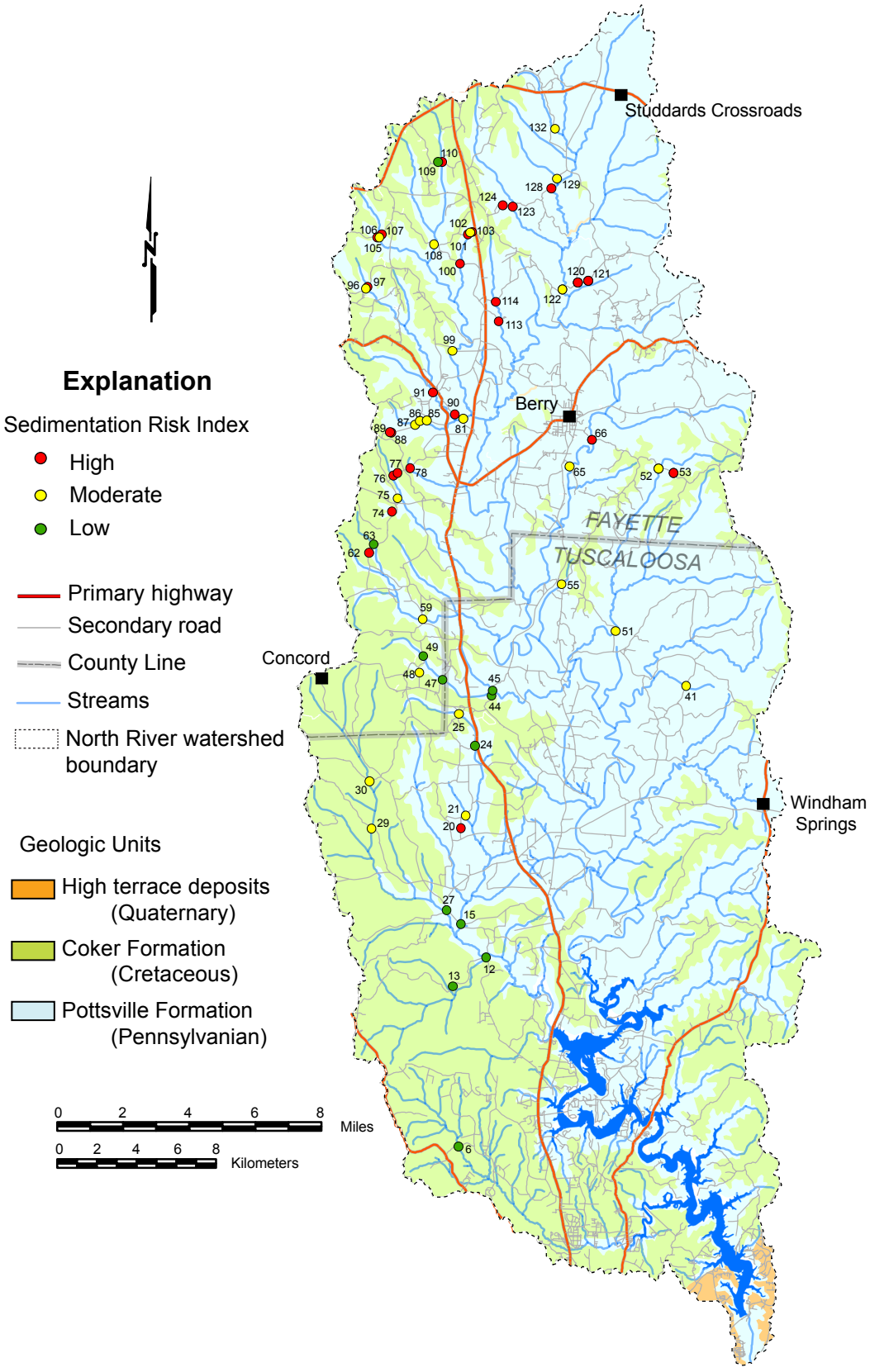
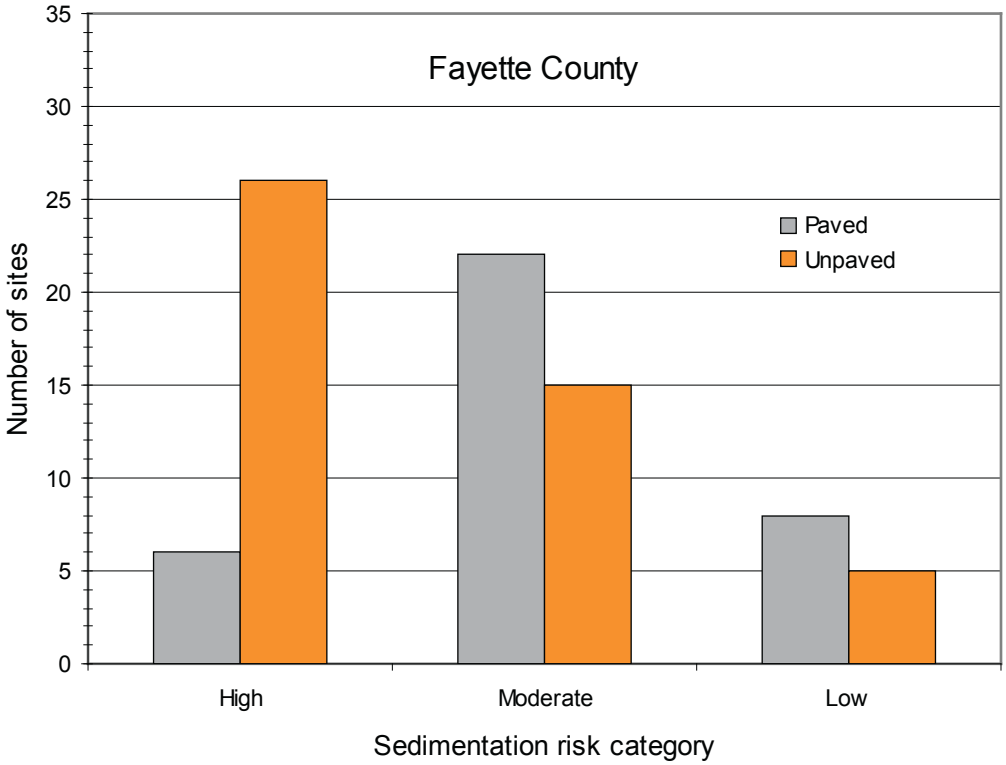


Figure 7. Sedimentation risk index for selected unpaved stream crossings in Fayette and Tuscaloosa Counties.



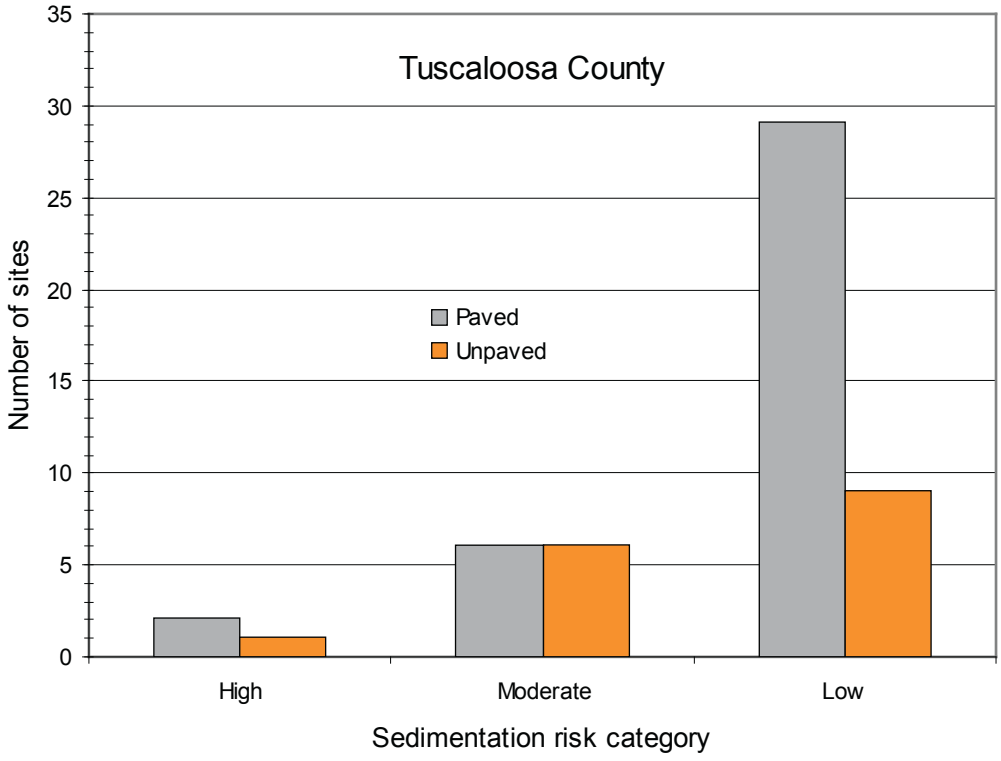


Figure 8. Distribution of road crossing type with respect to the sedimentation risk index for selected roads in Fayette and Tuscaloosa Counties.

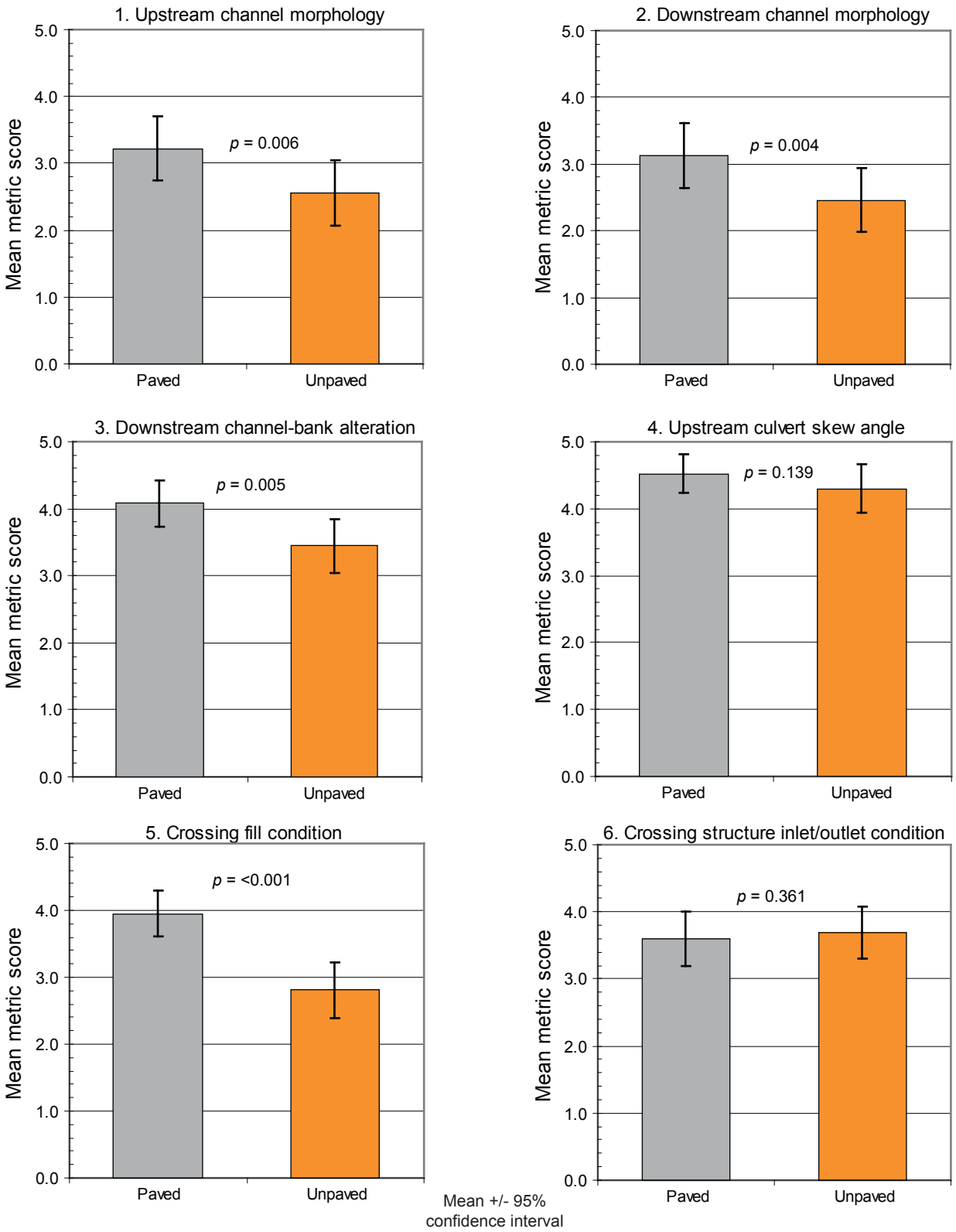


Figure 9. Comparison of metric scores between paved and unpaved roads for metrics 1-6 of the sedimentation risk index.

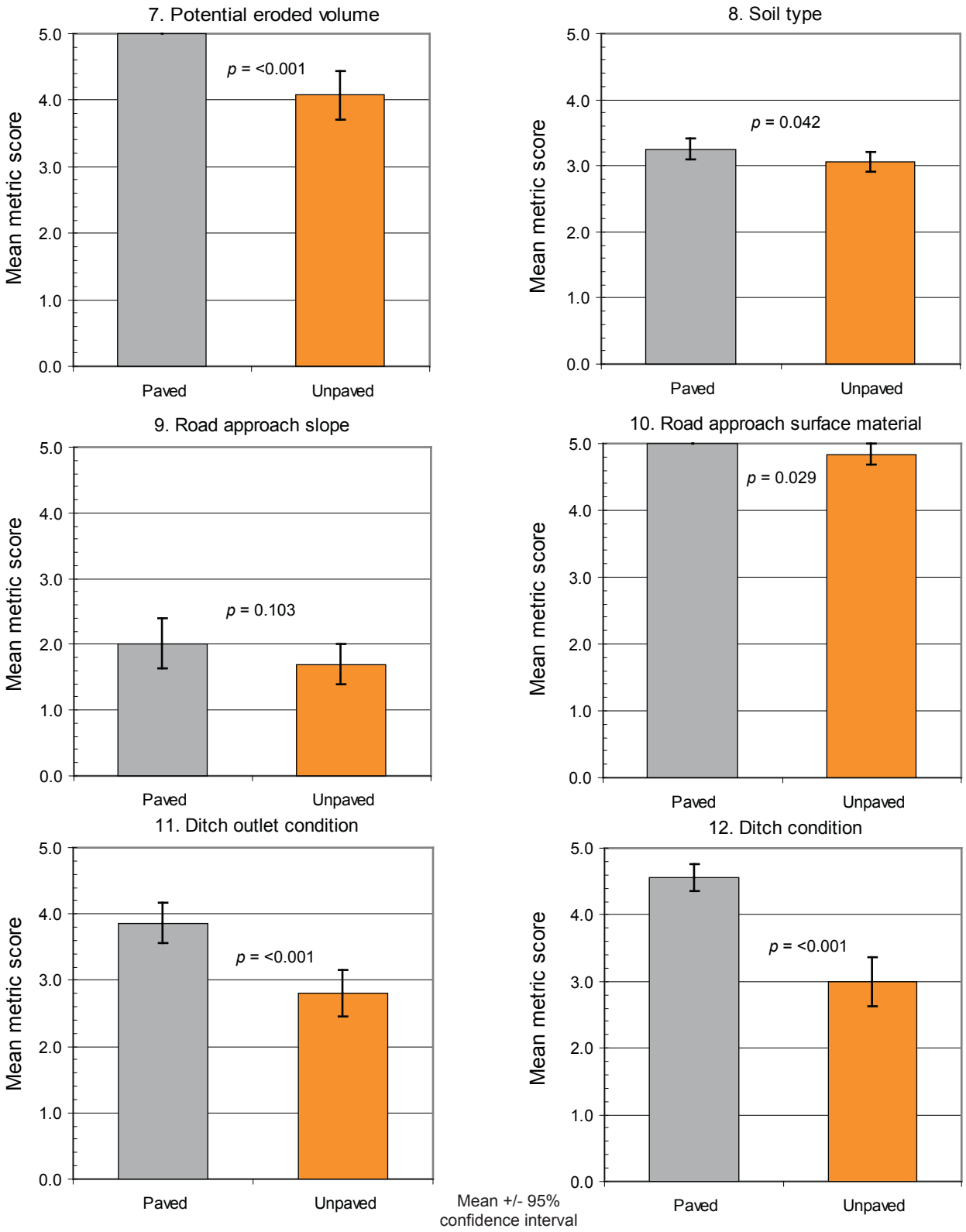


Figure 10. Comparison of metric scores between paved and unpaved roads for metrics 7-12 of the sedimentation risk index.

structure generally scored poorly, as well as upstream and downstream channel morphology and alteration of the downstream channel and banks.

The issues and recommended improvements identified during this investigation are presented for each site in appendix C and summarized in figure 11. The most frequently recommended improvement (44 sites) is the installation of small retention basins in ditches near the outlets to trap sediment before it drains into the stream. These basins can be constructed of riprap, or other rubble-sized material, or can simply be a constructed depression deep enough to capture the heavier sediment particles. The most frequently observed issue at the 27 SRI sites was fish migration barriers. Movements of fishes up and downstream can be restricted by culverts that are perched above the water surface during low flow times of the year and by culvert openings that are blocked by debris and snags.

Stream crossing and ditch upgrades are needed at 20 sites represented by crushed corrugated pipe ends, improperly sized pipes, pipes set at extreme angles causing sedimentation, eroding bridge fill material, bare soil ditches, and bare soil outlets. Six sites needed restoration of riparian vegetation up and(or) downstream of the crossing. Five state/county highway right-of-ways needed additional erosion control and better vegetative cover. Three sites had substantial bank damage from domestic animals. Twenty-six sites had multiple issues related to sedimentation risk, and four sites had other issues including filling of a lake, the bridge structure causing geomorphic changes to the downstream channel, and unstable banks on road approaches (appendix C).

HABITAT THREAT SEVERITY INDEX

Twenty sites were evaluated for habitat threat severity in Clear and Deadwater Creeks (table 5, fig. 12, appendix B) in the upper reaches of the North River. Eleven of these sites ranked as low risk, eight as moderate risk, and one site ranked as high risk (table 6). The high risk site was located just downstream of the Bays Lake dam and was impaired for several reasons: fish passage blocked, presence of shoring structures along banks, and eroded banks due to the effects of flood waters over the spillway

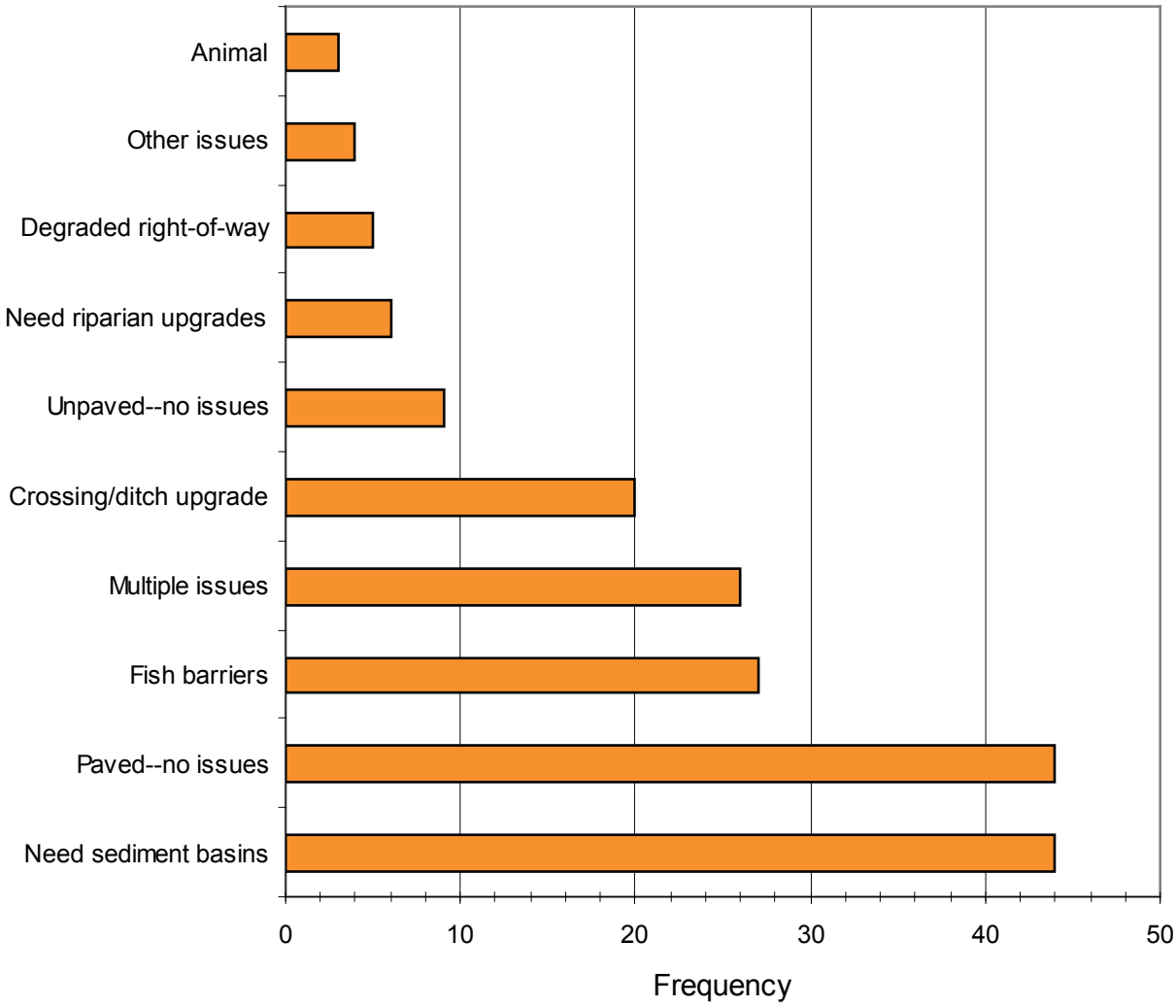


Figure 11. Habitat and sedimentation risk issues and recommended improvements for selected stream crossings in Fayette and Tuscaloosa Counties.

Table 5. Habitat threat severity sites in Clear and Deadwater Creeks.

Site No.	Site name [1]	Field Code	SHU code	County	Latitude	Longitude	Date	Time
1	Clear Creek 200 yds d/s of Ala. Hwy. 13 bridge	MWP120307-01	21120307201	Fayette	33.6604	87.6490	7-Mar-12	0830
2	Clear Creek u/s Ala. Hwy. 13 at Deadwater Cr. mouth	MWP120307-02	21120307202	Fayette	33.6618	87.6525	7-Mar-12	0925
3	Clear Creek at old RR crossing	MWP120307-03	21120307203	Fayette	33.6632	87.6527	7-Mar-12	1000
4	Clear Creek d/s of Co. Hwy. 93 (site 5)	CCJ120313-05	21120313205	Fayette	33.6639	87.6537	13-Mar-12	1210
5	Clear Creek d/s of Co. Hwy. 93 (site 4)	CCJ120313-04	21120313204	Fayette	33.6724	87.6562	13-Mar-12	1115
6	Clear Creek d/s of Co. Hwy. 93 (site 3)	CCJ120313-03	21120313203	Fayette	33.6751	87.6589	13-Mar-12	1025
7	Clear Creek d/s of Co. Hwy. 93 (site 2)	CCJ120313-02	21120313202	Fayette	33.6767	87.6588	13-Mar-12	0955
8	Clear Creek d/s of Co. Hwy. 93 (site 1)	CCJ120313-01	21120313201	Fayette	33.6776	87.6596	13-Mar-12	0920
9	Clear Creek d/s Lowery Road near gage (site 4)	EAW120314-04	21120314204	Fayette	33.6792	87.6599	14-Mar-12	1100
10	Clear Creek d/s Lowery Road (site 3)	EAW120314-03	21120314203	Fayette	33.6829	87.6603	14-Mar-12	1015
11	Clear Creek d/s Lowery Road (site 2)	EAW120314-02	21120314202	Fayette	33.6866	87.6644	14-Mar-12	0935
12	Clear Creek d/s Lowery Road (site 1)	EAW120314-01	21120314201	Fayette	33.6889	87.6642	14-Mar-12	0900
13	Clear Creek d/s of Bays Lake (site 3)	CCJ120313-08	21120313208	Fayette	33.6908	87.6614	13-Mar-12	1445
14	Clear Creek d/s of Bays Lake (site 2)	CCJ120313-07	21120313207	Fayette	33.6912	87.6618	13-Mar-12	1425
15	Clear Creek d/s of Bays Lake (site 1)	CCJ120313-06	21120313206	Fayette	33.6922	87.6534	13-Mar-12	1345
16	Deadwater Creek at gage d/s Overhead Road bridge	MWP120307-04	21120307204	Fayette	33.6601	87.6559	7-Mar-12	1050
17	Deadwater Creek u/s Overhead Road bridge	EAW120307-01	21120307205	Fayette	33.6594	87.6596	7-Mar-12	1230
18	Unnamed tributary to Deadwater Creek	EAW120307-02	21120307206	Fayette	33.6583	87.6619	7-Mar-12	1300
19	Deadwater Creek u/s of unnamed trib	EAW120307-03	21120307207	Fayette	33.6596	87.6624	7-Mar-12	1335
20	Deadwater Creek d/s U.S. Hwy. 43	EAW120307-04	21120307208	Fayette	33.6616	87.6674	7-Mar-12	1430

[1] - u/s upstream, d/s downstream

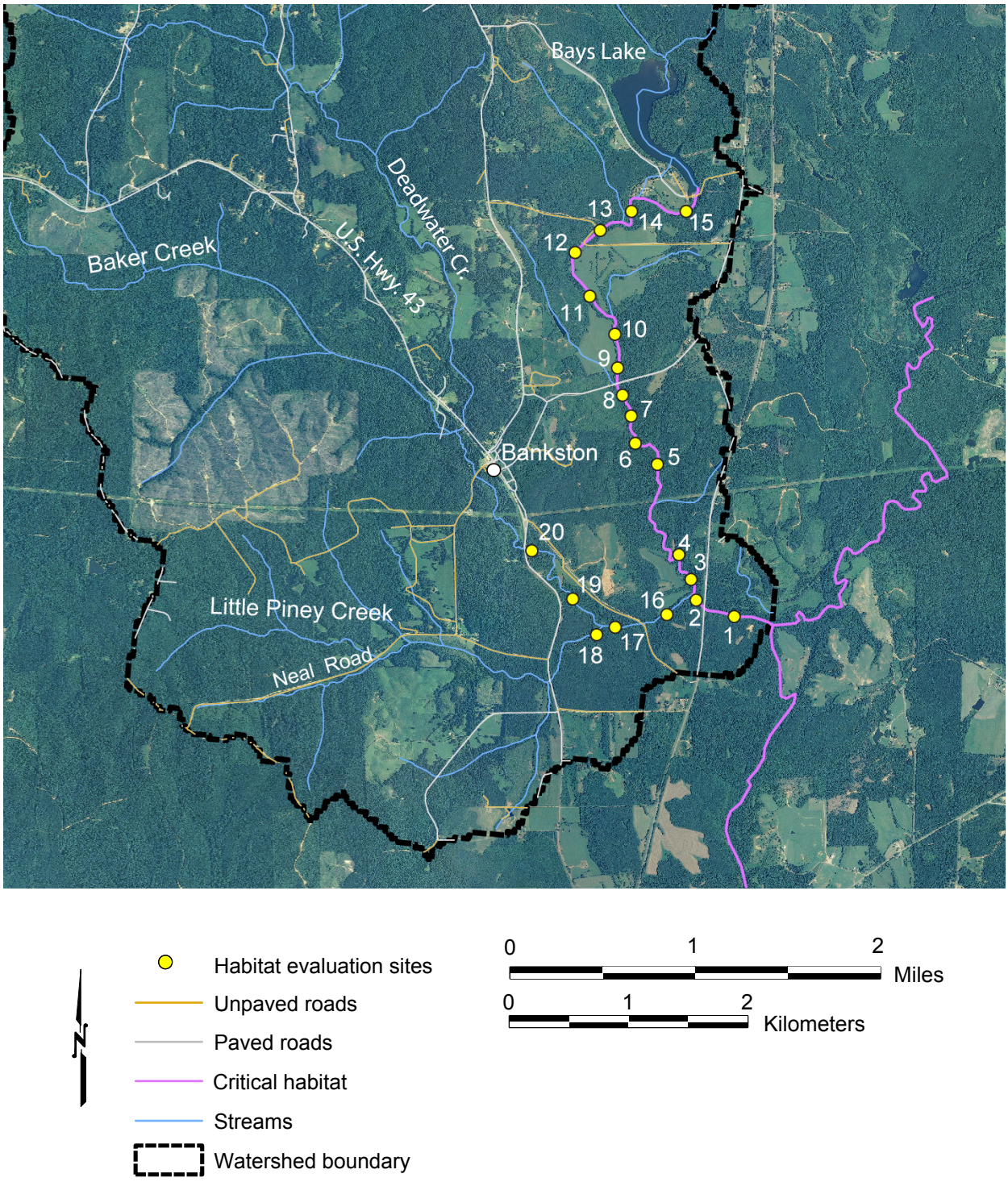


Figure 12. Habitat threat severity assessment sites in the Clear Creek watershed.

Table 6. Habitat threat severity scores for sites in Clear and Deadwater Creeks.

Site No.	Site name [1]	Habitat threat severity metric scores												
		1. Water odors	2. Channel stability	3. Channel alteration	4. Shoring structures	5. Fish passage	6. Buffer width	7. Local NPS potential	8. Floodplain access	9. Bank erosion	10. Pipe discharge	11. BEHI	Total score	Threat severity ranking
1	Clear Creek 200 yds d/s Ala. Hwy. 13 bridge	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.50	3.50	Low
2	Clear Creek u/s Ala. Hwy. 13 at Deadwater Creek mouth	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.25	1.00	0.00	0.50	3.75	Low
3	Clear Creek at old RR crossing	0.00	1.00	0.00	0.00	0.00	0.25	0.50	0.00	1.00	0.00	0.50	3.25	Low
4	Clear Creek d/s of Co. Hwy. 93 (site 5)	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.25	1.50	0.00	0.00	3.75	Low
5	Clear Creek d/s of Co. Hwy. 93 (site 4)	0.00	1.00	0.00	0.00	0.00	0.00	0.50	0.00	1.00	0.00	0.00	2.50	Low
6	Clear Creek d/s of Co. Hwy. 93 (site 3)	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.75	1.00	0.00	0.50	3.25	Low
7	Clear Creek d/s of Co. Hwy. 93 (site 2)	0.00	1.00	0.00	0.00	0.00	0.00	0.50	0.00	1.50	0.00	0.50	3.50	Low
8	Clear Creek d/s of Co. Hwy. 93 (site 1)	0.00	1.00	0.00	0.00	0.00	0.75	1.00	0.00	1.50	0.00	0.50	4.75	Moderate
9	Clear Creek d/s Lowery Road near gage (site 4)	0.00	1.00	0.00	0.00	0.00	0.50	0.50	0.50	1.50	0.00	0.50	4.50	Moderate
10	Clear Creek d/s Lowery Road (site 3)	0.00	1.00	0.00	0.00	0.00	0.75	1.50	0.00	1.00	0.00	0.50	4.75	Moderate
11	Clear Creek d/s Lowery Road (site 2)	0.00	1.50	0.00	0.00	0.00	0.50	1.50	0.00	1.50	0.00	0.50	5.50	Moderate
12	Clear Creek d/s Lowery Road (site 1)	0.00	1.00	0.00	0.00	0.00	0.75	1.00	0.00	1.00	0.00	0.50	4.25	Moderate
13	Clear Creek d/s of Bugs Lake (site 3)	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.25	0.50	0.00	0.50	2.25	Low
14	Clear Creek d/s of Bugs Lake (site 2)	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.50	2.00	Low
15	Clear Creek d/s of Bugs Lake (site 1)	0.00	1.00	1.50	1.50	1.50	0.75	1.00	0.00	1.50	0.00	0.50	9.25	High
16	Deadwater Creek at gage d/s Overhead Road bridge	0.00	1.50	0.00	0.00	0.00	0.75	1.50	0.00	1.00	0.00	0.50	5.25	Moderate
17	Deadwater Creek u/s Overhead Road bridge	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.50	3.50	Low
18	Unnamed tributary to Deadwater Creek	0.00	1.50	0.00	0.00	0.00	0.00	1.50	0.00	1.50	0.00	0.50	5.00	Moderate
19	Deadwater Creek u/s of unnamed trib	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.50	3.00	Low
20	Deadwater Creek d/s U.S. Hwy. 43	0.00	1.00	0.00	0.00	0.00	0.75	1.50	0.00	1.00	0.00	0.50	4.75	Moderate

1 - u/s upstream, d/s downstream

during storm events. Habitat at this site appears stable but is altered due to the structural and hydrologic effects of the dam. There appears to be few options to enhance/restore habitat at this site. The BEHI scores (table 7) indicated few bank erosion problems in Clear and Deadwater Creeks with three sites scoring low risk and 17 sites scoring moderate risk. Six of the sites were determined to be highly entrenched, 3 were moderately entrenched, and 11 were only slightly entrenched.

The main channel of Clear Creek from its mouth upstream to the Bays Lake dam appears to be reasonably stable with respect to incision and aggradation of sediment, bank erosion potential, and sources of polluted runoff. This reach of critical habitat could benefit in the long term by slightly expanding the riparian buffer width just upstream of Fayette Co. Hwy. 93 and working with landowners to better restrict animal access in a short reach of Clear Creek near Lowery Road. The channel of Deadwater Creek has greater potential for headcutting with four of six sites being highly entrenched (table 7).

EVALUATION OF UNPAVED ROAD BEST MANAGEMENT PRACTICES FOR SEDIMENT CONTROL

Several ditches and culvert crossings along unpaved roads that were identified as high risk for sedimentation were selected for the establishment of BMPs (Best Management Practices). These BMPs would allow capture of mobile sediment moving to streams. The following criteria were used to select sites to implement BMPs: (1) prioritization of the Clear Creek watershed for restoration and recovery of mussel critical habitat, (2) proximity of the crossing to a stream within the basin, (3) access for BMP installation, and (4) sufficient topographic relief to allow for construction of the BMP without jeopardizing functionality of the drainage features of the unpaved road. A low cost/maintenance sediment capture system was needed, and simple check dams of riprap turned out to be sufficient in reducing sediment movement into streams.

Construction of the dams was accomplished with a rubber tired backhoe or a skid steer loader. Riprap was placed across the drainage feature from bank to bank with thickness of the check dam equal to the height of the dam. Dam elevations were maintained at levels that would allow for temporary impoundment of storm waters while

Table 7. Habitat threat severity channel measurements and BEHI scores for sites in Clear and Deadwater Creeks.

Site No.	Site name [1]	Channel measurements									BEHI scores				
		Entrenchment ratio	Bankfull width (ft)	Bankfull depth (ft)	Flood prone width (ft)	Bank height (ft)	Wetted width (ft)	Water depth at thalweg (ft)	Reach length (est. ft)	Bank angle (°)	Bank ht/Bankfull depth	Bank root density	Bank angle	Total BEHI score	BEHI ranking
1	Clear Creek 200 yds d/s Ala. Hwy. 13 bridge	14.5	41	5.6	600	9.6	35	1.9	100	70	6.5	1.9	4.9	13.3	Moderate
2	Clear Creek u/s Ala. Hwy. 13 at Deadwater Creek mouth	16.2	53	6.6	850	9.9	37	4.6	200	70	5.9	1.9	4.9	12.7	Moderate
3	Clear Creek at old RR crossing	3.0	34	3.9	100	7.5	34	1.7	200	75	7.5	2.7	5.4	15.6	Moderate
4	Clear Creek d/s of Co. Hwy. 93 (site 5)	15.2	40	5.9	600	8.4	27	3.3	200	60	5.5	1.6	3.9	11.0	Low
5	Clear Creek d/s of Co. Hwy. 93 (site 4)	11.4	44	5.4	500	8.5	37	1.9	200	55	6.0	1.9	3.6	11.5	Low
6	Clear Creek d/s of Co. Hwy. 93 (site 3)	21.5	37	6.2	800	8.5	29	2.6	240	55	5.3	1.9	3.6	10.8	Low
7	Clear Creek d/s of Co. Hwy. 93 (site 2)	19.5	51	5.3	1,000	9.0	25	2.4	175	60	6.5	3.9	3.9	14.3	Moderate
8	Clear Creek d/s of Co. Hwy. 93 (site 1)	24.0	42	4.9	1,000	9.0	41	3.2	150	54	7.2	2.3	3.6	13.1	Moderate
9	Clear Creek d/s Lowery Road near gage (site 4)	1.5	37	4.7	54	9.0	30	3.7	165	60	7.5	2.7	3.9	14.1	Moderate
10	Clear Creek d/s Lowery Road (site 3)	2.7	42	5	110	9.5	40	3.6	300	40	7.4	2.7	2.8	12.9	Moderate
11	Clear Creek d/s Lowery Road (site 2)	15.9	63	4.4	1,000	7.8	47	1.6	400	40	6.8	3.1	2.8	12.7	Moderate
12	Clear Creek d/s Lowery Road (site 1)	1.2	41	3.7	48	10.5	39	1.9	590	45	10.0	1.6	3.1	14.7	Moderate
13	Clear Creek d/s of Bugs Lake (site 3)	3.0	44	5.1	130	10.0	39	2.0	500	40	7.4	1.6	2.8	11.8	Moderate
14	Clear Creek d/s of Bugs Lake (site 2)	1.2	45	5.1	55	11.3	40	3.2	200	40	8.1	3.5	2.8	14.4	Moderate
15	Clear Creek d/s of Bugs Lake (site 1)	2.0	50	4.1	100	8.6	36	2.1	150	30	8.0	1.6	2.4	12.0	Moderate
16	Deadwater Creek at gage d/s Overhead Road bridge	1.2	32	4	39	8.0	29	1.1	950	82	7.9	1.4	6.0	15.3	Moderate
17	Deadwater Creek u/s Overhead Road bridge	1.2	31	3.5	37	7.4	27	1.5	150	86	8.0	1.4	7.0	16.4	Moderate
18	Unnamed trib to Deadwater Creek	1.2	18	2	21	7.4	7	0.6	50	47	10.0	3.5	3.2	16.7	Moderate
19	Deadwater Creek u/s of unnamed tributary	1.9	20	3.7	37	9.2	19	2.1	275	60	8.6	2.3	3.9	14.8	Moderate
20	Deadwater Creek d/s U.S. Hwy. 43	1.1	31	3.5	34	8.2	29	1.8	250	70	8.4	2.7	4.9	16.0	Moderate

1 - u/s upstream, d/s downstream

allowing sediments to settle, yet still function to keep storm waters off of the unpaved road surface. The impoundments were finished with a flat bottom and the dimensions of each impoundment varied based on site topography. Metal fence posts were driven into the impoundments and baseline measurements were made from the top of the fence posts to basin bottom. As sediments accumulated within the impoundments, the distance from the top of the post to the sediment surface decreases and this measurement, along with impoundment dimensions, was used to estimate the total volume of sediment accumulated through time. Some impoundments have two measurement posts and the measurements were averaged. The calculations were performed by first determining the average accumulated depth of sediment (ft) then multiplying this value by the area of the impoundment (ft^2) to determine cubic feet of sediment accumulated. A value of 100 pounds (lb) per cubic foot (ft^3) of sediment was assigned to the material. Therefore, one cubic yard (yd^3) of material (27 ft^3) weighs 2,700 lb. Total cubic yards was multiplied by 2,700 for total pounds, then total pounds was divided by 2,000 to determine tons (t).

Check dam BMPs have been installed at 12 sites in the Clear Creek watershed and one site just east of Clear Creek in Fayette County (fig. 13, table 8, appendix C). Quantities of sediment have varied from location to location (tab. 8) based on the size of the impoundment, the length of road or area draining to the impoundment, and the slope of the road leading to the impoundment. Average volume of sediment captured per month varied from 0.069 yd^3 at site 13 to 0.421 yd^3 at site 9 with the range of capture rates relatively equal for practices of 6-month and 13-month duration (fig. 14). The useful life (time to fill) sediment basins ranged from 10 months to 8 years with a median of 2.4 years and was determined by monthly filling rate and capacity. The first sedimentation basins were installed in November of 2011, and some of those impoundments are close to their useful capacity.

Four basins were installed in November 2012 on private property in Tuscaloosa County within the Gin Creek drainage basin (a tributary to Binion Creek), along Harless Road. These are much larger basins than those installed in Clear Creek and have the

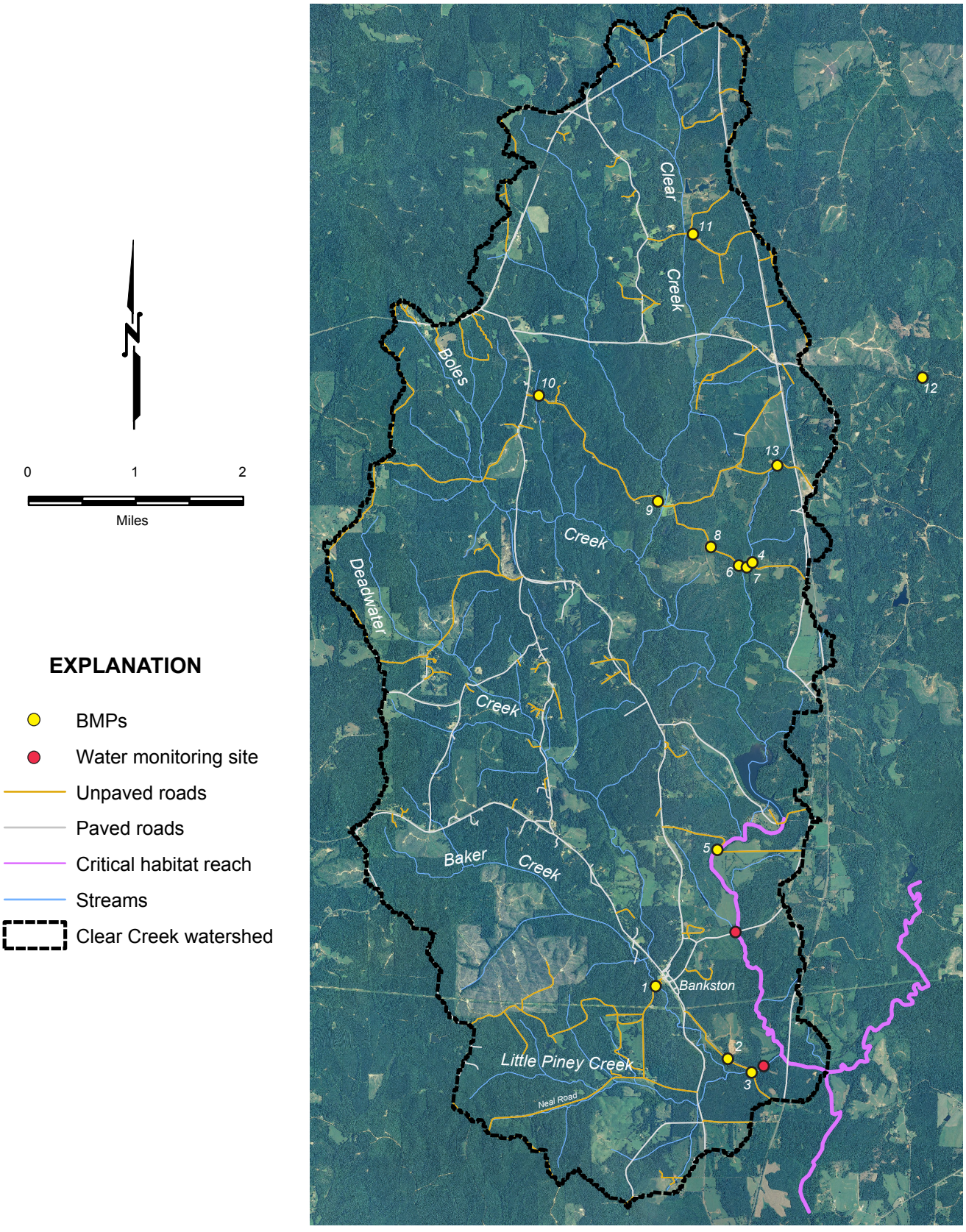


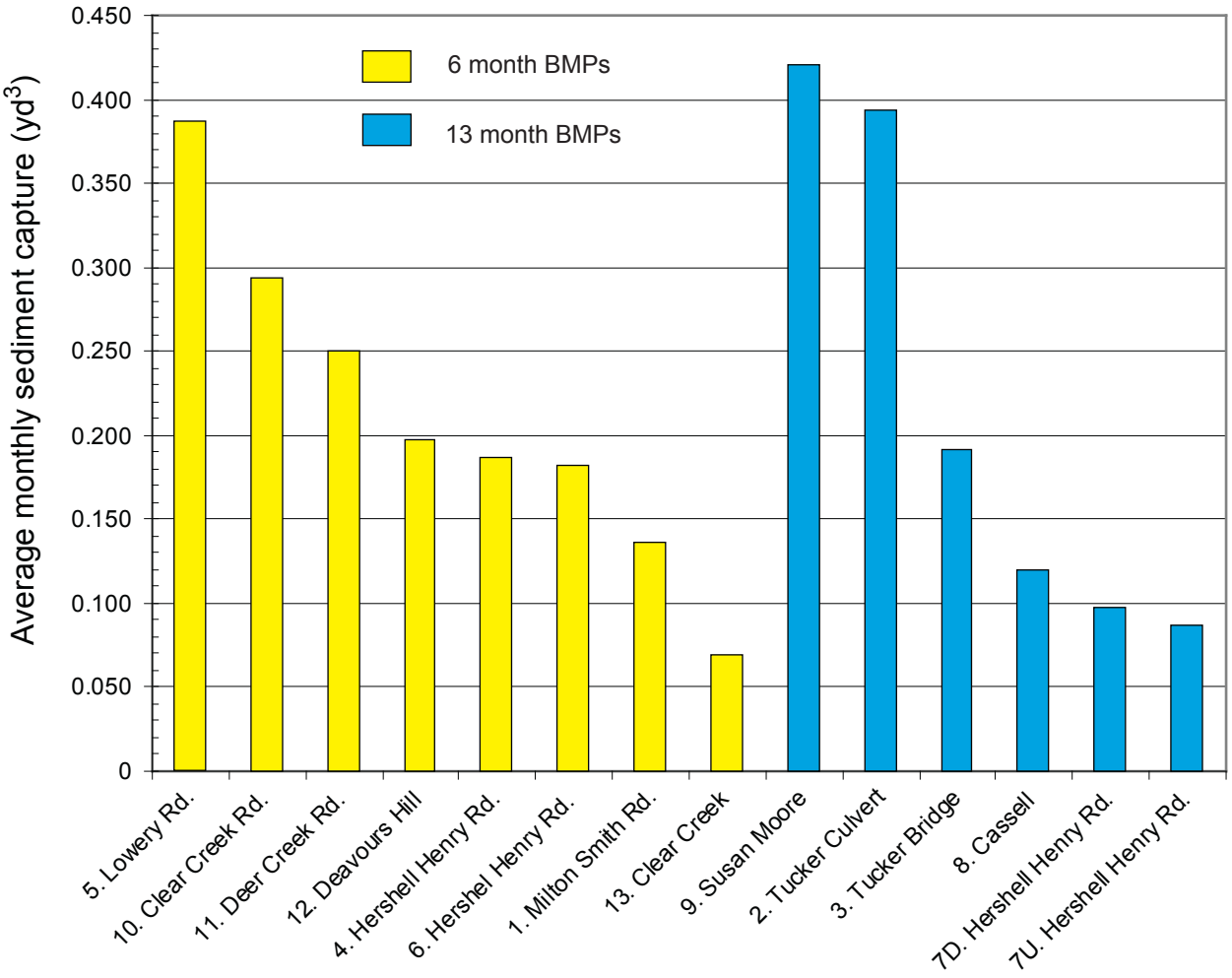
Figure 13. Location of sediment control practices in the Clear Creek watershed.

Table 8. Sediment capture statistics for sediment control structures in the Clear Creek watershed.

Site No.	Site name	Latitude-ºN	Longitude-ºW	Months operating [1]	Capacity (yd^3)	Volume (yd^3)		Weight (tons)		Useful life of control structure	
						Cumulative thru Dec. 2012	Average monthly	Cumulative thru Dec. 2012	Average monthly	(months)	(years)
1	Milton Smith Rd.	33.67093	87.67322	6	9.12	0.815	0.136	1.100	0.183	67	5.6
2	Tucker Culvert	33.66194	87.66163	13	7.11	5.120	0.394	6.912	0.532	18	1.5
3	Tucker Bridge	33.65971	87.65718	13	8.89	2.489	0.191	3.360	0.258	46	3.9
4	Hershell Henry Rd.	33.72840	87.65812	6	5.33	1.120	0.187	1.512	0.252	29	2.4
5	Lowery Rd.	33.68956	87.66349	6	13.16	2.322	0.387	3.135	0.523	34	2.8
6	Hershel Henry Rd.	33.72840	87.65812	6	5.33	1.093	0.182	1.475	0.246	29	2.4
7U	Hershel Henry Rd.	33.72799	87.65921	13	5.92	1.126	0.087	1.520	0.117	68	5.7
7D	Hershel Henry Rd.	33.72789	87.65913	13	9.44	1.275	0.098	1.721	0.132	96	8.0
8	Cassell	33.72953	87.66210	13	3.11	1.556	0.120	2.100	0.162	26	2.2
9	Susan Moore	33.73660	87.67344	13	7.33	5.476	0.421	7.392	0.569	17	1.5
10	Clear Creek Rd.	33.75074	87.69260	6	2.96	1.763	0.294	2.380	0.397	10	0.8
11	Deer Creek Rd.	33.77274	87.66780	6	3.4	1.500	0.250	2.025	0.338	14	1.1
12	Deavours Hill	33.75365	87.63068	6	3.11	1.182	0.197	1.596	0.266	16	1.3
13	Clear Creek	33.74175	87.65399	6	4.53	0.413	0.069	0.558	0.093	66	5.5

[1] - 6 months [June-December 2012]; 13 months [November 2011-December 2012].

Figure 14. Average monthly sediment capture for control practices of 6-month and 13-month duration in the Clear Creek watershed, Fayette County.



capacity to capture much larger volumes of sediment. The long-term capture rate statistics are not available for these basins, but from November 2012 through December 2012 they captured an estimated 70 tons of sediment.

Identifying specific sites for implementation of habitat restoration projects is one of the primary tasks of the SHU watershed process. Assessments of sedimentation risk and habitat threat severity revealed potential sites for implementing sedimentation reduction practices to improve water quality and reduce loads of sediment entering North River tributaries (table 9). Although the total measured volume of sediment retained by basins at 13 sites in Clear Creek over the course of one year is small by comparison to total sediment flux passing through the system, the methods outlined in this report are a good foundation to expand this process in the remainder of the Clear Creek watershed and to other tributaries in the North River. Plans are to double the number of unpaved road sediment control practices in upper Clear Creek in 2014 and increase the number of large sediment basins in the Binion Creek system as well.

We observed use of a similar sedimentation reduction and control practice in the Clear Creek watershed during installation of a rural water distribution system. Water lines were buried along roads in the area and many stream crossings were needed for the pipe network. A series of similar practices described in this report, but smaller in capacity, were typically installed at regular intervals on approaches to stream crossings and the areas were seeded shortly after the pipe was buried. The system appeared very effective at retaining sediment and little erosion and deposition was noticed around those stream crossings for several months post burial. These structures are still very functional almost two years after installation. Based on these observations, and our work, the control practices presented here should be successful in most watersheds because of low cost, ease of installation, and effectiveness. The degree of sediment retention will be determined by the numbers of practices installed in small watersheds and the frequency at which they are rehabilitated when filled.

Table 9. Prioritized list of unpaved road sites rated high risk for sedimentation.

Site No.	Stream	SRI Score	Risk
124	Unnamed tributary to Beaver Cr.	24	High
20	Unnamed tributary to Barbee Cr. at Dan Shelby Road	26	High
77	Unnamed tributary to Sandy Point Cr. (3)	26	High
128	Unnamed tributary to North River at Deavours Hill Road	26	High
53	Unnamed tributary to Tyro Cr. at Madison Road	28	High
88	Unnamed ephemeral tributary at Neal Road (1)	28	High
89	Unnamed ephemeral tributary at Neal Road (2)	28	High
121	Cane Cr. tributary at Jenkins Cemetery Road (1)	28	High
62	Unnamed ephemeral tributary to Freeman Cr. (1)	30	High
78	Rocky Branch at Rocky Branch Road	30	High
90	Unnamed tributary to Deadwater Cr. at Overhead Road	30	High
103	Unnamed tributary to Clear Cr. (3)	30	High
106	Unnamed ephemeral tributary to Boles Cr. at Fowler Road	30	High
120	Cane Cr. tributary at Jenkins Cemetery Road (2)	30	High
123	Beaver Cr. at Deavours Hill Road	32	High
74	Unnamed tributary to Sandy Point Cr. (1)	34	High
76	Sandy Point Cr. at unnamed road	34	High
97	Unnamed tributary to Deadwater Cr. on Piney Grove Road	34	High
101	Unnamed tributary to Clear Cr. (1)	34	High
107	Unnamed tributary to Boles Cr. at Fowler Road	34	High
114	Ellis Cr. at Morris Cr. Road	34	High
66	Cedar Cr. at Madison Road	36	High
91	Deadwater Cr. at Milton Smith Road (Bankston)	36	High
100	Unnamed tributary to Clear Cr. at Hershel Henry Road	36	High
110	Clear Cr. at Deer Cr. Road (steel culvert)	36	High
113	Ellis Cr. at Zion Road	36	High
122	North River at Jenkins Cemetery Road	38	High

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Appendix A

Stream crossing evaluation sites in the North River watershed, Fayette and Tuscaloosa Counties, Alabama.

Appendix A. Stream crossing evaluation sites in the North River watershed.

Site No.	Road type	Site name	Field Code	SHU code	County	Latitude	Longitude	Date	Time
1	Paved	Brush Cr. at Sexton Bend Road	CCJ120808-04	21120808204	Tuscaloosa	33.3224	87.5000	8-Aug-12	1220
2	Paved	Carroll Cr. at Ala. Hwy. 69	CCJ120808-03	21120808203	Tuscaloosa	33.2946	87.5687	8-Aug-12	1105
3	Paved	Carroll Cr. at U.S. Hwy. 43	CCJ120808-02	21120808202	Tuscaloosa	33.2950	87.5982	8-Aug-12	1020
4	Paved	Carroll Cr. at Rose Blvd.	CCJ120808-01	21120808201	Tuscaloosa	33.3035	87.6121	8-Aug-12	0930
5	Paved	Carroll Cr. at Curt Rue Road	CCJ120731-09	21120731209	Tuscaloosa	33.3243	87.6385	31-Jul-12	1515
6	Unpaved	Carroll Cr. at Curt Cunningham Road	CCJ120731-08	21120731108	Tuscaloosa	33.3394	87.6572	31-Jul-12	1445
7	Paved	Turkey Cr. at U.S. Hwy 69	CCJ120928-01	21120928101	Tuscaloosa	33.4099	87.5111	28-Sep-12	0920
8	Paved	Pole Bridge Cr. at Holly Spring Road	CCJ120731-07	21120731207	Tuscaloosa	33.3863	87.6131	31-Jul-12	1400
9	Paved	Pole Bridge Cr. at Old Fayette Road	CCJ120731-06	21120731206	Tuscaloosa	33.3805	87.6265	31-Jul-12	1330
10	Paved	Unnamed tributary to Binion Cr. at Lesueur Road	CCJ120731-04	21120731204	Tuscaloosa	33.4253	87.6275	31-Jul-12	1100
11	Paved	Dry Branch at Lesueur Road	CCJ120731-03	21120731203	Tuscaloosa	33.4315	87.6328	31-Jul-12	1035
12	Unpaved	Gin Cr. at Harless Road	CCJ120731-02	21120731102	Tuscaloosa	33.4229	87.6434	31-Jul-12	1005
13	Unpaved	Spenser Branch at Harless Road	CCJ120731-05	21120731105	Tuscaloosa	33.4098	87.6608	31-Jul-12	1240
14	Paved	Binion Cr. at Old Fayette Road	CCJ120731-01	21120731201	Tuscaloosa	33.4250	87.6428	31-Jul-12	0930
15	Unpaved	Wolf Cr. at Old Fayette Road	CCJ120516-09	21120516109	Tuscaloosa	33.4375	87.6567	16-May-12	1520
16	Paved	Wolf Cr. at Billy Bigham Road	CCJ120730-01	21120730201	Tuscaloosa	33.4672	87.6627	30-Jul-12	0940
17	Paved	Wolf Cr. at Graham Road	CCJ120730-02	21120730202	Tuscaloosa	33.4965	87.6802	30-Jul-12	1020
18	Paved	Barbee Cr. at Co. Hwy. 38	CCJ120730-05	21120730205	Tuscaloosa	33.4610	87.6452	30-Jul-12	1245
19	Paved	Barbee Cr. at Haygood Chapel Road	CCJ120730-06	21120730206	Tuscaloosa	33.4769	87.6500	30-Jul-12	1315
20	Unpaved	Unnamed tributary to Barbee Cr. at Dan Shelby Road	CCJ120730-07	21120730107	Tuscaloosa	33.4796	87.6569	30-Jul-12	1335
21	Unpaved	Unnamed tributary to Barbee Cr. at Fondren Road	CCJ120730-08	21120730108	Tuscaloosa	33.4851	87.6544	30-Jul-12	1400
22	Paved	Barbee Cr. at Fondren Road	CCJ120730-09	21120730209	Tuscaloosa	33.4915	87.6489	30-Jul-12	1430
23	Paved	Barbee Cr. at Sherman Road	CCJ120730-10	21120730210	Tuscaloosa	33.5077	87.6468	30-Jul-12	1450
24	Unpaved	Barbee Cr. at Grady Phillips Road	CCJ120730-04	21120730104	Tuscaloosa	33.5159	87.6499	30-Jul-12	1145
25	Unpaved	Barbee Cr. at Joe Taylor Road	CCJ120730-03	21120730103	Tuscaloosa	33.5298	87.6585	30-Jul-12	1115
26	Paved	Sam Norris Branch at Browns Road	CCJ120516-07	21120516207	Tuscaloosa	33.4377	87.6761	16-May-12	1420
27	Unpaved	Binion Cr. at Browns Road	CCJ120516-08	21120516108	Tuscaloosa	33.4434	87.6641	16-May-12	1450
28	Paved	Binion Cr. at Co. Hwy. 38	CCJ120516-06	21120516206	Tuscaloosa	33.4596	87.7000	16-May-12	1345
29	Unpaved	Binion Cr. at Kemp Road	CCJ120516-05	21120516105	Tuscaloosa	33.4792	87.7040	16-May-12	1315
30	Unpaved	Binion Cr. at Jones Mill Road	CCJ120516-04	21120516104	Tuscaloosa	33.4999	87.7051	16-May-12	1210
31	Paved	Unnamed tributary to North River at John Swindle Road	CCJ121004-09	21121004209	Tuscaloosa	33.4627	87.5914	4-Oct-12	1430
32	Paved	Unnamed tributary to North River at Co. Hwy. 63	CCJ121004-08	21121004208	Tuscaloosa	33.4674	87.6081	4-Oct-12	1400
33	Paved	Unnamed tributary to North River at Co. Hwy. 38	CCJ121004-06	21121004206	Tuscaloosa	33.4774	87.6115	4-Oct-12	1320
34	Paved	Cripple Cr. at Co. Hwy. 38	CCJ120412-05	21120412205	Tuscaloosa	33.4929	87.5623	12-Apr-12	1330
35	Paved	Johnson Branch at Utley Loop Road	CCJ120412-06	21120412206	Tuscaloosa	33.5211	87.5463	12-Apr-12	1405
36	Paved	North River at Co. Hwy. 38	CCJ121004-07	21121004207	Tuscaloosa	33.4800	87.5958	4-Oct-12	1335
37	Paved	Unnamed tributary to North River at Co. Hwy. 63	CCJ121004-05	21121004205	Tuscaloosa	33.4911	87.6021	4-Oct-12	1250
38	Paved	Gin Branch at Co. Hwy. 40	CCJ121004-04	21121004204	Tuscaloosa	33.5158	87.6035	4-Oct-12	1215
39	Paved	Bear Cr. at Oregonia Road	CCJ120412-03	21120412203	Tuscaloosa	33.5428	87.5612	12-Apr-12	1130
40	Paved	Bear Cr. at Evanstown Road	CCJ120412-02	21120412202	Tuscaloosa	33.5473	87.5563	12-Apr-12	1045

Appendix A. Stream crossing evaluation sites in the North River watershed.

Site No.	Road type	Site name	Field Code	SHU code	County	Latitude	Longitude	Date	Time
41	Unpaved	Dry Branch at Sid Davis Road	CCJ120412-04	21120412104	Tuscaloosa	33.5428	87.5391	12-Apr-12	1200
42	Paved	Boone Creek at Co. Hwy. 55	CCJ121004-03	21121004203	Tuscaloosa	33.5422	87.6041	4-Oct-12	1055
43	Paved	Boone Creek at Co. Hwy. 63	CCJ121004-02	21121004202	Tuscaloosa	33.5365	87.6240	4-Oct-12	1020
44	Unpaved	Boone Creek at Bill Lunceford Road	CCJ121003-08	21121003208	Tuscaloosa	33.5399	87.6414	3-Oct-12	1425
45	Unpaved	Unnamed tributary to Boone Creek at Bill Lunceford Road	CCJ121003-09	21121003209	Tuscaloosa	33.5407	87.6410	3-Oct-12	1440
46	Paved	Boone Creek at U.S. Hwy. 43	CCJ121003-07	21121003207	Tuscaloosa	33.5377	87.6533	3-Oct-12	1400
47	Unpaved	Boone Creek at Logan Road	CCJ121003-06	21121003206	Fayette	33.5462	87.6670	3-Oct-12	1325
48	Unpaved	Unnamed tributary to Boone Creek at New Hope Road	CCJ121003-05	21121003205	Fayette	33.5496	87.6794	3-Oct-12	1250
49	Unpaved	Boone Creek at Freeman Creek Road	CCJ121003-04	21121003204	Fayette	33.5552	87.6778	3-Oct-12	1150
50	Paved	Tyro Cr. at Old Jasper Hwy.	CCJ120516-03	21120516203	Tuscaloosa	33.5540	87.6005	16-May-12	1005
51	Unpaved	Tyro Cr. at Upper Tyro Road	CCJ120412-01	21120412101	Tuscaloosa	33.5666	87.5763	12-Apr-12	0850
52	Unpaved	Tyro Cr. at Madison Rd	CCJ120404-16	21120404116	Fayette	33.6383	87.5542	4-Apr-12	1320
53	Unpaved	Unnamed trib to Tyro Cr. at Madison Rd	CCJ120404-15	21120404115	Fayette	33.6366	87.5462	4-Apr-12	1235
54	Paved	North River at Old Jasper Road	CCJ120516-02	21120516202	Tuscaloosa	33.5500	87.6017	16-May-12	0935
55	Unpaved	Unnamed trib to North River at Willingham Road	CCJ120516-01	21120516101	Tuscaloosa	33.5872	87.6048	16-May-12	0840
56	Paved	North River at Co. Hwy. 63	CCJ121004-01	21121004201	Tuscaloosa	33.5621	87.6303	4-Oct-12	0935
57	Paved	Freeman Creek at U.S. Hwy. 43	CCJ121009-01	21121009201	Tuscaloosa	33.5741	87.6584	9-Oct-12	1300
58	Paved	Intermittent stream at Co. Hwy. 68	CCJ121003-02	21121003202	Tuscaloosa	33.5751	87.6605	3-Oct-12	1045
59	Unpaved	Freeman Creek at Freeman Creek Road	CCJ121003-03	21121003203	Fayette	33.5725	87.6778	3-Oct-12	1120
60	Paved	Freeman Cr. at Co. Hwy. 68	PEO120404-24	21120404224	Fayette	33.5846	87.6927	4-Apr-12	1435
61	Paved	Freeman Cr. at Co. Hwy. 15	PEO120404-12	21120404212	Fayette	33.5912	87.6986	4-Apr-12	0820
62	Unpaved	Unnamed ephemeral trib to Freeman Cr. (1)	PEO120404-13	21120404113	Fayette	33.6006	87.7063	4-Apr-12	0900
63	Unpaved	Unnamed ephemeral trib to Freeman Cr. (2)	PEO120404-14	21120404114	Fayette	33.6043	87.7038	4-Apr-12	0930
64	Paved	Unnamed trib to Freeman Cr. at Co. Hwy. 15	PEO120404-23	21120404223	Fayette	33.5971	87.6849	4-Apr-12	1410
65	Unpaved	Cedar Cr. at Flat Cr. Road	CCJ120404-18	21120404118	Fayette	33.6392	87.6011	4-Apr-12	1430
66	Unpaved	Cedar Cr. at Madison Road	CCJ120404-17	21120404117	Fayette	33.6507	87.5893	4-Apr-12	1345
67	Paved	Little Cedar Cr. at Co. Hwy. 30	CCJ120404-12	21120404212	Fayette	33.6659	87.5796	4-Apr-12	1010
68	Paved	Cedar Cr. at Co. Hwy. 46	CCJ120404-14	21120404214	Fayette	33.6617	87.5364	4-Apr-12	1150
69	Paved	Pine Branch at Co. Hwy. 46	CCJ120404-13	21120404213	Fayette	33.6691	87.5304	4-Apr-12	1045
70	Paved	Sandy Point Creek at U.S. Hwy. 43	CCJ121009-02	21121009202	Fayette	33.6000	87.6635	9-Oct-12	1335
71	Paved	Sandy Point Cr. at Co. Hwy. 15	PEO120404-22	21120404222	Fayette	33.6113	87.6771	4-Apr-12	1350
72	Paved	Unnamed trib to Sandy Point Cr. at Co. Hwy. 26	PEO120404-20	21120404220	Fayette	33.6220	87.6847	4-Apr-12	1255
73	Paved	Sandy Point Cr. at Co. Hwy. 26	PEO120404-21	21120404221	Fayette	33.6221	87.6876	4-Apr-12	1315
74	Unpaved	Unnamed trib to Sandy Point Cr. (1)	PEO120404-15	21120404115	Fayette	33.6187	87.6943	4-Apr-12	1005
75	Unpaved	Unnamed trib to Sandy Point Cr. (2)	PEO120404-16	21120404116	Fayette	33.6246	87.6913	4-Apr-12	1040
76	Unpaved	Sandy Point Cr. at unnamed road	PEO120404-17	21120404117	Fayette	33.6346	87.6937	4-Apr-12	1110
77	Unpaved	Unnamed trib to Sandy Point Cr. (3)	PEO120404-18	21120404118	Fayette	33.6357	87.6915	4-Apr-12	1130
78	Unpaved	Rocky Branch at Rocky Branch Rd	PEO120404-19	21120404119	Fayette	33.6379	87.6849	4-Apr-12	1220
79	Paved	North River at Ala. Hwy. 18	CCJ121003-01	21121003201	Fayette	33.6307	87.6540	3-Oct-12	0900
80	Paved	Clear Creek at U.S. Hwy. 43	CCJ121009-03	21121009203	Fayette	33.6619	87.6515	9-Oct-12	1410

Appendix A. Stream crossing evaluation sites in the North River watershed.

Site No.	Road type	Site name	Field Code	SHU code	County	Latitude	Longitude	Date	Time
81	Unpaved	Deadwater Cr. at Overhead Road	PEO120314-02	21120314102	Fayette	33.6599	87.6573	14-Mar-12	1300
82	Paved	Unnamed tributary to Deadwater Cr. at U.S. Hwy. 43	PEO120328-19	21120328219	Fayette	33.6555	87.6662	28-Mar-12	1245
83	Paved	Unnamed tributary to Deadwater Cr. nr. U.S. Hwy. 43	PEO120327-02	21120327202	Fayette	33.6528	87.6661	27-Mar-12	0830
84	Paved	Unnamed tributary to Deadwater Cr. at Co. Hwy. 132	PEO120327-03	21120327203	Fayette	33.6477	87.6768	27-Mar-12	0900
85	Unpaved	Unnamed tributary to Deadwater Cr. (Taylor intersection)	PEO120327-08	21120327108	Fayette	33.6589	87.6764	27-Mar-12	1200
86	Unpaved	Unnamed tributary to Deadwater Cr. (West property)	PEO120327-07	21120327107	Fayette	33.6587	87.6801	27-Mar-12	1125
87	Unpaved	Unnamed tributary to Deadwater Cr. (Taylor property)	PEO120327-06	21120327106	Fayette	33.6570	87.6825	27-Mar-12	1045
88	Unpaved	Unnamed ephemeral tributary at Neal Road (1)	PEO120327-04	21120327104	Fayette	33.6535	87.6948	27-Mar-12	0945
89	Unpaved	Unnamed ephemeral tributary at Neal Road (2)	PEO120327-05	21120327105	Fayette	33.6537	87.6957	27-Mar-12	1010
90	Unpaved	Unnamed tributary to Deadwater Cr. at Overhead Road	PEO120327-01	21120327101	Fayette	33.6618	87.6616	27-Mar-12	0745
91	Unpaved	Deadwater Cr. at Milton Smith Road (Bankston)	PEO120321-01	21120321101	Fayette	33.6711	87.6732	21-Mar-12	0745
92	Paved	Unnamed tributary to Deadwater Cr. at U.S. Hwy. 43	PEO120328-11	21120328211	Fayette	33.6924	87.7079	28-Mar-12	0830
93	Paved	Unnamed tributary to Deadwater Cr. at Co. Hwy. 101	PEO120328-12	21120328212	Fayette	33.6934	87.7094	28-Mar-12	0900
94	Paved	Unnamed tributary tributary NW Bankston at Heartline Road	PEO120327-09	21120327209	Fayette	33.7016	87.6910	27-Mar-12	1245
95	Paved	Deadwater Cr. NW Bankston at Heartline Road	PEO120327-10	21120327210	Fayette	33.7035	87.6919	27-Mar-12	1300
96	Unpaved	Deadwater Cr. at Piney Grove Road	PEO120328-13	21120328113	Fayette	33.7169	87.7088	28-Mar-12	0935
97	Unpaved	Unnamed tributary to Deadwater Cr. on Piney Grove Road	PEO120328-14	21120328114	Fayette	33.7176	87.7080	28-Mar-12	1000
98	Paved	Clear Cr. at Co. Hwy. 93	PEO120321-02	21120321202	Fayette	33.6784	87.6602	21-Mar-12	0815
99	Unpaved	Clear Cr. at Lowery Road	PEO120314-01	21120314101	Fayette	33.6895	87.6631	14-Mar-12	1200
100	Unpaved	Unnamed tributary to Clear Cr. at Hershel Henry Road	PEO120321-03	21120321103	Fayette	33.7280	87.6593	21-Mar-12	0850
101	Unpaved	Unnamed tributary (1) to Clear Cr.	PEO120321-05	21120321105	Fayette	33.7410	87.6554	21-Mar-12	1000
102	Unpaved	Unnamed tributary (2) to Clear Cr.	PEO120321-06	21120321106	Fayette	33.7417	87.6541	21-Mar-12	1045
103	Unpaved	Unnamed tributary (3) to Clear Cr.	PEO120321-07	21120321107	Fayette	33.7419	87.6531	21-Mar-12	1115
104	Paved	Boles Cr. at Co. Hwy. 67	PEO120328-18	21120328218	Fayette	33.7352	87.6961	28-Mar-12	1205
105	Unpaved	Boles Cr. at Fowler Road	PEO120328-16	21120328116	Fayette	33.7393	87.7018	28-Mar-12	1100
106	Unpaved	Unnamed ephemeral tributary to Boles Cr. at Fowler Road	PEO120328-15	21120328115	Fayette	33.7394	87.7030	28-Mar-12	1040
107	Unpaved	Unnamed tributary to Boles Cr. at Fowler Road	PEO120328-17	21120328117	Fayette	33.7407	87.7008	28-Mar-12	1145
108	Unpaved	Clear Cr. at Clear Cr. Road	PEO120321-04	21120321104	Fayette	33.7364	87.6730	21-Mar-12	0920
109	Unpaved	Unnamed tributary to Clear Cr. at Deer Cr. Road	PEO120321-09	21120321109	Fayette	33.7727	87.6714	21-Mar-12	1245
110	Unpaved	Clear Cr. at Deer Cr. Road (steel culvert)	PEO120321-08	21120321108	Fayette	33.7728	87.6691	21-Mar-12	1200
111	Paved	Clear Cr. at Ala. Hwy. 102	PEO120321-10	21120321210	Fayette	33.7956	87.6753	21-Mar-12	1330
112	Paved	North River at Co. Hwy. 30	CCJ120403-01	21120403201	Fayette	33.6806	87.0315	3-Apr-12	0820
113	Unpaved	Ellis Cr. at Zion Road	PEO120328-20	21120328120	Fayette	33.7028	87.6388	28-Mar-12	1320
114	Unpaved	Ellis Cr. at Morris Cr. Road	PEO120328-21	21120328121	Fayette	33.7112	87.6404	28-Mar-12	1350
115	Paved	Cane Cr. at Co. Hwy. 63	CCJ120403-06	21120403206	Fayette	33.7001	87.5886	3-Apr-12	1210
116	Paved	Cane Cr. at Co. Hwy. 125	CCJ120403-05	21120403205	Fayette	33.6996	87.5755	3-Apr-12	1140
117	Paved	Cane Cr. tributary at Co. Hwy. 127	CCJ120403-02	21120403202	Fayette	33.6997	87.5619	3-Apr-12	0910
118	Paved	Cane Cr. at Co. Hwy. 127	CCJ120403-03	21120403203	Fayette	33.7037	87.5587	3-Apr-12	0950
119	Paved	Cane Cr. tributary at Co. Hwy. 126	CCJ120403-04	21120403204	Fayette	33.7126	87.5678	3-Apr-12	1020
120	Unpaved	Cane Cr. tributary at Jenkins Cemetery Road (2)	CCJ120403-08	21120403108	Fayette	33.7200	87.5974	3-Apr-12	1330

Appendix A. Stream crossing evaluation sites in the North River watershed.

Site No.	Road type	Site name	Field Code	SHU code	County	Latitude	Longitude	Date	Time
121	Unpaved	Cane Cr. tributary at Jenkins Cemetery Road (1)	CCJ120403-07	21120403107	Fayette	33.7208	87.5919	3-Apr-12	1245
122	Unpaved	North River at Jenkins Cemetery Road	CCJ120403-09	21120403109	Fayette	33.7169	87.6054	3-Apr-12	1410
123	Unpaved	Beaver Cr. at Deavours Hill Road	PEO120403-10	21120403110	Fayette	33.7534	87.6318	3-Apr-12	1340
124	Unpaved	Unnamed tributary to Beaver Cr.	PEO120403-11	21120403111	Fayette	33.7539	87.6370	3-Apr-12	1405
125	Paved	Beaver Cr. at Co. Hwy. 45	PEO120403-01	21120403201	Fayette	33.7761	87.6511	4-Apr-12	0910
126	Paved	Georges Cr. at Co. Hwy. 63	CCJ120404-11	21120404211	Fayette	33.7476	87.5908	4-Apr-12	0915
127	Paved	Georges Cr. tributary at Co. Hwy. 63	CCJ120404-10	21120404210	Fayette	33.7439	87.5882	4-Apr-12	0830
128	Unpaved	Unnamed tributary to North River at Deavours Hill Road	PEO120403-09	21120403109	Fayette	33.7613	87.6115	3-Apr-12	1305
129	Unpaved	Lowery Branch at Deavours Hill Road	PEO120403-08	21120403108	Fayette	33.7657	87.6086	3-Apr-12	1230
130	Paved	Hendon Cr. at Co. Hwy. 63	PEO120403-07	21120403207	Fayette	33.7748	87.6036	3-Apr-12	1200
131	Paved	Lick Cr. at Co. Hwy. 63	PEO120403-05	21120403205	Fayette	33.7802	87.6029	3-Apr-12	1100
132	Unpaved	Tanyard Cr. at Jud Cook Road	PEO120403-06	21120403106	Fayette	33.7876	87.6096	3-Apr-12	1135
133	Paved	Tanyard Cr. at Ala. Hwy. 102	PEO120403-02	21120403202	Fayette	33.8038	87.6161	3-Apr-12	0945
134	Paved	Lick Cr. at Ala. Hwy. 102	PEO120403-03	21120403203	Fayette	33.8050	87.6027	3-Apr-12	1010
135	Paved	North River at Ala. Hwy. 102	PEO120403-04	21120403204	Fayette	33.8052	87.5831	3-Apr-12	1040

Appendix B

Sedimentation risk index scores for stream crossings in the North River watershed.

Appendix B. Sedimentation risk index scores for stream crossings in the North River watershed.

Site No.	Road type	Site name	Sedimentation Risk Index (SRI) Assessment Metrics												SRI	Risk
			Waterway			Crossing structure			Road approaches I				Road appr. II			
			U/S channel morphology	D/S channel morphology	D/S channel/bank alteration	U/S culvert skew	Crossing fill condition	Crossing inlet/outlet condition	Potential eroded volume	Soil type	Road approach slope	Road approach surface material	Outlet condition	Ditch condition		
1	Paved	Brush Cr. at Sexton Bend Road	5	5	1	5	1	1	5	3	1	5	3	3	38	Moderate
2	Paved	Carroll Cr. at Ala. Hwy. 69	5	5	5	5	3	5	5	3	5	5	5	3	54	Low
3	Paved	Carroll Cr. at U.S. Hwy. 43	5	5	3	5	3	5	5	1	5	5	5	1	48	Low
4	Paved	Carroll Cr. at Rose Blvd.	1	1	3	3	3	5	5	3	5	5	3	3	40	Moderate
5	Paved	Carroll Cr. at Curt Rue Road	5	5	5	5	3	5	5	3	5	5	5	5	56	Low
6	Unpaved	Carroll Cr. at Curt Cunningham Road	5	5	1	5	5	3	3	3	1	5	5	5	46	Low
7	Paved	Turkey Cr. at Ala. Hwy. 69	5	5	3	3	5	5	5	5	5	5	5	3	54	Low
8	Paved	Pole Bridge Cr. at Holly Spring Road	3	1	1	1	3	1	5	3	1	5	5	5	34	High
9	Paved	Pole Bridge Cr. at Old Fayette Road	5	1	1	5	3	1	5	3	1	5	5	5	40	Moderate
10	Paved	Unnamed trib to Binion Cr. at Lesueur Road	5	5	3	5	1	3	5	3	1	5	3	5	44	Moderate
11	Paved	Dry Branch at Lesueur Road	5	5	5	5	3	3	5	3	1	5	5	5	50	Low
12	Unpaved	Gin Cr. at Harless Road	5	5	5	5	5	5	5	1	5	5	5	5	56	Low
13	Unpaved	Spenser Branch at Harless Road	5	5	5	5	1	5	1	3	1	5	5	5	46	Low
14	Paved	Binion Cr. at Old Fayette Road	5	5	5	5	3	5	5	1	5	5	5	5	54	Low
15	Unpaved	Wolf Cr. at Old Fayette Road	5	5	5	5	5	5	5	1	5	5	5	5	56	Low
16	Paved	Wolf Cr. at Billy Bigham Road	3	5	5	5	5	5	5	3	1	5	5	5	52	Low
17	Paved	Wolf Cr. at Graham Road	5	5	5	5	5	5	5	3	1	5	5	5	54	Low
18	Paved	Barbee Cr. at Co. Hwy. 38	5	5	5	5	5	1	5	3	5	5	5	5	54	Low
19	Paved	Barbee Cr. at Haygood Chapel Road	5	5	5	5	5	5	5	3	3	5	5	5	56	Low
20	Unpaved	Unnamed trib to Barbee Cr. at Dan Shelby Road	5	1	1	5	1	1	1	3	1	1	3	3	26	High
21	Unpaved	Unnamed trib to Barbee Cr. at Fondren Road	5	5	1	5	3	3	1	3	1	5	5	3	40	Moderate
22	Paved	Barbee Cr. at Fondren Road	5	5	5	5	3	5	5	3	1	5	5	5	52	Low
23	Paved	Barbee Cr. at Sherman Road	5	5	3	3	5	5	5	3	1	5	5	5	50	Low
24	Unpaved	Barbee Cr. at Grady Phillips Road	5	5	1	5	5	5	5	5	1	5	3	3	48	Low
25	Unpaved	Barbee Cr. at Joe Taylor Road	5	5	1	5	3	5	1	3	1	5	5	5	44	Moderate
26	Paved	Sam Norris Branch at Browns Road	5	3	5	5	3	3	5	3	1	5	3	3	44	Moderate
27	Unpaved	Binion Cr. at Browns Road	5	5	5	5	5	5	1	3	3	5	3	3	48	Low
28	Paved	Binion Cr. at Co. Hwy. 38	5	5	5	5	5	3	5	3	3	5	5	5	54	Low
29	Unpaved	Binion Cr. at Kemp Road	5	5	5	5	5	5	1	3	1	5	5	5	50	Low
30	Unpaved	Binion Cr. at Jones Mill Road	5	5	5	5	3	5	1	3	1	3	5	5	46	Low
31	Paved	Unnamed tributary to North River at John Swindle Road	5	5	5	5	5	5	5	3	5	5	5	5	58	Low
32	Paved	Unnamed tributary to North River at Co. Hwy. 63	5	5	5	5	5	3	5	5	3	5	5	5	56	Low
33	Paved	Unnamed tributary to North River at Co. Hwy. 38	5	5	5	5	5	5	5	3	3	5	5	5	56	Low
34	Paved	Cripple Cr. at Co. Hwy. 38	5	5	5	5	5	3	5	5	1	5	5	5	54	Low
35	Paved	Johnson Branch at Utley Loop Road	1	5	5	5	3	1	5	5	1	5	3	5	44	Moderate

Appendix B. Sedimentation risk index scores for stream crossings in the North River watershed.

Site No.	Road type	Site name	Sedimentation Risk Index (SRI) Assessment Metrics												SRI	Risk
			Waterway			Crossing structure			Road approaches I				Road appr. II			
			U/S channel morphology	D/S channel morphology	D/S channel/bank alteration	U/S culvert skew	Crossing fill condition	Crossing inlet/outlet condition	Potential eroded volume	Soil type	Road approach slope	Road approach surface material	Outlet condition	Ditch condition		
36	Paved	North River at Co. Hwy. 38	5	5	5	5	5	5	5	5	1	5	3	5	54	Low
37	Paved	Unnamed tributary to North River at Co. Hwy. 63	5	5	5	5	5	5	5	5	1	5	5	5	56	Low
38	Paved	Gin Branch at Co. Hwy. 40	1	5	5	5	5	5	5	3	1	5	5	5	50	Low
39	Paved	Bear Cr. at Oregonia Road	5	1	5	5	5	5	5	5	1	5	5	3	50	Low
40	Paved	Bear Cr. at Evanstown Road	1	1	3	5	1	5	1	5	1	5	3	5	36	High
41	Unpaved	Dry Branch at Sid Davis Road	5	5	5	5	1	1	3	5	1	5	3	3	42	Moderate
42	Paved	Boone Creek at Co. Hwy. 55	5	5	5	5	5	5	5	3	3	5	5	5	56	Low
43	Paved	Boone Creek at Co. Hwy. 63	5	5	5	5	5	5	5	3	1	5	5	5	54	Low
44	Unpaved	Boone Creek at Bill Lunceford Road	5	5	5	5	5	5	5	3	1	5	5	5	54	Low
45	Unpaved	Unnamed tributary to Boone Creek at Bill Lunceford Road	5	5	5	5	5	5	5	3	1	5	5	5	54	Low
46	Paved	Boone Creek at U.S. Hwy. 43	3	5	3	5	5	5	5	3	1	5	5	5	50	Low
47	Unpaved	Boone Creek at Logan Road	5	5	5	5	5	5	5	3	3	3	5	3	52	Low
48	Unpaved	Unnamed tributary to Boone Creek at New Hope Road	5	5	1	5	1	5	5	3	3	3	3	5	44	Moderate
49	Unpaved	Boone Creek at Freeman Creek Road	3	5	5	5	5	1	5	3	3	5	5	5	50	Low
50	Paved	Tyro Cr. at Old Jasper Hwy.	5	5	5	5	3	5	5	3	1	5	3	5	50	Low
51	Unpaved	Tyro Cr. at Upper Tyro Road	5	5	5	5	5	5	3	3	1	5	1	1	44	Moderate
52	Unpaved	Tyro Cr. at Madison Road	1	1	5	5	5	3	5	3	5	5	3	5	46	Low
53	Unpaved	Unnamed trib to Tyro Cr. at Madison Road	1	5	1	1	1	1	5	3	3	5	1	1	28	High
54	Paved	North River at Old Jasper Road	1	1	5	5	5	5	5	3	5	5	5	5	50	Low
55	Unpaved	Unnamed trib to North River at Willingham Road	5	5	3	5	3	3	1	5	1	5	3	1	40	Moderate
56	Paved	North River at Co. Hwy. 63	5	5	5	5	5	5	5	3	5	5	5	5	58	Low
57	Paved	Freeman Creek at U.S. Hwy. 43	5	5	5	5	3	1	5	3	1	5	5	3	46	Low
58	Paved	Intermittent stream at Co. Hwy. 68	5	5	5	5	5	3	5	3	1	5	5	5	52	Low
59	Unpaved	Freeman Creek at Freeman Creek Road	5	5	5	1	5	3	5	3	3	5	3	5	48	Low
60	Paved	Freeman Cr. at Co. Hwy. 68	5	5	5	5	3	5	5	3	1	5	3	5	50	Low
61	Paved	Freeman Cr. at Co. Hwy. 15	1	1	3	5	3	5	5	3	5	5	3	5	44	Moderate
62	Unpaved	Unnamed ephemeral trib to Freeman Cr. (1)	1	1	5	1	1	5	5	3	1	5	1	1	30	High
63	Unpaved	Unnamed ephemeral trib to Freeman Cr. (2)	5	5	3	5	3	1	5	3	1	5	5	5	46	Low
64	Paved	Unnamed trib to Freeman Cr. at Co. Hwy. 15	5	5	3	5	3	1	5	3	1	5	3	5	44	Moderate
65	Unpaved	Cedar Cr. at Flat Cr. Road	1	1	5	5	3	5	5	3	3	5	3	5	44	Moderate
66	Unpaved	Cedar Cr. at Madison Road	1	1	5	5	5	1	3	3	1	5	3	3	36	High
67	Paved	Little Cedar Cr. at Co. Hwy. 30	1	1	5	3	5	1	5	3	3	5	3	5	40	Moderate
68	Paved	Cedar Cr. at Co. Hwy. 46	1	1	5	5	5	5	5	3	3	5	5	5	48	Low
69	Paved	Pine Branch at Co. Hwy. 46	1	1	5	1	1	5	5	3	1	5	3	3	34	High
70	Paved	Sandy Point Creek at U.S. Hwy. 43	3	5	3	1	3	1	5	3	5	5	3	5	42	Moderate

Appendix B. Sedimentation risk index scores for stream crossings in the North River watershed.

Site No.	Road type	Site name	Sedimentation Risk Index (SRI) Assessment Metrics												SRI	Risk
			Waterway			Crossing structure			Road approaches I				Road appr. II			
			U/S channel morphology	D/S channel morphology	D/S channel/bank alteration	U/S culvert skew	Crossing fill condition	Crossing inlet/outlet condition	Potential eroded volume	Soil type	Road approach slope	Road approach surface material	Outlet condition	Ditch condition		
71	Paved	Sandy Point Cr. at Co. Hwy. 15	5	5	5	5	1	1	5	3	1	5	1	3	40	Moderate
72	Paved	Unnamed trib to Sandy Point Cr. at Co. Hwy. 26	5	5	5	5	5	5	5	3	1	5	1	5	50	Low
73	Paved	Sandy Point Cr. at Co. Hwy. 26	5	5	5	5	1	5	5	3	1	5	1	5	46	Low
74	Unpaved	Unnamed trib to Sandy Point Cr. (1)	1	1	1	5	3	3	5	3	1	5	3	3	34	High
75	Unpaved	Unnamed trib to Sandy Point Cr. (2)	5	5	5	5	1	5	3	3	1	5	3	1	42	Moderate
76	Unpaved	Sandy Point Cr. at unnamed road	1	1	5	5	1	5	5	3	1	5	1	1	34	High
77	Unpaved	Unnamed trib to Sandy Point Cr. (3)	1	1	1	5	1	1	5	3	1	5	1	1	26	High
78	Unpaved	Rocky Branch at Rocky Branch Road	1	1	3	5	1	5	3	3	1	5	1	1	30	High
79	Paved	North River at Ala. Hwy. 18	5	5	5	5	3	5	5	3	1	5	5	5	52	Low
80	Paved	Clear Creek at U.S. Hwy. 43	5	5	5	5	5	5	5	3	1	5	3	3	50	Low
81	Unpaved	Deadwater Cr. at Overhead Road	1	1	5	5	1	5	5	3	1	5	3	3	38	Moderate
82	Paved	Unnamed trib to Deadwater Cr. at U.S. Hwy. 43	1	1	3	5	3	3	5	3	1	5	3	5	38	Moderate
83	Paved	Unnamed trib to Deadwater Cr. nr. U.S. Hwy. 43	1	1	3	1	3	5	5	3	1	5	5	5	38	Moderate
84	Paved	Unnamed trib to Deadwater Cr. at Co. Hwy. 132	5	5	3	5	3	5	5	3	1	5	3	3	46	Low
85	Unpaved	Unnamed trib to Deadwater Cr. (Taylor intersection)	1	1	3	5	5	5	5	3	1	5	3	3	40	Moderate
86	Unpaved	Unnamed trib to Deadwater Cr. (West property)	1	1	3	5	3	3	5	3	5	5	3	3	40	Moderate
87	Unpaved	Unnamed trib to Deadwater Cr. (Taylor property)	1	1	1	5	3	5	5	3	3	5	1	5	38	Moderate
88	Unpaved	Unnamed ephemeral trib at Neal Road (1)	1	1	3	1	1	1	5	3	3	5	1	3	28	High
89	Unpaved	Unnamed ephemeral trib at Neal Road (2)	1	1	3	1	3	3	5	3	1	5	1	1	28	High
90	Unpaved	Unnamed trib to Deadwater Cr. at Overhead Road	1	1	3	3	1	1	5	3	1	5	3	3	30	High
91	Unpaved	Deadwater Cr. at Milton Smith Road (Bankston)	1	1	5	5	3	3	5	3	1	5	1	3	36	High
92	Paved	Unnamed trib to Deadwater Cr. at U.S. Hwy. 43	1	1	3	5	5	5	5	3	1	5	5	5	44	Moderate
93	Paved	Unnamed trib to Deadwater Cr. at Co. Hwy. 101	1	1	1	5	5	1	5	3	1	5	3	3	34	High
94	Paved	Unnamed trib trib NW Bankston at Heartline Road	1	1	5	1	5	3	5	3	1	5	5	5	40	Moderate
95	Paved	Deadwater Cr. NW Bankston at Heartline Road	1	1	1	5	3	1	5	3	1	5	5	5	36	High
96	Unpaved	Deadwater Cr. at Piney Grove Road	1	1	3	5	3	5	5	3	1	5	3	3	38	Moderate
97	Unpaved	Unnamed trib to Deadwater Cr. on Piney Grove Road	1	1	3	3	5	1	5	3	1	5	3	3	34	High
98	Paved	Clear Cr. at Co. Hwy. 93	1	1	5	5	5	5	5	3	1	5	3	5	44	Moderate
99	Unpaved	Clear Cr. at Lowery Road	1	1	3	5	5	5	5	3	1	5	3	3	40	Moderate
100	Unpaved	Unnamed trib to Clear Cr. at Hershel Henry Road	1	1	5	5	3	3	3	3	1	5	3	3	36	High
101	Unpaved	Unnamed trib to Clear Cr. (1)	5	1	5	1	1	5	5	3	1	5	1	1	34	High
102	Unpaved	Unnamed trib to Clear Cr. (2)	5	1	3	5	3	5	5	3	1	5	3	1	40	Moderate
103	Unpaved	Unnamed trib to Clear Cr. (3)	1	1	3	3	1	5	5	3	1	5	1	1	30	High
104	Paved	Boles Cr. at Co. Hwy. 67	1	1	3	5	3	1	5	3	1	5	5	5	38	Moderate
105	Unpaved	Boles Cr. at Fowler Road	1	1	5	5	3	5	5	3	5	5	3	3	44	Moderate

Appendix B. Sedimentation risk index scores for stream crossings in the North River watershed.

Site No.	Road type	Site name	Sedimentation Risk Index (SRI) Assessment Metrics												SRI	Risk
			Waterway			Crossing structure			Road approaches I				Road appr. II			
			U/S channel morphology	D/S channel morphology	D/S channel/bank alteration	U/S culvert skew	Crossing fill condition	Crossing inlet/outlet condition	Potential eroded volume	Soil type	Road approach slope	Road approach surface material	Outlet condition	Ditch condition		
106	Unpaved	Unnamed ephemeral tributary to Boles Cr. at Fowler Road	1	1	3	5	1	1	5	3	1	5	1	3	30	High
107	Unpaved	Unnamed trib to Boles Cr. at Fowler Road	5	1	1	5	1	5	5	3	1	5	1	1	34	High
108	Unpaved	Clear Cr. at Clear Cr. Road	1	5	1	5	5	5	5	3	1	5	1	3	40	Moderate
109	Unpaved	Unnamed trib to Clear Cr. at Deer Cr. Road	5	5	5	5	3	3	5	3	1	5	3	3	46	Low
110	Unpaved	Clear Cr. at Deer Cr. Road (steel culvert)	1	5	3	5	1	3	3	3	1	5	3	3	36	High
111	Paved	Clear Cr. at Ala. Hwy. 102	3	1	5	5	1	3	5	3	3	5	3	3	40	Moderate
112	Paved	North River at Co. Hwy. 30	1	1	5	5	5	3	5	3	5	5	3	5	46	Low
113	Unpaved	Ellis Cr. at Zion Road	1	1	3	5	3	3	5	3	1	5	3	3	36	High
114	Unpaved	Ellis Cr. at Morris Cr. Road	1	1	3	5	3	3	3	3	1	5	3	3	34	High
115	Paved	Cane Cr. at Co. Hwy. 63	5	1	1	5	3	3	5	3	5	5	3	5	44	Moderate
116	Paved	Cane Cr. at Co. Hwy. 125	1	1	5	5	3	1	5	3	1	5	3	3	36	High
117	Paved	Cane Cr. trib at Co. Hwy. 127	1	1	5	5	5	3	5	3	3	5	3	5	44	Moderate
118	Paved	Cane Cr. at Co. Hwy. 127	1	1	5	5	5	5	5	3	3	5	3	5	46	Low
119	Paved	Cane Cr. trib at Co. Hwy. 126	1	1	5	5	5	1	5	3	1	5	3	5	40	Moderate
120	Unpaved	Cane Cr. trib at Jenkins Cemetery Road (2)	5	1	3	1	1	1	5	3	3	5	1	1	30	High
121	Unpaved	Cane Cr. trib at Jenkins Cemetery Road (1)	1	1	1	1	1	3	5	3	1	5	3	3	28	High
122	Unpaved	North River at Jenkins Cemetery Road	1	1	5	5	1	5	5	3	1	5	3	3	38	Moderate
123	Unpaved	Beaver Cr. at Deavours Hill Road	1	1	5	5	1	5	3	3	1	5	1	1	32	High
124	Unpaved	Unnamed trib to Beaver Cr.	1	1	1	1	1	3	5	3	1	5	1	1	24	High
125	Paved	Beaver Cr. at Co. Hwy. 45	5	5	3	5	5	1	5	3	1	5	5	3	46	Low
126	Paved	Georges Cr. at Co. Hwy. 63	1	1	1	3	1	3	5	3	5	5	1	3	32	High
127	Paved	Georges Cr. trib at Co. Hwy. 63	1	1	5	3	3	3	5	3	3	5	3	5	40	Moderate
128	Unpaved	Unnamed trib to North River at Deavours Hill Road	1	1	1	3	1	5	3	3	1	5	1	1	26	High
129	Unpaved	Lowery Branch at Deavours Hill Road	1	1	5	5	5	5	5	3	1	5	3	3	42	Moderate
130	Paved	Hendon Cr. at Co. Hwy. 63	5	5	5	5	1	5	5	3	1	5	3	3	46	Low
131	Paved	Lick Cr. at Co. Hwy. 63	1	1	3	5	1	3	5	3	1	5	3	5	36	High
132	Unpaved	Tanyard Cr. at Jud Cook Road	1	1	5	5	3	3	5	3	1	5	3	3	38	Moderate
133	Paved	Tanyard Cr. at Ala. Hwy. 102	1	1	1	5	5	3	5	3	1	5	3	5	38	Moderate
134	Paved	Lick Cr. at Ala. Hwy. 102	5	1	1	5	5	3	5	3	1	5	3	5	42	Moderate
135	Paved	North River at Ala. Hwy. 102	1	1	3	5	5	5	5	3	1	5	5	5	44	Moderate

Appendix C

Potential sedimentation issues and recommended improvements for unpaved road – stream crossing sites in the North River watershed.

Appendix C. Potential sedimentation issues and recommended improvements for stream crossing sites in the North River watershed.

Site no.	Road type	Site name	Sediment basins	State/County highway r.o.w.	Stream crossing/ditch upgrades	Animal access	Riparian restoration	Fish barriers	Other issues (see comments)	Paved no issues	Unpaved no issues	Comments
1	Paved	Brush Cr. at Sexton Bend Road	X									Sed basins need to be installed on right u/s ditch.
2	Paved	Carroll Cr. at Ala. Hwy. 69								X		
3	Paved	Carroll Cr. at U.S. Hwy. 43								X		
4	Paved	Carroll Cr. at Rose Blvd.				X						Restrict cattle access to stream with fencing
5	Paved	Carroll Cr. at Curt Rue Road								X		
6	Unpaved	Carroll Cr. at Curt Cunningham Road	X									Add sed basins in left u/s road side ditch
7	Paved	Turkey Cr. at Ala. Hwy. 69								X		
8	Paved	Pole Bridge Cr. at Holly Spring Road							X			Lake filling in with sediment.
9	Paved	Pole Bridge Cr. at Old Fayette Road							X			Bridge is causing geomorphic changes d/s of bridge
10	Paved	Unnamed trib to Binion Cr. at Lesueur Road								X		
11	Paved	Dry Branch at Lesueur Road								X		
12	Unpaved	Gin Cr. at Harless Road									X	
13	Unpaved	Spenser Branch at Harless Road	X									Add sed basins in road side ditch. Turn out is going into woods away from creek
14	Paved	Binion Cr. at Old Fayette Road								X		
15	Unpaved	Wolf Cr. at Old Fayette Road									X	
16	Paved	Wolf Cr. at Billy Bigham Road								X		
17	Paved	Wolf Cr. at Graham Road	X									Sed basins need to be in place on left d/s road side ditch
18	Paved	Barbee Cr. at Co. Hwy. 38			X			X				Box culvert is a fish barrier during low flow events
19	Paved	Barbee Cr. at Haygood Chapel Road								X		
20	Unpaved	Unnamed trib to Barbee Cr. at Dan Shelby Road	X		X							Sed basins need to be in place due to bank instability
21	Unpaved	Unnamed trib to Barbee Cr. at Fondren Road								X		
22	Paved	Barbee Cr. at Fondren Road								X		
23	Paved	Barbee Cr. at Sherman Road								X		
24	Unpaved	Barbee Cr. at Grady Phillips Road								X		
25	Unpaved	Barbee Cr. at Joe Taylor Road								X		
26	Paved	Sam Norris Branch at Browns Road							X			Bank instability on left road approach
27	Unpaved	Binion Cr. at Browns Road									X	
28	Paved	Binion Cr. at Co. Hwy. 38								X		
29	Unpaved	Binion Cr. at Kemp Road									X	

Appendix C. Potential sedimentation issues and recommended improvements for stream crossing sites in the North River watershed.

Site no.	Road type	Site name	Sediment basins	State/County highway r.o.w.	Stream crossing/ditch upgrades	Animal access	Riparian restoration	Fish barriers	Other issues (see comments)	Paved no issues	Unpaved no issues	Comments
30	Unpaved	Binion Cr. at Jones Mill Road	X						X			Add sed basins, road material all sand. Power line right of way is washing
31	Paved	Unnamed trib to North River at John Swindle Road								X		
32	Paved	Unnamed trib to North River at Co. Hwy. 63								X		Significant bank erosion d/s of bridge
33	Paved	Unnamed trib to North River at Co. Hwy. 38						X				Fish barrier on box culvert
34	Paved	Cripple Cr. at Co. Hwy. 38								X		
35	Paved	Johnson Branch at Utley Loop Road	X		X			X				Add sed basins on left u/s road side ditches
36	Paved	North River at Co. Hwy. 38								X		
37	Paved	Unnamed trib to North River at Co. Hwy. 63								X		
38	Paved	Gin Branch at Co. Hwy. 40						X				Coalbed sed basin u/s of bridge
39	Paved	Bear Cr. at Oregonia Road								X		
40	Paved	Bear Cr. at Evanstown Road	X									Add sed basin on right u/s ditch
41	Unpaved	Dry Branch at Sid Davis Road	X									Sed basins needed on both sides of the road
42	Paved	Boone Creek at Co. Hwy. 55								X		
43	Paved	Boone Creek at Co. Hwy. 63								X		
44	Unpaved	Boone Creek at Bill Lunceford Road									X	
45	Unpaved	Unnamed trib to Boone Creek at Bill Lunceford Road										County has constructed sed basins
46	Paved	Boone Creek at U.S. Hwy. 43								X		Site of tornado damage and tree removal on banks
47	Unpaved	Boone Creek at Logan Road	X									Left ditch d/s needs sed basin
48	Unpaved	Unnamed trib to Boone Creek at New Hope Road					X	X				Poor fill condition, perched culvert, heavy animal use
49	Unpaved	Boone Creek at Freeman Creek Road						X				d/s culvert perched
50	Paved	Tyro Cr. at Old Jasper Hwy.								X		
51	Unpaved	Tyro Cr. at Upper Tyro Road	X									Sed basin could be placed on right d/s ditch and on left u/s ditch
52	Unpaved	Tyro Cr. at Madison Road									X	
53	Unpaved	Unnamed trib to Tyro Cr. at Madison Road	X		X			X				Culvert crossing is poorly constructed, cross fill is poor, 4 ft. culvert drop, add ditch check dams
54	Paved	North River at Old Jasper Road								X		
55	Unpaved	Unnamed trib to North River at Willingham Road	X									Sed basins need to be placed on right and left road side ditches
56	Paved	North River at Co. Hwy. 63								X		
57	Paved	Freeman Creek at U.S. Hwy. 43		X								Debris dam at u/s side of bridge
58	Paved	Intermittent stream at Co. Hwy. 68								X		

Appendix C. Potential sedimentation issues and recommended improvements for stream crossing sites in the North River watershed.

Site no.	Road type	Site name	Sediment basins	State/County highway r.o.w.	Stream crossing/ditch upgrades	Animal access	Riparian restoration	Fish barriers	Other issues (see comments)	Paved no issues	Unpaved no issues	Comments
59	Unpaved	Freeman Creek at Freeman Creek Road									X	Partial blockage of culvert with snags
60	Paved	Freeman Cr. at Co. Hwy. 68								X		
61	Paved	Freeman Cr. at Co. Hwy. 15						X				Fish barrier during low flow
62	Unpaved	Unnamed ephemeral trib to Freeman Cr. (1)	X		X							Add sed basins on right and left u/s and d/s ditches; ditches are bare soil
63	Unpaved	Unnamed ephemeral trib to Freeman Cr. (2)	X					X				Add sed basins on right d/s ditch; fish barrier
64	Paved	Unnamed trib to Freeman Cr. at Co. Hwy. 15								X		
65	Unpaved	Cedar Cr. at Flat Cr. Road									X	
66	Unpaved	Cedar Cr. at Madison Road	X									Sed basin needs to be placed on right d/s road ditch and right u/s ditch
67	Paved	Little Cedar Cr. at Co. Hwy. 30								X		
68	Paved	Cedar Cr. at Co. Hwy. 46						X				Fish barrier during low flow
69	Paved	Pine Branch at Co. Hwy. 46					X					Approach landowner to try and seed unstable hillside next to drainage ditch
70	Paved	Sandy Point Creek at U.S. Hwy. 43		X								Heavy sediment load in stream
71	Paved	Sandy Point Cr. at Co. Hwy. 15			X							Left u/s culvert is being scoured--will eventually compromise road
72	Paved	Unnamed trib to Sandy Point Cr. at Co. Hwy. 26								X		
73	Paved	Sandy Point Cr. at Co. Hwy. 26								X		
74	Unpaved	Unnamed trib to Sandy Point Cr. (1)	X									Add sed basins on right u/s ditch
75	Unpaved	Unnamed trib to Sandy Point Cr. (2)	X									Add sed basins on left d/s and u/s ditch
76	Unpaved	Sandy Point Cr. at unnamed road	X									Add sed basins on both sides of road
77	Unpaved	Unnamed trib to Sandy Point Cr. (3)	X		X							Add sed basins on right and left ditches--bare soil; culvert is damaged
78	Unpaved	Rocky Branch at Rocky Branch Road	X					X				Add sed basin on right and left d/s ditch; no flow through culvert during low flow
79	Paved	North River at Ala. Hwy. 18								X		
80	Paved	Clear Creek at U.S. Hwy. 43								X		
81	Unpaved	Deadwater Cr. at Overhead Road	X									Sed basins already in place
82	Paved	Unnamed trib to Deadwater Cr. at U.S. Hwy. 43		X								ALDOT has plan to straighten Hwy.
83	Paved	Unnamed trib to Deadwater Cr. nr. U.S. Hwy. 43								X		Site has good vegetated ditches and culvert is not damaged.
84	Paved	Unnamed trib to Deadwater Cr. at Co. Hwy. 132						X				Culvert outfall drop was 2 feet at time of survey

Appendix C. Potential sedimentation issues and recommended improvements for stream crossing sites in the North River watershed.

Site no.	Road type	Site name	Sediment basins	State/County highway r.o.w.	Stream crossing/ditch upgrades	Animal access	Riparian restoration	Fish barriers	Other issues (see comments)	Paved no issues	Unpaved no issues	Comments
85	Unpaved	Unnamed trib to Deadwater Cr. (Taylor intersection)	X			X	X					Possible cow crossing project; perhaps a small sed basin
86	Unpaved	Unnamed trib to Deadwater Cr. (West property)					X	X				Creek is on pasture land and could use improved riparian work
87	Unpaved	Unnamed trib to Deadwater Cr. (Taylor property)				X						Possible cow crossing project
88	Unpaved	Unnamed ephemeral trib at Neal Road (1)	X		X							Add sed basin and culvert needs to be replaced
89	Unpaved	Unnamed ephemeral trib at Neal Road (2)	X									Culvert is not crushed or altered; Add check dam to slow water in ditch
90	Unpaved	Unnamed trib to Deadwater Cr. at Overhead Road			X							Add an extra culvert to compensate for small culvert size that already is in place
91	Unpaved	Deadwater Cr. at Milton Smith Road (Bankston)	X									Most sediment from upstream; install sed basin on d/s right ditch
92	Paved	Unnamed trib to Deadwater Cr. at U.S. Hwy. 43	X	X				X				Fish barrier; small check dams could be installed in ditches to slow water
93	Paved	Unnamed trib to Deadwater Cr. at Co. Hwy. 101						X				Fish barrier and some headcutting
94	Paved	Unnamed trib trib NW Bankston at Heartline Road								X		
95	Paved	Deadwater Cr. NW Bankston at Heartline Road								X		
96	Unpaved	Deadwater Cr. at Piney Grove Road									X	
97	Unpaved	Unnamed trib to Deadwater Cr. on Piney Grove Road	X									Sed basin could be installed on left d/s ditch where road is washing
98	Paved	Clear Cr. at Co. Hwy. 93								X		
99	Unpaved	Clear Cr. at Lowery Road	X									Add sed basins on right u/s and d/s ditch
100	Unpaved	Unnamed trib to Clear Cr. at Hershel Henry Road	X					X				Sed basins already installed; slightly perched d/s of culvert; add sed basin on right d/s ditch
101	Unpaved	Unnamed trib to Clear Cr. (1)	X									Add sed basin d/s of culvert
102	Unpaved	Unnamed trib to Clear Cr. (2)	X									Add sed basin u/s left and right ditch
103	Unpaved	Unnamed trib to Clear Cr. (3)	X					X				Add sed basin d/s of culvert
104	Paved	Boles Cr. at Co. Hwy. 67						X				Box culvert is a fish barrier
105	Unpaved	Boles Cr. at Fowler Road	X									Sed basins need be installed and check dams installed in ditches to slow water
106	Unpaved	Unnamed ephemeral trib to Boles Cr. at Fowler Road	X		X							Severe sediment risk. Sed basins need to be installed; culvert is blocked and needs upgraded

Appendix C. Potential sedimentation issues and recommended improvements for stream crossing sites in the North River watershed.

Site no.	Road type	Site name	Sediment basins	State/County highway r.o.w.	Stream crossing/ditch upgrades	Animal access	Riparian restoration	Fish barriers	Other issues (see comments)	Paved no issues	Unpaved no issues	Comments
107	Unpaved	Unnamed trib to Boles Cr. at Fowler Road	X		X							Sed basins need to be installed; cross fill needs to be stabilized with riprap
108	Unpaved	Clear Cr. at Clear Cr. Road	X				X					Sed basins already installed; remove sediment cleanout material; add riparian cover on d/s left bank
109	Unpaved	Unnamed trib to Clear Cr. at Deer Cr. Road	X					X				Add sed basins u/s right and left ditch
110	Unpaved	Clear Cr. at Deer Cr. Road (steel culvert)						X				Add fish passage structure
111	Paved	Clear Cr. at Ala. Hwy. 102		X								Need to grass floodplain; improve silt fences, add riprap near box culvert
112	Paved	North River at Co. Hwy. 30								X		
113	Unpaved	Ellis Cr. at Zion Road	X									Sed basin needs to be installed in outlet; sock is in place in road side ditch.
114	Unpaved	Ellis Cr. at Morris Cr. Road	X									Sed basin needs to be installed in u/s right ditch and in outlets. Silt fence failure
115	Paved	Cane Cr. at Co. Hwy. 63								X		Recently replaced culverts
116	Paved	Cane Cr. at Co. Hwy. 125			X			X				Culvert is crushed on upstream side of crossing; fish barrier
117	Paved	Cane Cr. trib at Co. Hwy. 127						X				Fish barrier
118	Paved	Cane Cr. at Co. Hwy. 127								X		
119	Paved	Cane Cr. trib at Co. Hwy. 126	X		X							Culvert is above grade and needs replacing; sed basins in divert ditch
120	Unpaved	Cane Cr. trib at Jenkins Cemetery Road (2)			X							Add sed basins, culvert is damaged
121	Unpaved	Cane Cr. trib at Jenkins Cemetery Road (1)					X					Approach landowner for possible riparian work
122	Unpaved	North River at Jenkins Cemetery Road	X									Add sed basins, ditch is starting to head cut
123	Unpaved	Beaver Cr. at Deavours Hill Road	X									Add sed basins on d/s left ditch; improve outlets with vegetation
124	Unpaved	Unnamed trib to Beaver Cr.			X			X				Add sed basin on right d/s outlet; fish barrier
125	Paved	Beaver Cr. at Co. Hwy. 45			X							Culvert has failed-needs replacing
126	Paved	Georges Cr. at Co. Hwy. 63							X			Outlets need some vegetation to slow down water; sediment loading culvert recently replaced
127	Paved	Georges Cr. trib at Co. Hwy. 63								X		
128	Unpaved	Unnamed trib to North River at Deavours Hill Road			X			X				Damaged culvert; fish barrier

Appendix C. Potential sedimentation issues and recommended improvements for stream crossing sites in the North River watershed.

Site no.	Road type	Site name	Sediment basins	State/County highway r.o.w.	Stream crossing/ditch upgrades	Animal access	Riparian restoration	Fish barriers	Other issues (see comments)	Paved no issues	Unpaved no issues	Comments
129	Unpaved	Lowery Branch at Deavours Hill Road	X									Add check dam with riprap on left u/s ditch to slow water down
130	Paved	Hendon Cr. at Co. Hwy. 63			X			X				Box culvert is a fish barrier
131	Paved	Lick Cr. at Co. Hwy. 63							X			Cross fill needs to be stabilized with riprap or vegetation, etc.
132	Unpaved	Tanyard Cr. at Jud Cook Road	X									Add sed basin on right d/s ditch
133	Paved	Tanyard Cr. at Ala. Hwy. 102			X			X				Box culvert is a fish barrier
134	Paved	Lick Cr. at Ala. Hwy. 102			X			X				Box culvert is a fish barrier
135	Paved	North River at Ala. Hwy. 102								X		

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