KY 59/KY 344/KY 377 Planning Study
Final Report
January 2018

Prepared For

KENTUCKY TRANSPORTATION CABINET

Lewis and Rowan Counties
Item No. 9-231.00
KY 9 (AA Highway) in Vanceburg to KY 799 (Big Perry Road) in Triplett

Prepared by

QK4

KY 377


KY 377 Lewis/Rowan County Line


KY 344


KY 59


KY 59 on Vanceburg Hill

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Acronyms

ADT……..Average Daily Traffic
ALT……Short Segment of an Alternative
ATS……Average Travel Speed
BA…….. Biological Assessment
BTADD……Buffalo Trace Area Development District
CAAA…….. Clean Air Act Amendment
CCRF…….. Critical Crash Rate Factor
CE……..Conservation Easement
CFR…….. Code of Federal Regulations
DBNF…….. Daniel Boone National Forest
EJ……Environmental Justice
EMS…….. Emergency Medical Services
FE……..Federal Endangered (species)
FILO…….. Fees In-Lieu Of
GADD…….. Gateway Area Development District
HAZMAT……Hazardous Material
IRI…….. International Roughness Index
KDFWR……..Kentucky Division of Fish and Wildlife Resources
KDOW…… Kentucky Division of Water
KHC……..Kentucky Heritage Council
KSNPC…….. Kentucky State Nature Preserves Commission
LOS…….. Level of Service
L'Trans…….. Lewis Trans Service
Mor'Trans…….. Morehead Transit
MP……Milepoint
MSAT……..Mobile Source Air Toxics
NAAQS…….. National Ambient Air Quality Standards
NEPA…….. National Environmental Policy Act
NRCS…….. Natural Resource Conservation Service
NRHP……..National Register of Historic Places
OSA……..Office of State Archaeology
PM 2.5……Particulate matter 2.5 microns or smaller in size (a potential air pollutant)
PTSF……..Percent Time Spent Following
ROW……Right of Way
USACE…… United States Army Corps of Engineers
USDA…….. United States Department of Agriculture
USDOT……U.S. Department of Transportation
USFWS……United States Fish and Wildlife Services
V/C……Volume to Capacity Ratio
VPD……..Vehicles per Day

Executive Summary

Introduction

The purpose of this planning study is to examine alternative concepts to improve safety, travel time, and regional connectivity from Vanceburg to Morehead, Kentucky, for access to medical, educational, and shopping destinations and to I-64. The KY 59/KY 344/KY 377 corridor (approximately 26 miles) is the only direct highway connection between these two cities. The project study area is shown in **Figure ES 1**. The study area varied in width from approximately 1,500 feet along KY 377 to 3,500 feet near the KY 377/KY 344 and KY 344/KY 59 intersections. Due to terrain along KY 59 and possible connections to KY 9 in Vanceburg, the study area was widened to approximately 2.80 miles at the north end of the project. KY 377 in Rowan County, between KY 32 north of Morehead, and KY 799 at Triplett, is already programmed as a two-lane improvement (Item Number 9-8406.00).

Project Purpose and Need

Given the existing conditions and early public and local officials input, the project purpose and need was refined. The purpose of the project is to:

> *... improve safety and travel time and provide reliable system connectivity from Vanceburg to Morehead for access to medical (St. Claire Regional Medical Center), educational [Morehead State University, Rowan County Branch of Maysville Community & Technical College (CTC)] and shopping destinations (Kroger, Lowe's, Wal-Mart, etc.) and to enhance connectivity between I-64 in Rowan County and KY 9, the AA-Highway in Lewis County. The travel routes from Vanceburg to Morehead consist of KY 59, KY 344, KY 377, and KY 32 which collectively serve as the most direct route between the cities of Vanceburg and Morehead. KY 9, the John Y. Brown AA Highway (KY 9), and I-64 provide major 4-lane east-west corridors in northeastern Kentucky. However, there is no modern north-south connection, built to current design standards, linking KY 9 in or near Vanceburg (or all of Lewis County), with I-64. The current network of roads is substandard and includes areas that frequently flood, and others with poor drainage, failing shoulders, poor sight distance, limited passing opportunities, narrow bridges, and substandard intersections and horizontal and vertical curves. Providing a route addressing these conditions would improve travel time and provide reliable system connectivity between KY 9/Vanceburg and Morehead.*

The need derives from narrow lanes (nine to 11 feet) and shoulders (90% are two feet or less), as well as numerous horizontal (75) and vertical (69) curves that do not meet today's highway design standards for 55 mph. Travel speeds average less than 55 mph (46 mph), and passing opportunities are infrequent (no passing 50% in Rowan County and 95% in Lewis County). Crash clusters occur near the northern and southern ends of the corridor. The corridor has flooding and slope stability issues along with shoulder drop offs.

The shortest route between Morehead and Vanceburg uses 26 miles of the study corridor. The 2040 forecasted average travel time is 36.40 minutes between the northern and southern termini. If the entire roadway is built to current design standards with passing lanes at strategic locations, it is estimated that overall travel time would be reduced by approximately 6 minutes, to 30.41 minutes. This is a substantial savings in time, especially for emergency service vehicles, school buses, and other public services. Additionally, a rebuilt corridor would improve safety by reducing crashes, and improve travel time and mobility by addressing flooding and maintenance issues.

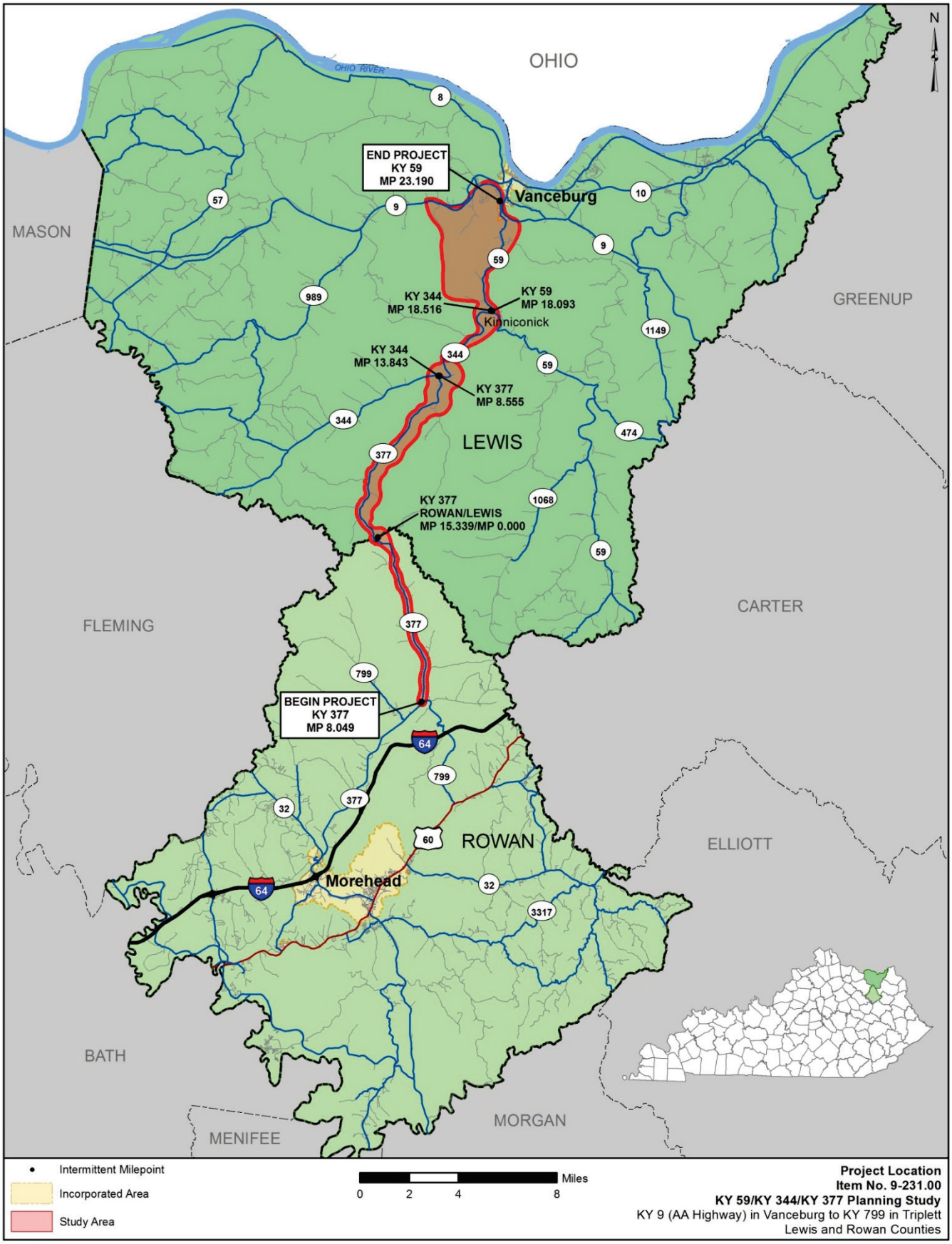


Figure ES 1: Study Area

Project Goals

The Project Team identified the following goals for this project:

- Reconstruct the corridor to current design standards for rural context, similar to other planned or recently constructed road projects in the area.
- Provide a continuous corridor by improving and realigning the KY 377/KY 344 and KY 344/KY 59 intersections.
- Avoid and/or minimize environmental impacts.

Existing Conditions and Future Traffic

KY 377, KY 344, and KY 59 have rolling terrain, are functionally classified as Rural Major Collectors and State Secondary Routes for maintenance purposes, and are characterized by travel lanes between nine- and 11-feet-wide with two- to three-feet-wide shoulders**.** Existing conditions are described as follows and illustrated in **Figure ES 2**.

KYTC District 9 staff identified nine locations along the corridor having recurring maintenance issues. There are also a significant number of locations where shoulder failures have occurred. Railroad steel (T-rail) retaining walls (using steel posts), varying in length and height, are along existing KY 377, KY 344 and KY 59. These types of walls were installed as a mitigation measure to help stabilize the roadway embankment adjacent to waterways. These walls may need to be replaced with cast-in-place concrete walls, mechanically stabilized earth walls, or other retaining structures if any build alternatives or spot improvements are advanced to future project development phases. In areas where stream bank stabilization appears to be a problem (e.g. outside bends), stream stabilization techniques may be employed to reduce stream bank erosion and scour.


KY 377 Landscape

Sheltowee Trace Trailhead


Lewis/Rowan County Line

KY 377

KY 377 in Rowan and Lewis counties is 15.8 miles in length, carries a range of 380 to 1,300 vehicles per day (vpd) and operates at LOS D (see **right**). It is projected to carry 480-1,500 vpd in the design year 2040 and is expected to operate at LOS E due to narrow lanes and shoulders and a low average travel speed (ATS). Along its length; there are multiple shoulder drop-offs and 68 horizontal and vertical curves that do not meet 55 mph design criteria. Most are between Cooper Fork and KY 344 in Lewis County. Three structures are considered functionally obsolete, all having a sufficiency rating exceeding 60. There are two 0.1 mile high-crash spot locations in Rowan County, one just south of Brookside Drive (MP 9.7–9.8) and another just north of Dry Branch Road near Elk Lick Road (MP 10.6–10.7). The Daniel Boone National Forest (DBNF) lies on either side of KY 377; the Sheltowee Trace National Trail skirts the Rowan/Lewis county line where the corridor

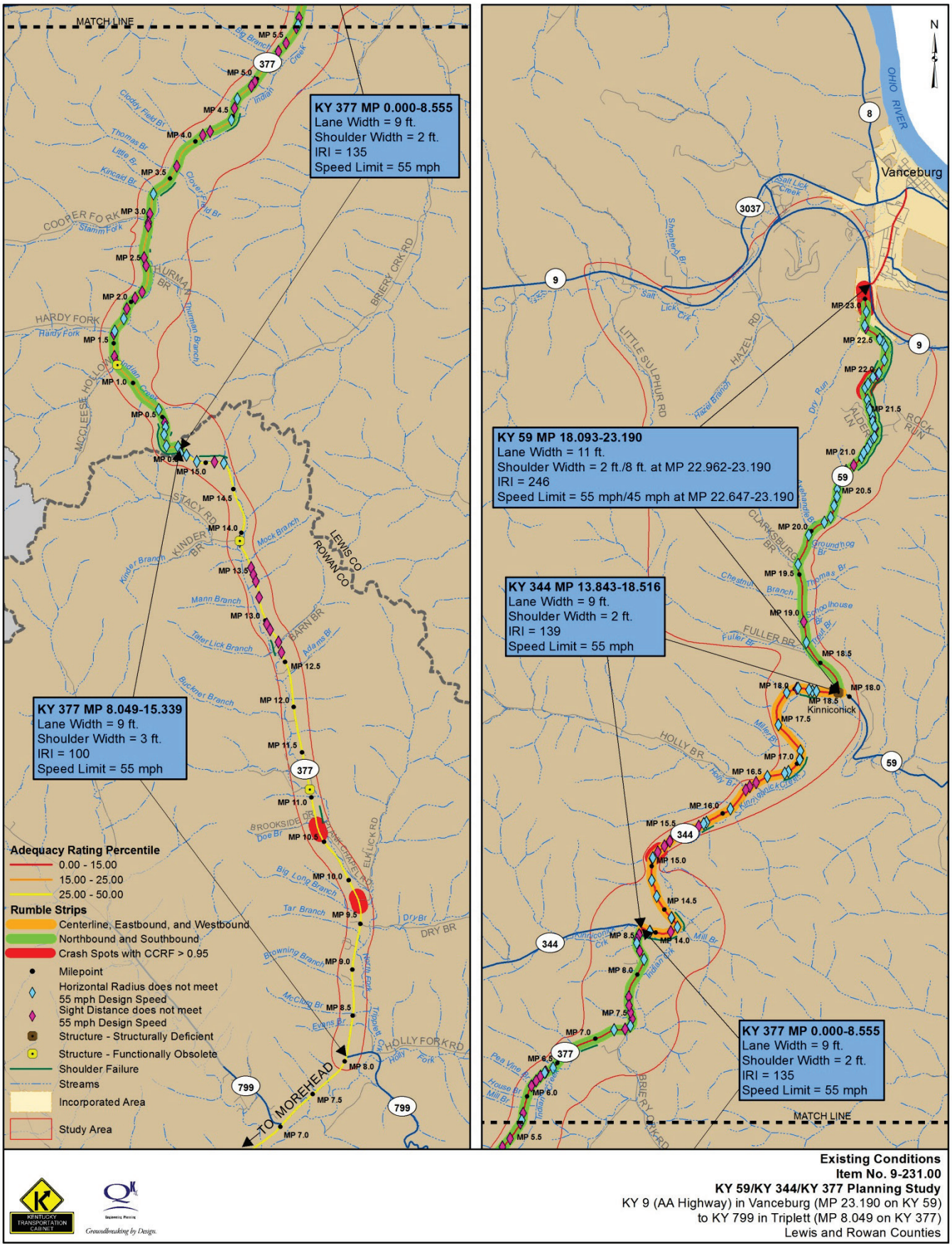
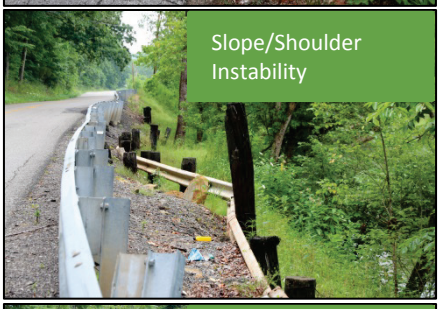


Figure ES 2: Existing Conditions


Bridge Rail (struck multiple times by trucks)


Slope/Shoulder Instability


Lewis County Park

terrain becomes rugged with multiple substandard curves. In addition, the Sheltowee Trace has a trailhead on KY 377. Potentially historic structures dot the corridor and a major pipeline parallels KY 377 in the south. Also at MP 1.3 in Lewis County, there are three natural gas line crossings.

KY 344

KY 344 is 4.67 miles in length, carries 700 vpd, and operates at LOS C. In 2040, KY 344 is projected to carry 900 vpd and operate at LOS C. It has 34 horizontal and vertical curves that do not meet 55 mph design criteria. There is one 0.1 mile high-crash spot location between MP 15.1 and MP 15.2 (2 crashes). One structure over Grassy Branch at the KY 59/KY 344 intersection (MP 18.481) in Lewis County is structurally deficient with a sufficiency rating of 49.4. Tractor trailers traveling south on KY 59 turning west onto KY 344 have hit the narrow bridge railing numerous times because of the bridge proximity to the intersection (see **left**).

Indian Creek runs north along KY 344 until its intersection with KY 59 where it meets Kinniconick Creek (designated as an Outstanding State Resource Waters (OSRW), Exceptional Waters, and Reference Reach Waters). Any impacts to this stream may require permits from the U.S. Army Corps of Engineers (USACE) and the Kentucky Division of Water (KDOW).

A protected five-mile stream mitigation site (Kinniconick and Indian Creeks) is located at the KY 377/KY 344 intersection. This site is permanently protected through the implementation of a conservation easement which places permanent restrictions on its use. The Lewis County Park is also along KY 344. This park received Land and Water Conservation Funds which may require avoidance or mitigation measures.


Slope Instability along Vanceburg Hill


Stream near KY 59 and 344 Intersection


Slope Instability and Cribbing

KY 59

KY 59 is 5.10 miles in length, carries between 1,180 and 2,200 vpd, and operates at LOS C except at Vanceburg Hill, where it operates at LOS D. In 2040, KY 59 is projected to carry 1,515-2,700 vpd and will continue to operate at LOS C but drops to LOS E over Vanceburg Hill. It has 42 horizontal and vertical curves that do not meet 55 mph design criteria (see **right**). The terrain becomes rugged from Vanceburg Hill near Clarksburg Branch (MP 19.704) to approximately Leslie Street (MP 22.488). On Vanceburg Hill the vertical grade exceeds nine percent. A segment crash analysis shows four 0.1-mile high-crash spot locations between MP 21.8 and 23.1. Along this corridor, Vanceburg Hill is the number one

priority with local officials and KYTC District 9 staff. No structures are considered functionally obsolete or structurally deficient.

In 2040, the KY 377/KY 799, KY 377/KY 344, and KY 344/KY 59 intersections are projected to operate at LOS A or B. The KY 9/KY 59 intersection northbound left would operate at LOS F and the northbound through/right would operate at LOS D due to left turns from KY 59. However, the queue length is only four vehicles.

Crashes

During a five-year period (January 1, 2009 to December 31, 2013), there were 91 crashes on the KY 59/KY 344/KY 377 corridor between KY 799 in Rowan County and KY 9 in Lewis County; 26 (29%) resulted in one or more injuries. Sixty-three of the study corridor crashes (nearly 70%) involved only one vehicle with 29 of those indicated as "Ran Off Roadway," 22% of which occurred in a curve. Using Kentucky Transportation Center (KTC) methodology for crash analysis, statistical calculations resulting in a Critical Crash Rate Factor greater than or near 1.0 indicates a potential crash concern. Those 0.1-mile high-crash locations are shown in **Figure ES 2 (p. ES4)**.

Environmental Concerns and Resource Agency Coordination

An environmental overview was conducted for this study. A host of environmental resources were studied, but the ones that provide project- and alignment-specific concerns are summarized in this section along with resource agency comments. More information about each resource studied, other agency comments, and accompanying exhibits can be found in Section 7.0 Environmental Overview of the Full Report.

Daniel Boone National Forest (DBNF)

The DBNF straddles KY 377 in Rowan and Lewis counties and will necessitate special considerations.

Kinniconick Creek and Indian Creek

Kinniconick Creek flows northeastward in the northern portion of the study area and has the following designations: Outstanding State Resource Waters (OSRW), Exceptional Waters, and Reference Reach Waters. Stream impacts would require permits from the U.S. Army Corps of Engineers (USACE) and the Kentucky Division of Water (KDOW).

A 5.2-mile stream mitigation site of Kinniconick and Indian Creeks is located near the KY 377/KY 344 intersection that includes a conservation easement. A stream mitigation site is a stream that has been restored, established, enhanced or preserved for the purpose of providing compensation for unavoidable impacts to resources permitted under Section 404 of the Clean Water Act. Impacts to this area should be avoided.

Portions of KY 344 south of the Kinniconick community lie within the 100-year floodplain of Kinniconick Creek. Members of the public identified two areas along KY 344 (MP 17.2 and MP 17.5) that are noted for continual flooding.

During agency coordination, the U.S. Army Corps of Engineers requested an early planning meeting concerning the impacts to Kinniconick Indian Creek mitigation site. The Kentucky Division of Water

(KDOW) noted the status of Kinniconick Creek as an Outstanding State Resource Waters (OSRW) and advised that habitat and water quality should not be degraded. KDOW stated the need to avoid or minimize impacts to Kinniconick Creek and a Kentucky Division of Fish and Wildlife Resources (KDFWR) stream restoration project (located around the KY 377/KY 344 intersection) as alternatives are developed.

Lewis County Park

Lewis County Park, adjacent to KY 344 near MP 15.7, is a Section 4(f) site, and has received Section 6(f) funds (Land and Water Conservation Funds). During the Design phase, this site should be avoided if possible; if not, efforts to minimize impacts to the park must be considered. Due to possible Section 4(f) impacts, the County must put in writing that any use to the park will not have an adverse effect. Due to Section 6(f) concerns, any taking of 6(f) land must be replaced with adjacent property from the the same area.

Sheltowee Trace

The Sheltowee Trace begins on KY 377 at the trailhead and follows the Rowan/Lewis County line. The Sheltowee Trace is also a designated recreation area and will be afforded some level of protection under Section 4(f).

Geotechnical Concerns

Due to mountainous terrain, geotechnical concerns will be a major factor during the design phase. Ohio and Sunbury shales are present and are known acidic stratums in the northern part of the corridor along KY 59. Particular attention should be given to the design of cut slopes and embankments near existing formations. Several landslides have been noted along the existing alignments of KY 59 and KY 344. Additional costs will be associated with design and mitigation of these slide areas if disturbed. Numerous railroad retaining walls exist along KY 59, KY 344, and KY 377. These walls should be surveyed and evaluated. Depending on the selected alignment, the affected walls will likely require repairs and/or replacement. Additional costs could be incurred for repair/replacement of these walls. Oil and gas wells have been drilled near/along the study corridor.

Alternatives Development

Numerous meetings were held involving the Project Team, local officials/stakeholders, and the public. Input received at these meetings guided the development and screening of alternatives. Design criteria used to develop alternatives in the project corridor, with the exception of improvements to Vanceburg Hill, are consistent with the proposed section for Item 9-8406.00 [KY 377 reconstruction from KY 32 (Flemingsburg Road) to KY 799 (Big Perry Road)]. The typical section used is shown in **Figure ES 3**.

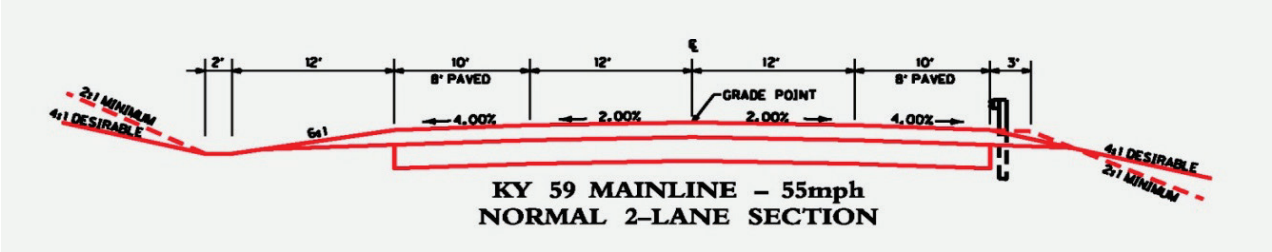


Figure ES 3: Typical Section

The corridor was divided into five manageable sections to examine two total reconstruction alternatives and 45 mph spot improvements. An early screening process eliminated many alternatives further from the existing corridor and the following concepts were carried forward.

- Sections 1 and 2—two reconstruction alternatives along or near KY 377 were examined for widening existing KY 377.
- Section 3—due to horizontal and vertical curves not meeting current design criteria near the Rowan/Lewis county line, DBNF, Sheltowee Trace and trailhead, multiple alternative corridors were studied both on and off the existing alignment.

  KYTC District 9 staff met with representatives of the Sheltowee Trace Association on September 20, 2017 to provide a project update and discuss impacts this study, in particular Section 3, could have on the Trace. Representatives agreed Alt 3D-1 would be the most favorable due to its compatibility with the Trace's long-term plans to extend the trail toward Jenny Wiley Trail in South Portsmouth Kentucky. In addition, the remaining Section 3 Alts would be acceptable if impacts to the trail are properly mitigated to allow the trailhead to function as it currently does. KYTC agreed to mitigate impacts to the trailhead. If Alt 3A-1 is preferred, KYTC agreed a section of KY 377 would remain in place to provide access to the existing trailhead or some other form of mitigation considered.
- Section 4 (KY 377 and a portion of KY 344)—two alternative corridors and spot improvements were examined to minimize flooding and impacts to Lewis County Park. Due to the desire to have a continuous corridor, the KY 377/KY 344 intersection was also modified to eliminate the stop condition and minimize or eliminate impacts to the KDFWR mitigation site.
- Section 5, south of the KY 344/KY 59 intersection north to KY 9—two alternatives were examined to again provide for a continuous corridor. Near MP 16.5, multiple alternative corridors for reconstruction were examined both on and off existing KY 59.

For each of these five sections, a screening process was performed that included numerous section and alternative combinations as discussed in the Full Report and illustrated on **Figure ES 4**. The report also addresses the No-Build/Do-Nothing Alternative, which was used as a means of comparison for future conditions with and without reconstructing the roadway corridor, and is summarized in the following sections.

No-Build Alternative

The purpose of this project is to improve safety, travel time, and regional connectivity from Vanceburg to Morehead for access to medical, educational, and shopping destinations and to I-64. The No-Build or Do-Nothing Alternative does not satisfy the purpose and need as only regular maintenance of KY 59,

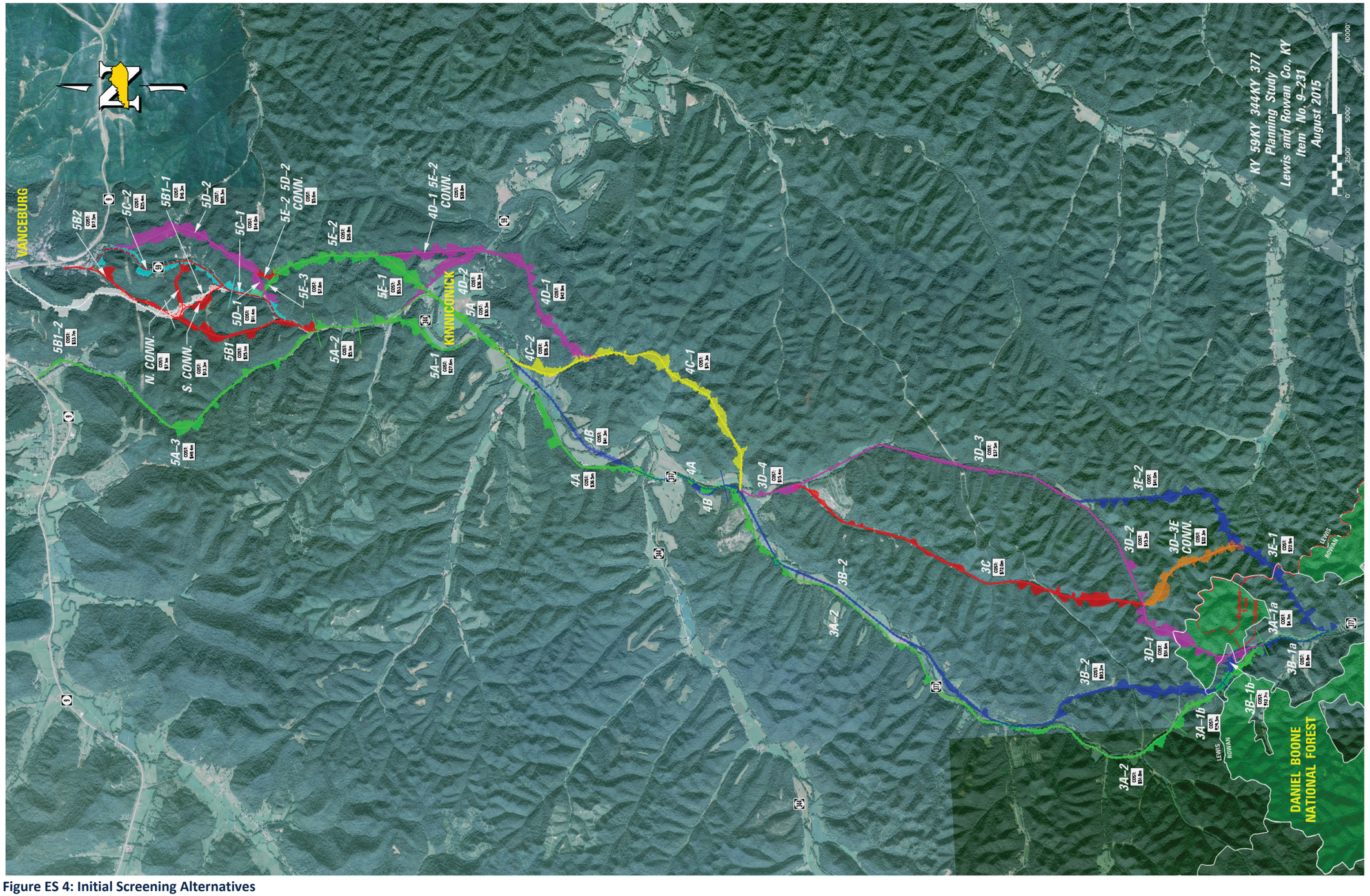


Figure ES 4: Initial Screening Alternatives

KY 344 and KY 377 would take place. The No-Build Alternative would not improve substandard conditions or travel time, nor result in a road facility build to current design standards that are appropriate for the rural setting.

Comparing the 2040 No-Build versus 2040 Build Alternatives **(Table ES 1)**, corridor travel time, average travel speeds, and percent time spent following (KY 59 and Vanceburg Hill only) improve with a Build Alternative. According to the travel demand model, improvements will not generate more traffic in the corridor; and therefore, there would not be any anticipated adverse impacts from induced traffic volumes.

Table ES 1: No-Build (Do-Nothing) vs. Build Alternatives

Alternative	2040 Improved Average Travel Speed (mph)	2040 Improved Percent Time Spent Following	2040 Improved LOS No-Build vs. Build	2040 Improved Total Corridor Travel Time (minutes/vehicle)
Entire Corridor	4–10	KY 377/KY 344–0% KY 59–11.1%	E vs. C–KY 377 C vs. B–KY 344 C vs. C–KY 59	6.0
Vanceburg Hill Only	7–10	4.7%	E vs. C–Vanceburg Hill	1.6

Regarding safety, proposed improvements with the Build Alternatives are anticipated to reduce traffic crashes by 15% to 50% depending on the improvements (i.e., wider shoulders, better sight distances, etc.). These safety improvement benefits would not be realized with the No-Build Alternative. Safety is also a major component of the purpose and need for the project. Wider lanes and shoulders, improved ditches, and improved geometry (whether 45 or 55 mph) will enhance safety for the traveling public.

Spot Improvements

Given horizontal and vertical curves not meeting current design standards, recurring maintenance issues, high-crash locations, shoulder failures, local official and public input, and the major investment of total reconstruction, spot improvements were also identified along the corridor. Spot improvements were given an associated name known to the communities along the corridor and are shown on **Figure ES 5**.

Cost Estimates

Total reconstruction and spot improvement cost estimates and impacts were quantified, compared, and discussed at Project Team Meetings and presented to the public at the last round of public involvement. All spot improvements meet 45 mph design criteria and total $99.4 million. The total reconstruction cost to improve the entire corridor to 55 mph design criteria, except along Vanceburg Hill, ranges from $226 to $284 million.

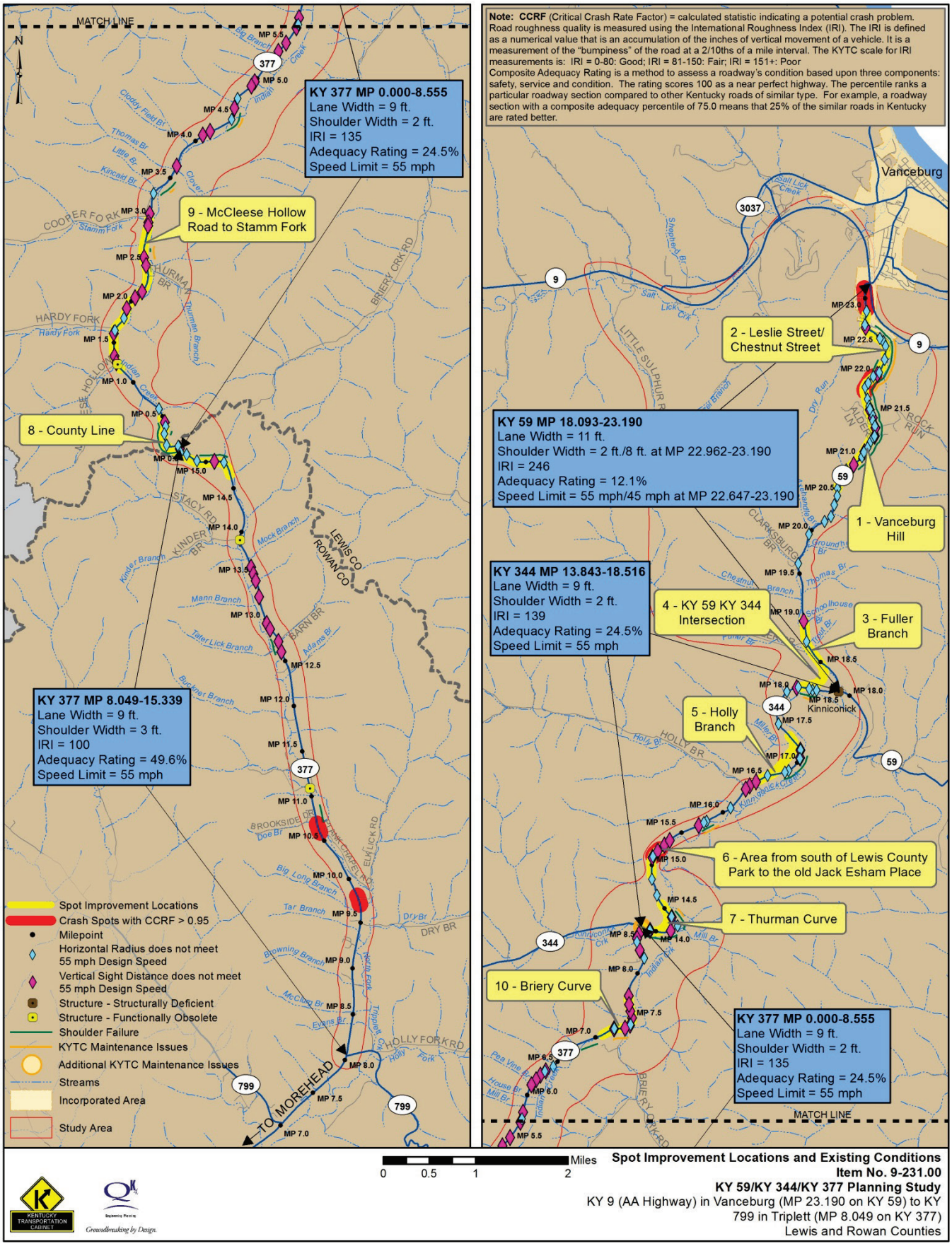


Figure ES 5: Spot Improvement Locations

Recommendations

Priorities for alternatives to be advanced to the next project development phase were agreed to by the Project Team and should be based on available funding and design considerations. Each priority has options with at least one total reconstruction alternative and one spot improvement. The Alternatives to be considered are shown in **Figure ES 6**. The No-Build (Do-Nothing) Alternative should be a consideration with each priority.

Priority 1–Vanceburg Hill (near MP 19.5 to KY 9 AA Highway) – Section 5

As a section of independent utility with logical termini, conduct Phase I design and NEPA documentation from KY 344 to KY 9 (AA Highway). The benefits for total reconstruction include improved safety and travel time, reduced KYTC maintenance costs, and a truck climbing lane in both directions to help with speed differential.

At this stage there is not enough information to make a recommendation for a preferred alternative, as each has benefits and impacts that should be analyzed in more detail in design. Given the project's rough terrain, it is expected geotechnical findings will significantly impact all alternatives and associated costs. The estimated cost of alternatives/spot improvements for Priority 1 range from $6.3 million to $64.0 million.

1) From MP 19.5 to MP 23.0
    - ALTS 5C-1, 5B1-1, AND 5B1-2 ($64.0 million)
    - ALTS 5C-1 AND 5C-2 ($39.4 million)
    - ALTS 5B1, 5B2 and North Connector ($49.7 million)
    - ALTS 5C-1, 5B1-1, AND 5B2 ($47.8 million)
    - ALTS 5B1 AND 5B2 ($42.6 million)

2) From MP 20.7 to MP 23.0
    - ALTS 5B1-1 and 5B1-2 ($50.0 million)
    - ALT 5C-2 ($25.4 million)
    - ALTS 5B1-1 and 5B2 ($33.8 million)

3) Spot improvements within Priority 1
    - Spot Improvement 1–Vanceburg Hill ($21.6 million)
    - Spot Improvement 2–Leslie Street/Chestnut Street ($6.3 million)

Priority 2–KY 59/KY 344 Intersection–Section 5

This priority replaces a structurally deficient bridge and realigns the intersection of KY 344 and KY 59 to meet one of the project goals for a continuous corridor between Vanceburg and Morehead. There are considerable slope/shoulder stability issues on KY 344 between MP 18.1 and MP 18.2. This section of roadway is adjacent to Kinniconick Creek and fronts the "Kinniconick Hotel." There are also numerous substandard horizontal and vertical curves along with flooding that each improvement would correct. The estimated costs for Priority 2 range from $2.5 million to $30.3 million.

- ALT 5A ($30.3 million)
- Spot improvements within Priority 2
    - Spot Improvement 3–Fuller Branch ($2.5 million)
    - Spot Improvement 4–KY 59/KY 344 intersection ($17.7 million)

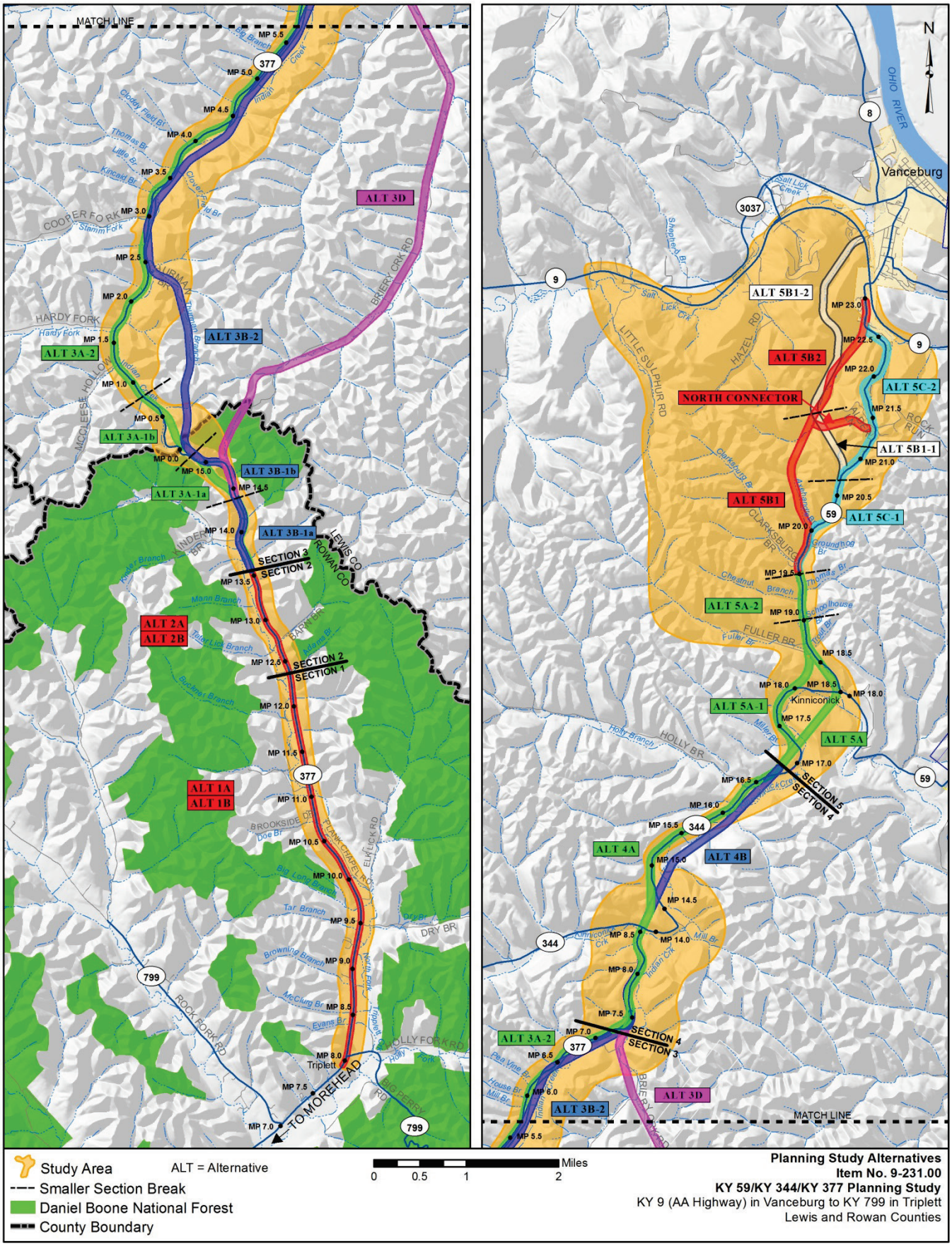


Figure ES 6: Recommended Alternatives

Priority 3–5A-2–Section 5

ALT 5A-2 would complete Section 5, from south of KY 344 (approximately MP 16.5) to KY 9/AA Highway. ALT 5A-2 is along existing KY 59 just north of the KY 344/KY 59 intersection. This section currently has 11-foot-wide lanes, generally 2-foot-wide shoulders, and one sag vertical curve that does not meet sight distance for 55 mph design criteria. The estimated cost for Priority 3 is $5.1 million.

- ALT 5A-2 ($5.1 million)

Priority 4–KY 344–Section 4

This section was chosen due to recurring slope/shoulder stability maintenance issues (between MPs 14.3–14.4 and MPs 15.7–15.9), a high crash spot location (MP 15.1–15.2), a flooding issue, and substandard horizontal and vertical curves. The estimated cost of alternatives/spot improvements for Priority 4 ranges from $2.6 million to $41.3 million.

- ALT 4A ($36.5 million)
- ALT 4B ($41.3 million)
- Spot improvements within Priority 4
  - Spot Improvement 5–Holly Branch ($11.0 million)
  - Spot Improvement 6–Area from south of Lewis County Park to the old Jack Esham Place ($2.6 million)
  - Spot Improvement 7–Thurman Curve ($7.7 million)
  - Spot Improvement 10–Briery Curve (could be in Section 3 or 4) ($4.6 million)

Sections 1, 2, and 3 are beyond foreseeable funding and therefore are considered long-term projects.

I. Corridor Overview

The purpose of this planning study is to examine alternative concepts to improve safety, travel time, and regional connectivity from Vanceburg to Morehead, Kentucky, for access to medical, educational, and shopping destinations and to I-64. The KY 59/KY 344/KY 377 corridor (approximately 26 miles) is the only direct highway connection between these two cities. The project study area was defined early on and is shown in **Figure 1 (p. 2)**. The corridor study although named the KY 59/KY 344/ KY 377 Planning Study, is described from south to north due to the way the routes are identified by milepoint. The study area varies in width from approximately 1,500 feet along KY 377 to 3,500 feet near the KY 377/KY 344 and KY 344/KY 59 intersections. Due to terrain along KY 59 and possible connections to KY 9 in Vanceburg, the study area was widened to approximately 2.80 miles at the north end of the project. All milepoints (MP), lengths, alternatives, and spot locations are approximate for purposes of this study.

KY 377 in Rowan County, between KY 32 just north of Morehead and KY 799 at Triplett, is already programmed as a two-lane improvement (Item Number 9-8406.00).

A. Project Goals

The Project Team identified the following goals for this project:

- Reconstruct the corridor to current design standards fitting for the rural context, similar to other planned or recently constructed road projects in the area.
- Provide a continuous corridor by improving and realigning the KY 377/KY 344 and KY 344/KY 59 intersections.
- Avoid and/or minimize environmental impacts.

B. Project Setting

Much of Rowan County is part of the Daniel Boone National Forest (DBNF), located along the Cumberland Plateau in the Appalachian foothills of Eastern Kentucky. The forest encompasses over 700,000 acres of mostly rugged terrain. The land is characterized by steep, forested ridges dissected by narrow ravines and over 3,400 miles of sandstone cliffs. The DBNF is one of the most heavily used forests in the South, with over 5 million visitors annually. The U.S. Forest Service considers the 290-mile Sheltowee Trace National Recreation Trail the "backbone" of the forest's trail system.[1] According to the Sheltowee Trace Association, "the Sheltowee Trace National Recreation Trail is a significant national resource for the enjoyment of hikers, bikers and equestrians, and for the value that wild and scenic lands provide to all people."[2]

The city of Morehead was named for James Morehead, Kentucky's first native-born governor (1834–1836). The estimated 2015 population of Morehead was 7,045.

Lewis County was formed from a portion of Mason County in 1806, and is named in honor of explorer Meriwether Lewis of the famed Lewis and Clark Expedition. It has the thirteenth largest area of

[1] http://www.fs.usda.gov/recarea/dbnf/recarea/?recid=70839
[2] http://www.sheltoweetrace.org/

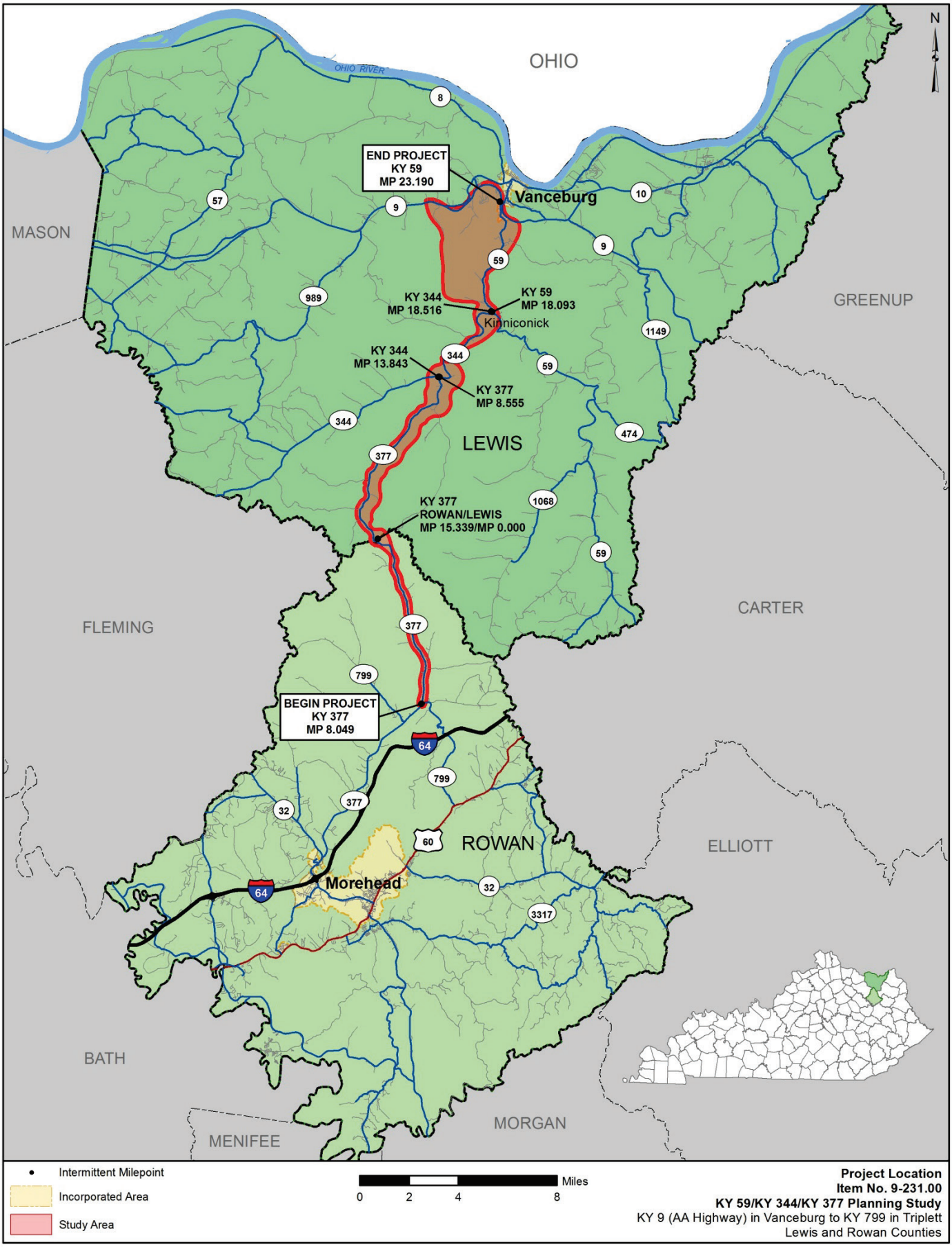


Figure 1: Study Area

Kentucky's 120 counties. The heavily forested hills of the county are said to have some of the best oak hardwoods in the United States. Throughout the county's history, the forests have been the mainstay for laborers and their income, always producing vast amounts of lumber, barrel staves, tanbark, railroad ties, firewood, and numerous wood products.

The Lewis County seat is Vanceburg, which was founded in 1797 and named after Joseph Vance who was one of the founders. It became an important port and its location relatively high above the Ohio River made it less susceptible to floods than other riverside communities. Vanceburg was incorporated in 1827. The estimated 2015 population of Vanceburg was 1,448.

The shortest route between Morehead and Vanceburg is via KY 32 in Morehead north to KY 377, then KY 377 into Lewis County to KY 344, then KY 344 to KY 59, and finally KY 59 into Vanceburg. This route is 40 miles long (study area corridor). The shortest alternative is to travel east on I-64 from Morehead to the I-64/KY 59 Exit, and take KY 59 north to Vanceburg, a route 8 miles longer and classified as a Rural Minor Collector. **Figure 2 (p. 4)** illustrates other routes to reach Vanceburg from Morehead.

C. Project History

KY 377 in Rowan County, from KY 32 north of Morehead to KY 799 in Triplett, is listed as Item Number 9-8406.00 in Kentucky's FY 2014-FY 2020 Highway Plan (hereafter referred to as the 2014 Highway Plan), and the 2016-2018 enacted Biennial Highway Construction Plan. This study (Item Number 9-231.00 in both the 2014 Highway Plan and 2016-2018 Biennial Plan) seeks a logical sequence of practical improvements to upgrade the KY 59/KY 344/KY 377 corridor between Vanceburg and Morehead in Lewis and Rowan counties. In the 2014-2020 Plan, only the Planning phase was funded, and in the 2016-2018 Plan, the Design phase is funded. The corridor from Vanceburg to Morehead was identified in the KYTC District 9 Transportation Plan as one of several regional corridors needing improvements.

II. Review and Summarization of Previous Work

KYTC has six Project Identification Forms (PIFs) in the project corridor. The PIFs are shown in **Table 1** and in full in **Appendix A**.

Table 1: Project Identification Forms (PIF) in the Corridor

County	PIF Number	Year	Route	Beginning MP	Ending MP	Description	Cost in millions
Rowan	09 103 D0377 98.50	2010	KY 377	12.000	3.400	Improve safety, capacity and efficiency by addressing issues associated with narrow 9-foot lanes, and improve shoulders on the roadways	$21.5
Rowan	09 103 D0377 98.40	2008	KY 377	8.000	12.000		$28.3
Lewis	09 068 D0344 13.00	2011	KY 344	13.843	18.500	Reconstruct from Rowan County Line to Vanceburg	$43.3
Lewis	09 068 D0377 2.00	2013	KY 377	0.000	8.555	Scoping Study to reconstruct/widen	$0.5*
Lewis	09 068 D0377 1.00	2005	KY 377	0.000	8.555	Reconstruct from Rowan County Line to Vanceburg	$108.2
Lewis	09 068 D0059 2.00	2011	KY 59	18.100	23.190	Improve north-south system connectivity between the cities of Vanceburg in Lewis County and Morehead in Rowan County	$50.4

*Scoping Study for the Entire Corridor

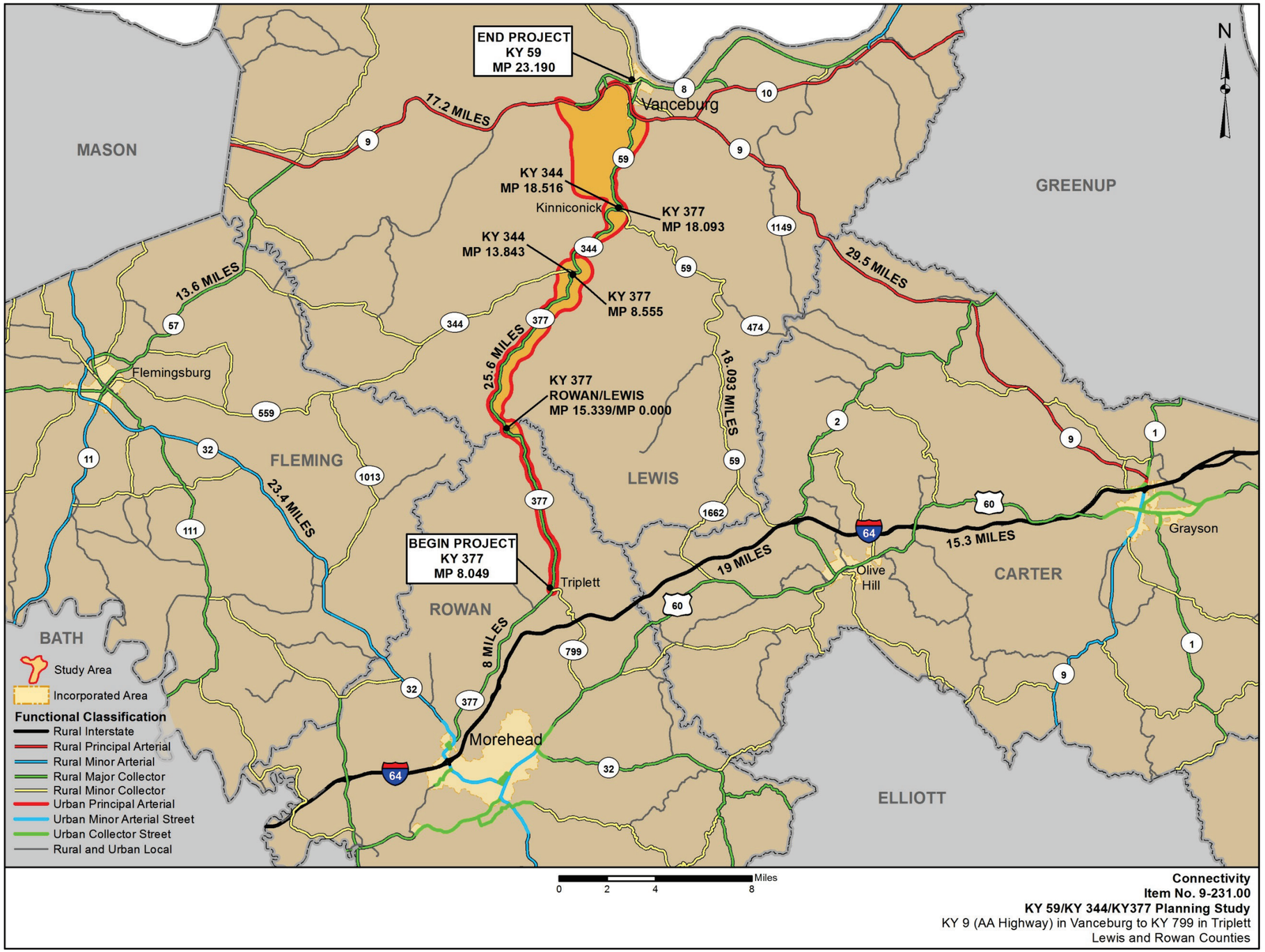


Figure 2: North South Connectivity

III. Existing Conditions Overview

A review of existing roadway conditions was performed to determine what conditions may not meet the goals of the project corridor. **Tables 2–3 (pp. 7–8)** summarize the existing roadway conditions within the corridor. **Appendix B** lists each horizontal and vertical deficiency along the three routes that do not meet 55 mph design speed. The corridor is described from south to north.

KY 377, KY 344, and KY 59, according to KYTC's Highway Information System (HIS), have rolling hills and are functionally classified as Rural Major Collectors and State Secondary Routes for maintenance purposes. According to HIS, the study corridor is characterized by travel lanes between nine and eleven feet wide with two- to three-foot-wide shoulders. However, the shoulders on KY 59 north of milepoint (MP) 22.90 are eight feet wide north to KY 9. The posted speed limit is 55 mph with the exception of KY 59 north of MP 22.60, near Moore Street, where it is 45 mph. Average daily traffic (ADT) volumes range from 2,200 vehicles per day (vpd) on KY 9 to fewer than 380 vpd on KY 377 near its intersection with KY 377. The maximum gross truck weight allowed on the corridor is 62,000 pounds. Truck percentages for the corridor range from less than 7% on KY 59 near KY 9 to nearly 14% on KY 377 in Lewis County.

Initially for this planning study, the 26-mile corridor was segmented into five (5) logical sections for data analysis and displays, presenting existing conditions, and naming of alternatives. As alternatives were developed, sections were modified to accommodate logical termini (rational begin and end points for a transportation improvement). Therefore, early handouts and public displays show the early sections.


KY 377 Landscape

Sheltowee Trace Trailhead

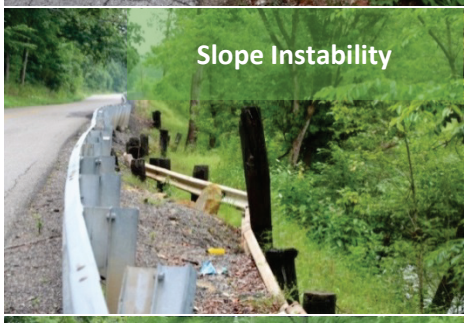

Lewis/Rowan County Line

A. KY 377

KY 377 in Rowan and Lewis counties is 15.80 miles in length and carries a range of 380 to 1,300 vpd. Along its length, there is a wide rolling landscape, are multiple shoulder drop-offs, 68 horizontal and vertical curves that do not meet 55 mph design criteria, and numerous access points (driveways). Most horizontal and vertical deficiencies are between Cooper Fork and KY 344 in Lewis County. Three structures are considered functionally obsolete, including two bridges and one culvert, all having a sufficiency rating exceeding 60. "Functionally obsolete" means that the design of a bridge is not suitable for its current use; for example, it could have a lack of safety shoulders or the inability to handle current traffic volume, speed, size, or weight.

KY 377 had 46 crashes between 2009 and 2013 (nearly 51% of the entire corridor), including 14 that left the roadway, 13 with animals, 7 with fixed objects, and 2 with pedestrians. There are two potential 0.1-mile high-crash locations in Rowan County, one just north of Dry Branch Road near Elk Lick Road (MP 10.6–10.7) and another just south of Brookside Drive (MP 9.7–9.8) indicating crashes may not be occurring randomly **(Section IV and Appendix G)**.

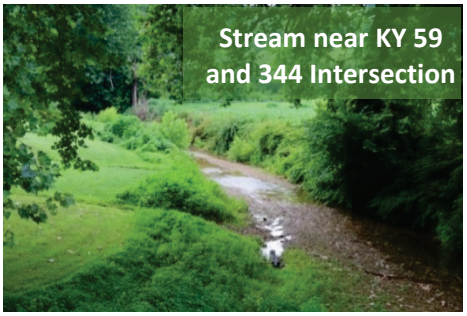
The DBNF is located on either side of KY 377 at the county line and potentially historic structures dot the corridor. The Sheltowee Trace Trail also follows the Rowan/Lewis County line and has a trailhead on KY 377.



B. KY 344

Along the corridor, KY 344 is 4.67 miles in length and carries 700 vpd. It has 34 deficient horizontal and vertical curves that do not meet 55 mph design criteria. Trucks travel this route and often use more than their lane widths. There are slope stability and flooding issues along this section of the study corridor. KY 344 had 6 crashes in the five-year period; KY 344 also had 4 sideswipes crashes in the five-year period. There is one 0.1-mile high-crash spot location between MP 15.1 and MP 15.2 (2 crashes). KY 344 has rolling terrain.

One bridge structure over Grassy Branch at the KY 59/KY 344 intersection (MP 18.481) in Lewis County is structurally deficient with a sufficiency rating of 49.4. Bridges are considered structurally deficient if significant load carrying elements are found to be in poor condition due to deterioration and determined to be extremely insufficient to the point of causing intolerable traffic interruptions. Tractor trailers traveling south on KY 59 turning west onto KY 344 have hit the bridge railing numerous times because the bridge is so narrow and close to the intersection. Indian Creek runs along KY 344 north until its intersection with KY 59, where it meets Kinniconick Creek (designated as an Outstanding State Resource Waters, Exceptional Waters, and Reference Reach Waters). Any impacts to this stream would require permits from the U.S. Army Corps of Engineers (USACE) and the Kentucky Division of Water (KDOW). The Lewis County Park is also along KY 344. This publicly-owned park received Land and Water Conservation Funds and, therefore, may require avoidance or mitigation measures.



C. KY 59

KY 59 is 5.10 miles in length, and carries between 1,180 and 2,200 vpd. It has 42 deficient horizontal and vertical curves that do not meet 55 mph design criteria. The terrain becomes rugged from Vanceburg Hill near Clarksburg Branch (MP 19.704) to approximately Leslie Street at MP 22.488. On Vanceburg Hill, the vertical grade exceeds 9%. There were a total of 39 crashes between 2009 and 2013, which equates to 43% of crashes along the corridor. A segment crash analysis shows there are four 0.1-mile high-crash spot locations of concern between MP 21.8 and 23.1. No structures are considered functionally obsolete or structurally deficient on KY 59.

The adequacy ratings for KY 377, KY 344, and KY 59 are 49.6%, 24.5%, and 12.1%, respectively. KYTC uses roadway adequacy ratings as a tool to evaluate highway conditions considering pavement condition, safety, and service. A perfect score is 100%.

Table 2: Existing Conditions

ROUTE DESCRIPTIONS							# of Curves Not Meeting 55 mph Design Speed*		CRASHES						
County	Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length (Miles)	Horizontal	Vertical	Total Number of Crashes	Number of Fatal Crashes	Number of Injury Crashes	Number of Property Damage Only Crashes	Actual Crash Rate	Critical Crash Rate	CCRF
Rowan	KY 377	8.049	KY 799 South	9.522	Clark Cemetery Road North	1.473	0	0	8	0	1	7	254.354	445.372	0.571
		9.522	Clark Cemetery Road North	15.339	Lewis County Line	5.817	5	9	30	0	11	19	274.360	335.064	0.819
Lewis	KY 377	0.000	Rowan County Line	1.310	McCleese Hollow	1.310	5	3	1	0	1	0	113.048	675.060	0.167
		1.310	McCleese Hollow	1.662	Hardy Fork	0.352	1	2	0	0	0	0	0.000	1202.909	0.000
		1.662	Hardy Fork	3.001	Cooper Fork	1.339	1	7	0	0	0	0	0.000	669.453	0.000
		3.001	Cooper Fork	7.361	Briery Creek Road	4.36	7	17	4	0	1	3	135.865	453.630	0.300
		7.361	Briery Creek Road	8.555	KY 344	1.194	3	8	3	0	1	2	372.094	699.652	0.532
Lewis	KY 344	13.843	KY 377	16.407	Holly Branch	2.564	9	9	3	0	2	1	96.700	447.061	0.216
		16.407	Holly Branch	18.516	KY 59	2.109	11	5	3	0	1	2	117.562	472.593	0.249
Lewis	KY 59	18.093	KY 344	18.752	Fuller Branch	0.659	0	0	2	0	0	2	136.310	562.626	0.242
		18.752	Fuller Branch	19.704	Clarksburg Branch	0.952	2	1	0	0	0	0	0.000	499.631	0.000
		19.704	Clarksburg Branch	21.389	Rock Run	1.685	15	4	7	0	0	7	186.58	424.789	0.439
		21.389	Rock Run	22.488	Leslie Street	1.099	14	3	14	0	4	10	448.599	446.329	**1.005**
		22.488	Leslie Street	22.647	Moore Street	0.159	0	0	1	0	0	1	0.352	1.418	0.248
		22.647	Moore Street	22.891	Spencer Street	0.244	2	1	3	0	1	2	0.790	1.620	0.486
		22.891	Spencer Street	22.962	Missionary Street	0.071	0	0	1	0	1	0	0.263	0.803	0.327
		22.962	Missionary Street	23.190	KY 9	0.228	0	0	11	0	2	9	2.888	1.553	**1.860**
					Total	25.615 miles									

*Utilizing the existing plans, a 55 mph design speed and 8% and 10% superelevation.

NOTE: CCRF–Critical Crash Rate Factor: The ratio of the Actual Crash Rate to the Critical Crash Rate produces a Critical Crash Rate Factor (CCRF). If the roadway segment's or spot's Actual Crash Rate exceeds the Critical Crash Rate (i.e., the CCRF is greater than 1.0), the section is identified for further analysis as a possible high-crash location.

Table 3: Existing Conditions (Continued)

ROUTE DESCRIPTIONS							SYSTEMS				TYPICAL SECTION					
County	Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length	Functional Class	New**** Functional Class	State System	Truck Weight Class	Number of Lanes	Lane Width (feet)	Shoulder Type	Shoulder Width	Speed Limit	Pavement Type
Rowan	KY 377	8.049	KY 799 South	9.522	Clark Cemetery Road North	1.473	Rural Major Collector	Major Collector	State Secondary	AA - 62,000 pounds	2	9	Earth	3	55	High Flexible
		9.522	Clark Cemetery Road North	15.339	Lewis County Line	5.817							Combination	2		
Lewis	KY 377	0.000	Rowan County Line	1.310	McCleese Hollow	1.310										
		1.310	McCleese Hollow	1.662	Hardy Fork	0.352										
		1.662	Hardy Fork	3.001	Cooper Fork	1.339										
		3.001	Cooper Fork	7.361	Briery Creek Road	4.360										
		7.361	Briery Creek Road	8.555	KY 344	1.194										
Lewis	KY 344	13.843	KY 377	16.407	Holly Branch	2.564										
		16.407	Holly Branch	18.516	KY 59	2.109										
Lewis	KY 59	18.093	KY 344	18.752	Fuller Branch	0.659						11				
		18.752	Fuller Branch	19.704	Clarksburg Branch	0.952										
		19.704	Clarksburg Branch	21.389	Rock Run	1.685										
		21.389	Rock Run	22.488	Leslie Street	1.099									45	
		22.488	Leslie Street	22.647	Moore Street	0.159										
		22.647	Moore Street	22.891	Spencer Street	0.244										
		22.891	Spencer Street	22.962	Missionary Street	0.071										
		22.962	Missionary Street	23.190	KY 9	0.228							Paved with Bituminous	8		

ROUTE DESCRIPTIONS							ACCESS POINTS		TRAFFIC		ADEQUACY RATING***					
County	Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length	Number of Access Points	Average Access Points/Mile	ADT	Truck %	Pavement Condition (Max 30)	Safety (Max 55)	Service (Max 15)	IRI**	Composite	Percentile
Rowan	KY 377	8.049	KY 799 South	9.522	Clark Cemetery Road North	1.473	44	30	1,148 (2014)	8.22%	30 Resurfaced 2013	34.5	15	100	79.5	49.6
		9.522	Clark Cemetery Road North	15.339	Lewis County Line	5.817	108	19	1,030 (2009)							
Lewis	KY 377	0.000	Rowan County Line	1.310	McCleese Hollow	1.310	10	8	370 (2013)	13.64%	23 KY 377 Resurfaced 2002 KY 344 Resurfaced 2014	34.5	15	135	72	24.5
		1.310	McCleese Hollow	1.662	Hardy Fork	0.352	7	20								
		1.662	Hardy Fork	3.001	Cooper Fork	1.339	10	7								
		3.001	Cooper Fork	7.361	Briery Creek Road	4.360	46	11								
		7.361	Briery Creek Rd	8.555	KY 344	1.194	9	8								
Lewis	KY 344	13.843	KY 377	16.407	Holly Branch	2.564	22	9	663 (2011)	12.10%				139		
		16.407	Holly Branch	18.516	KY 59	2.109	21	10								
Lewis	KY 59	18.093	KY 344	18.752	Fuller Branch	0.659	5	8	1,220 (2011)	10.70%	3 Resurfaced 2008	46.5	15	246	65	12.1
		18.752	Fuller Branch	19.704	Clarksburg Branch	0.952	12	13								
		19.704	Clarksburg Branch	21.389	Rock Run	1.685	21	12								
		21.389	Rock Run	22.488	Leslie Street	1.099	7	6	1,556 (2012)*							
		22.488	Leslie Street	22.647	Moore Street	0.159	1	6								
		22.647	Moore Street	22.891	Spencer Street	0.244	5	20	2,087 (2012)*	Not Available						
		22.891	Spencer Street	22.962	Missionary Street	0.071	4	56								
		22.962	Missionary Street	23.190	KY 9	0.228	6	26								

The project corridor is not on the National Highway System, National Truck Network, nor had Coal Haul Annual Tons reported.
*Computer Estimate
**International Roughness Index (IRI) is a measure of pavement roughness. IRI values less than 100 generally indicate smooth pavements; between 100 and 150 somewhat rough pavements, and greater than 150 very rough pavements.
***2014 Adequacy Rating is a numerical score from 0 to 100 evaluating the current condition of a roadway segment based on pavement condition (30 points), safety (55 points), service (15 points) for a Rural Major Collector.
**** KYTC is transitioning to functional classification without a rural/urban designation.

D. Recurring Maintenance Issues

KYTC District 9 staff identified locations along the corridor having recurring maintenance issues. These are described in **Table 4** and pictured in **Appendix C. Figure 3** shows one location on KY 344 between MPs 18.10 and 18.20 adjacent to the existing roadway at Kinniconick Creek: considerable slope and shoulder stability issues exist at the site. Another example is the northwest side of Vanceburg Hill, between MPs 21.80 and 23.50, as the uphill side of KY 59 is sliding into the roadway **(Figure 4)**.

Table 4: Recurring Maintenance Issues

Location	Route	From MP	To MP	Description
9	KY 377	2.50	2.70	Slope/shoulder stability issues adjacent to the roadway at Buck Crawford Place at Indian Creek.
8	KY 377	3.40	3.45	Slope/shoulder stability issues adjacent to the roadway at Mike Thomas Place at Indian Creek.
7	KY 377	4.45	4.50	Slope/shoulder stability issues adjacent to the roadway near Eddie Stamm Farm at Indian Creek.
6	KY 377	7.15	7.35	Slope/shoulder stability issues adjacent to the roadway at Indian Creek.
5	KY 344 / KY 377 Intersection	Occasional flooding of the intersection requires KYTC maintenance crews to close the road until water recedes.		
4	KY 344	14.30	14.40	Slope/shoulder stability issues adjacent to the roadway near Bob Thurman Curve at Kinniconick Creek.
3	KY 344	15.70	15.90	Slope/shoulder stability issues adjacent to the roadway near "Beaver Pond" at Kinniconick Creek.
2	KY 344	18.10	18.20	Issues adjacent to the roadway near the Kinniconick Hotel at Kinniconick Creek.
1	KY 59	21.80	23.50	Along the west slope of Vanceburg Hill, there are more problems with the uphill side falling into KY 59 than with the downhill side falling away from KY 59.

Photos provided and numbered by KYTC District 9 Staff

Figure 3: KY 344 along Kinniconick Creek

Figure 4: KY 59 West Slope of Vanceburg Hill

Table 5 (p. 11) provides information for the study corridor on structures that are either structurally deficient or functionally obsolete. Based on data extracted from the KYTC Inspection Report with Structural Inventory & Appraisal Data, the bridge (068B00015N), located at the KY 344/KY 59 intersection has a sufficiency rating of 49.4 and is listed as structurally deficient primarily due to its poor superstructure condition rating. A bridge is classified as structurally deficient if the deck, superstructure, substructure, or culvert is rated in "poor" condition or below—0 to 4 on the National Bridge Inventory (NBI) rating scale. This bridge has been submitted by KYTC District 9 staff to be considered for replacement. Tractor trailers traveling south on KY 59 turning west onto KY 344 have hit the bridge railing numerous times because the bridge is narrow and close to the intersection.

Two additional bridges and one culvert listed are considered functionally obsolete (FO)—their designs no longer meet current standards or are no longer adequate for its intended task (e.g., a bridge with narrow shoulders). The bridge (103B00027N) at MP 11.09 in Rowan County has a sufficiency rating of 73.1 and has substandard bridge railings. The culvert (103B00028N) at MP 13.91 in Rowan County has a sufficiency rating of 60.4 and is narrow and has an intolerable waterway adequacy due to silt buildup. The bridge (068B00053N) at MP 1.26 in Lewis County is narrow (19.7 feet) with substandard guardrail and has a sufficiency rating of 76.9.

A full structure inventory for the corridor is shown in **Appendix D.**

F. Existing Utilities

Figure 5 (p. 12) depicts utilities within the study corridor. Much of the information is derived from shape files from the Kentucky Infrastructure Authority through KYGeonet.[3] In addition, the following utility information was provided through the Kentucky Geological Survey (KGS), site visits, and Spectra Energy gas company correspondence. The following are listed from south to north.

- A Tennessee Gas pipeline, on the east side of KY 377 north of KY 799 (Big Perry Road), will be a major control point during design.
- Along KY 377 in Rowan County, a 4-inch PVC water line exists, changing to a 6-inch water line in Lewis County.
- A gas field is located along the KY 377 corridor between MP 14.00 in Rowan County and approximately MP 1.00 in Lewis County. There are also other oil and gas wells along the corridor.
- Coordination with Spectra Energy yielded a major gas line crossing on KY 377 just south of McCleese Hollow Road in Lewis County. These three lines are part of the Texas Eastern Transmission LP system. This system runs from the Gulf of Mexico, through Texas and Louisiana, and into New England. The three lines range from 30–36 inches in diameter. Correspondence with Spectra Energy and additional nationwide maps are provided in **Appendix E.**
- 8-inch PVC water lines are along the east side of KY 59 and the length of the west side of KY 344. Usually a 4-inch PVC water line exists along the crossroads.

[3] http://kygeonet.ky.gov/kia/dw/

Table 5: Structures Either Structurally Deficient or Functionally Obsolete

Route	County	MP	Bridge No.	Location Description	Features Intersected	Type	Year Built	Length (Ft.)	Approach Roadway Width (Ft.)	Width (Ft.) (Curb To Curb)	Skew	Sufficiency Rating	Date of Inspection	Structurally Deficient[3] (Yes or No)	Functionally Obsolete[4] (Yes or No)	Inventory Rating (Tons)	Operating Rating (Tons)	NBI Condition Ratings			
																		Deck	Super-structure	Sub-structure	Culvert
KY 344	Lewis	18.480	068B00015N[2]	.05 Mi. W of JCT KY 59	Grassy Branch	2-Span Concrete Tee Beam	1935	76.115	19	20.669	0	49.4	10/21/2014	Yes	N/A	41.8	69.7	5	4	5	
KY 377	Lewis	1.260	068B00053N[1]	1.2 Mi. N of Rowan CL	McCleese Hollow Branch	Single Span Concrete Tee	1955	33.0	17	19.685	0	76.9	2/6/2014	No	Yes	41.9	69.8	6	6	7	
KY 377	Rowan	13.910	103B00028N[1]	1.6 Mi. S of Lewis CL	Nickles Hollow Branch	2-Span Concrete Culvert	1951	26.903	17	23.750	0	60.4	5/9/2014	No	Yes	26.6	44.3				6
KY 377	Rowan	11.090	103B00027N[1]	3 Mi. N of E-JCT KY 799	N. Fork of Triplett Crk	3-Span Concrete Continuous Tee Beam	1948	99.081	17	20.125	30	73.1	5/9/2014	No	Yes	39.6	66.0	7	6	6	

Notes:
All data, with the exception of the Structurally Deficient and Functionally Obsolete columns, are taken from the Inspection Report with Structure Inventory & Appraisal Data. That column is taken from the Structural Inventory and Appraisal Sheets for each bridge.
[1]Bridge railing, approach guardrail, transitions, and guardrail ends are substandard.
[2]Bridge railing has been hit multiple times leaving exposed steel. Also, there are diagonal cracks in both faces of the barrier. Bridge railing, approach guardrail, transitions, and guardrail ends are substandard.
[3]Bridges are considered structurally deficient if significant load carrying elements are found to be in poor condition due to deterioration and are determined to be extremely insufficient to the point of causing intolerable traffic interruptions.
[4]The design of a bridge is not suitable for its current use; for example, it could have a lack of safety shoulders or the inability to handle current traffic volume, speed, size, or weight.

Condition Ratings-Culverts
6–Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls or pipes. Metal culverts have a smooth curvature, non-symmetrical curvature with superficial corrosion and moderate pitting.

Condition Ratings-Bridges
7–Good–Some minor problems structural elements how some minor deterioration.
6–Satisfactory–Structural elements show some minor deterioration.
5–Fair–All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4–Poor–Advanced section loss, deterioration, spalling, or scour.

Figure 5: Existing Utilities

- Several water wells are located on the west side of KY 59 near MP 19.10, on the east side near the intersection with Rock Run Road, and clustered on both sides north of MP 23.00 at the KY 9 intersection.
- Along Rock Run Road near KY 59 there is a 300,000 maximum gallon water tank.
- In the northern portion of the study area, a major transmission line crosses KY 59 near MP 22.10.
- A booster pump (turbine) is located next to the helipad just south of the KY 9/KY 59 intersection on the east side of KY 59.

G. Shoulder Failure Inventory

There are a significant number of locations where shoulder failures have occurred. A shoulder failure inventory can be reviewed in **Appendix F**.

There are a number of railroad steel (T-rail) retaining walls (using steel posts), varying in length and height, along existing KY 377, KY 344 and KY 59. These types of walls were installed as a mitigation measure to help stabilize the roadway embankment adjacent to waterways. These walls may need to be replaced with cast-in-place concrete walls, mechanically stabilized earth walls, or other retaining structures if any build alternatives or spot improvements are advanced to future project development phases. In areas where stream bank stabilization appears to be a problem (e.g., outside bends), stream stabilization techniques may be employed to reduce stream bank erosion and scour.

H. Rumble Strip Inventory

Rumble strips are grooves or rows of indents in the pavement designed to alert inattentive drivers through noise and vibration to reduce the number of crashes. Rumble strips are an effective, low-cost roadway treatment to minimize vehicle lane departures. Treatments are especially important when the traveling lanes or the clear zone is narrow. The corridor has shoulder rumble strips throughout. Center line rumble strips are present on KY 344. A rumble strip inventory can be reviewed in **Appendix F.**

I. Truck Type/Cargo Inventory

This corridor is not on Kentucky's freight network; however, the Project Team expressed a particular concern regarding the mix of truck types within the study corridor. Over four days, March 9 through March 12, 2015, manual observations were conducted while counting peak-hour traffic at the following intersections:

- KY 377/KY 799 (Big Perry Road)
- KY 377/KY 344
- KY 344/KY 59

School buses were the most common type of truck. With box trucks the next most common including bucket trucks, flatbed with logs, lumber, equipment, trash, etc. Semi-tractor trailers were observed with cargo including logs, wood chips, and fuel, steel, gravel, brush, etc. An inventory of truck types captured during peak hours is shown in **Appendix F.**

As stated previously, there are four structures considered functionally obsolete or structurally deficient with operating tons ranging from 44 to 70 tons. Also, the bridge located at the KY 59/KY 344 intersection is often struck by trucks due to its proximity to the intersection. The corridor has shoulder drop-offs and narrow lanes making the trips a challenge for these larger vehicles.

J. Curve Advisory

An inventory of curve warning signs and plaques is located in **Appendix F**. This inventory was compared to high-crash locations in curves. The corridor has 12 locations with curve advisory speeds less than 35 mph. All high-crash locations in curves have curve warning signs installed.

K. Adequacy Ratings

Composite Adequacy Rating[4] has been a method used by KYTC to assess a roadway's condition and aid in highway improvements. It ranks a particular roadway section compared to other Kentucky roads in the same functional class into a percentile, on a 100 scale. For example, a road section with a composite adequacy percentile of 75.0 means that 25% of the roads are rated better. The ratings are calculated by individual functional class and based upon the following three roadway components or indices with each comprised of several measures:

1) A measure of the roadway condition.
2) A measure of safety.
3) A measure of service.

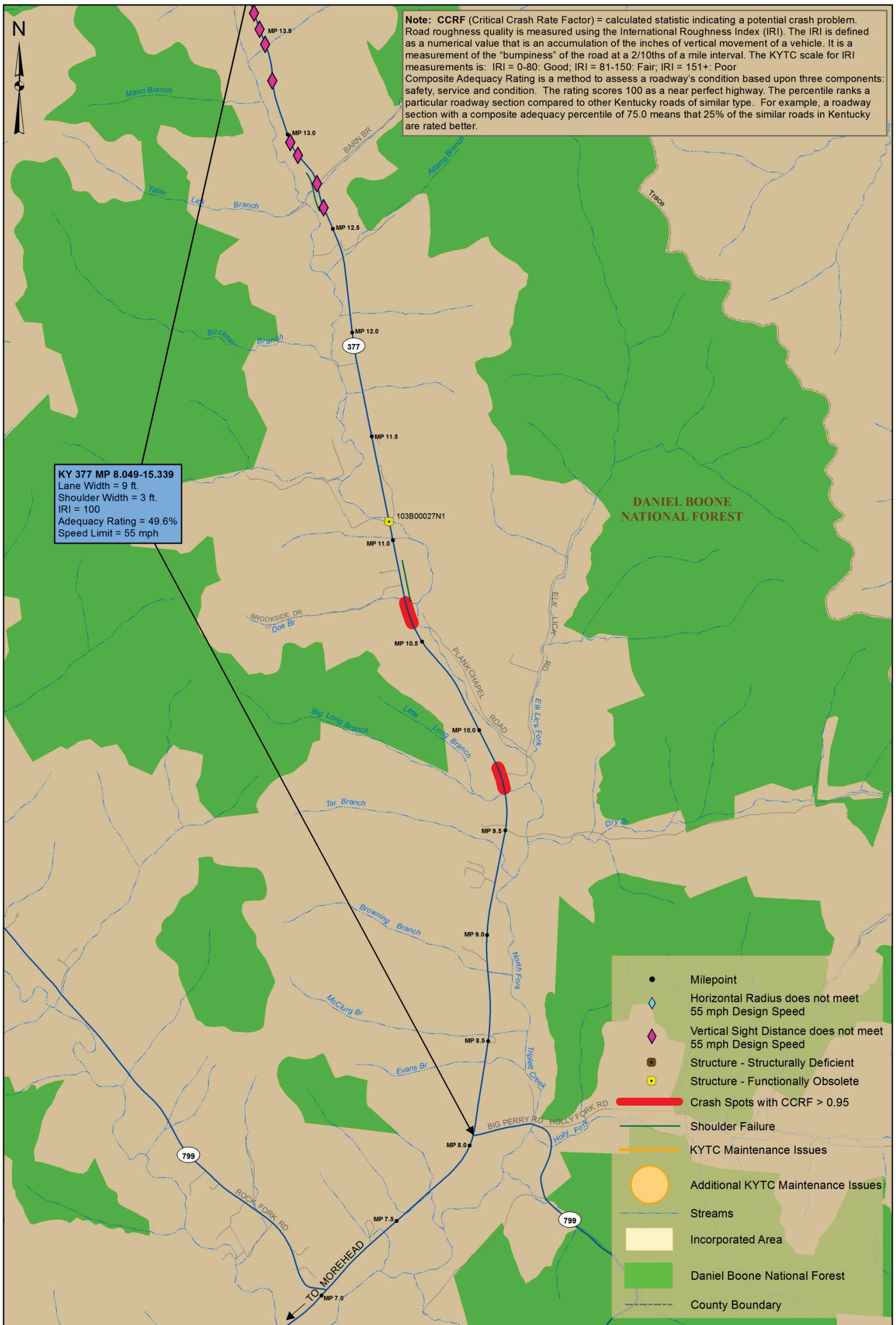
The three component measures are combined into an overall quantitative measure allowing roadway segments to be ranked. The points allocated to the three indices vary by functional class. For a Rural Major Collector, there are 30 points for pavement condition, 55 points for safety, and 15 points for service to equal 100.

As shown in **Table 3 (p. 8)**, the corridor adequacy rating percentile ranges from 12.1% (KY 59) to 49.6% (KY 377 in Rowan County). For instance, this means that nearly 88% of the roadways of similar type are rated better than KY 59.

All existing conditions are illustrated on **Figures 6–9 (pp. 15–18)**.

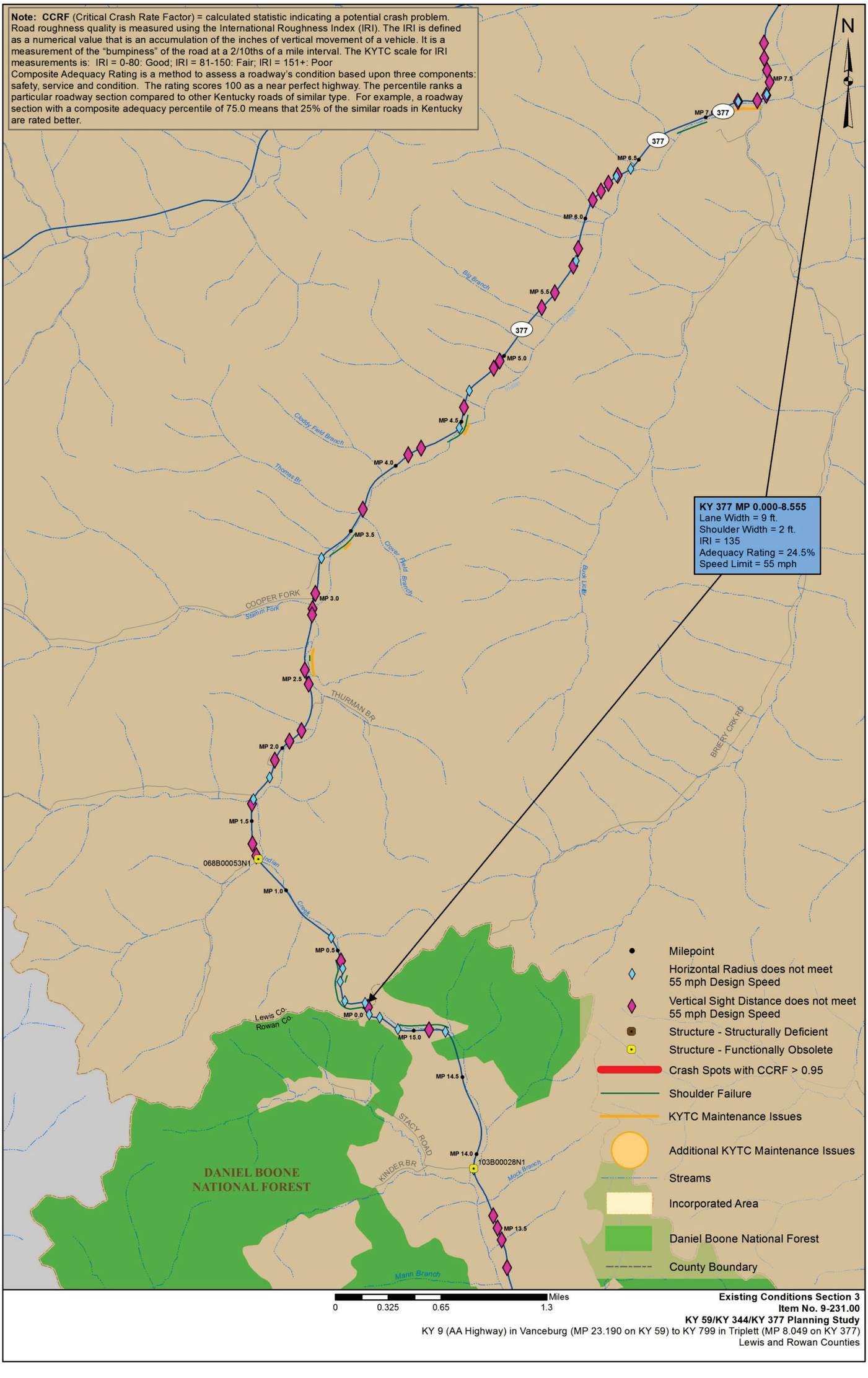
[4] http://www.ktc.uky.edu/Reports/KTC_02_30_SPR_256_01_1F.pdf

Figure 6: Existing Conditions Sections 1 and 2



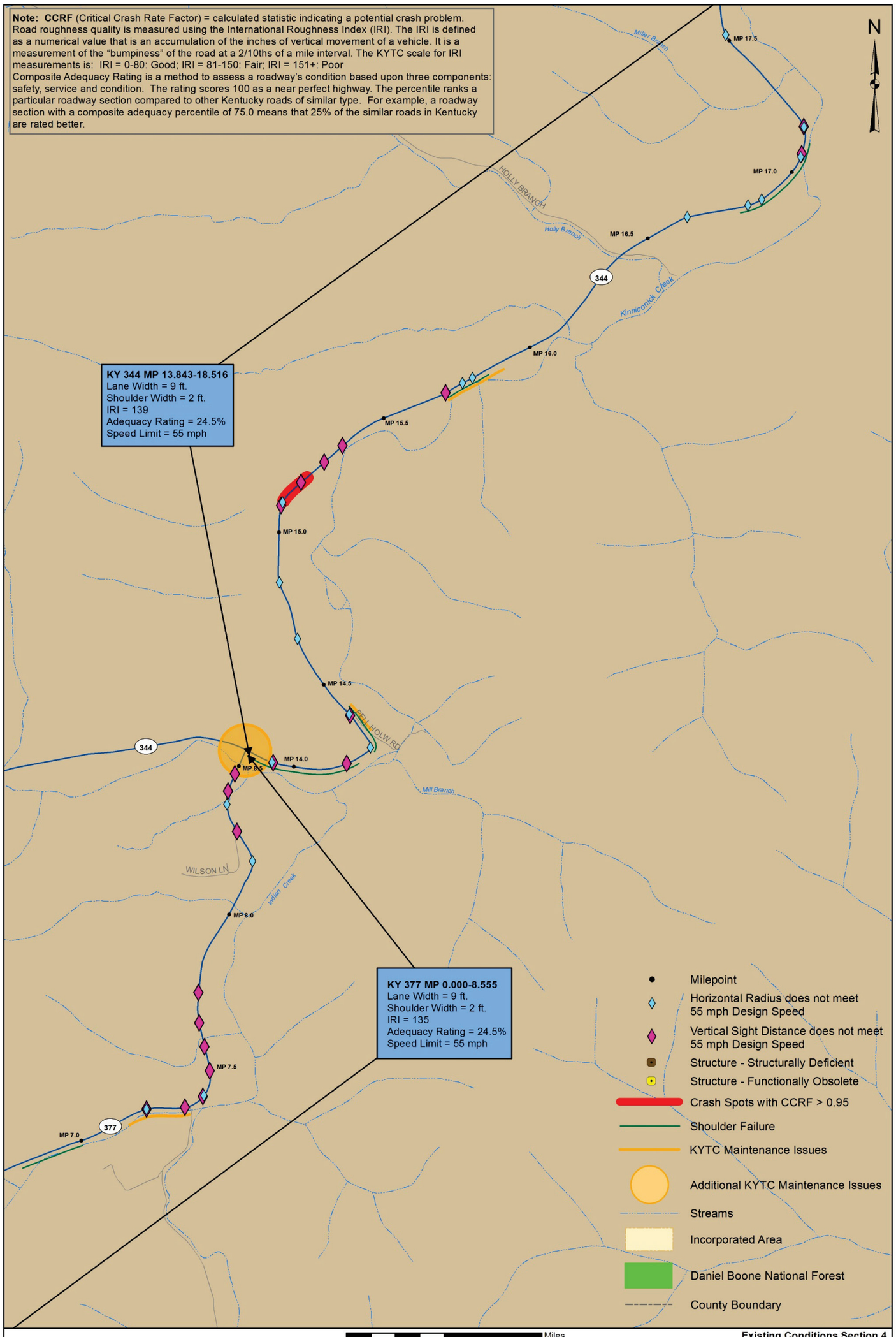
Existing Conditions Section 1 and Section 2
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

Figure 7: Existing Conditions Section 3



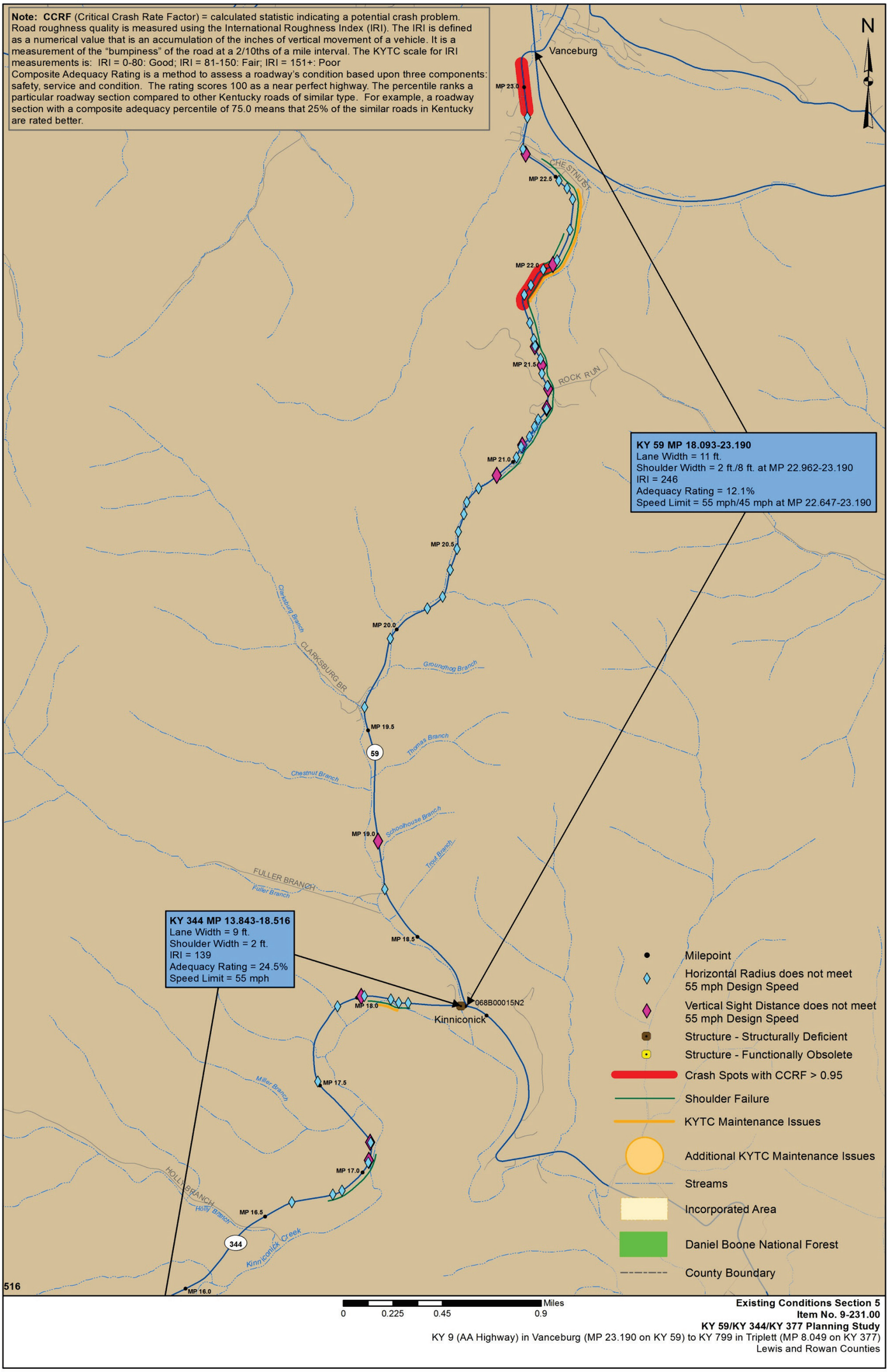
Existing Conditions Section 3
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

Figure 8: Existing Conditions Section 4



Existing Conditions Section 4
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

Figure 9: Existing Conditions Section 5



Existing Conditions Section 5
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

IV. Crashes

According to the Kentucky State Police[5], during a five-year period (January 1, 2009, to December 31, 2013), there were 91 crashes on the KY 59/KY 344/KY 377 corridor between KY 799 in Rowan County and KY 59 in Lewis County; 26 (29%) resulted in one or more injuries. This proportion of injury crashes is nearly 50% higher than the statewide average (19%). Thus, while crashes occur somewhat infrequently, they tend to be more serious. There were no fatalities in the five-year period. Crash types are shown in **Figure 10 (p. 21)**.

The most prominent crash type on rural, two-lane roads is typically a single vehicle crash; 63 of the study corridor crashes (nearly 70%) involved only one vehicle with 29 of those indicated as "Ran Off Roadway": 22% of those crashes occurred in a curve. "Collision with Animals" (16%), "Sideswipes" (14%), and "Collision with Fixed Object" (12%) were the only other crashes that constituted more than 10% of the total. The percentage of crashes occurring in wet, snow, or ice weather (27%) exceeds the statewide average (25.5%); likewise the percentage of crashes not occurring in daylight hours (41%) also exceeds the statewide average (29.4%). No crash involved a bicyclist; however two crashes (at MP 9.76 and 12.46 on KY 377 in Rowan County) involved a pedestrian. **Figure 11 (p. 22)** illustrates the crash manner of collision.

The Actual Crash Rate for a roadway section is calculated by using the number of crashes, roadway length, average daily traffic for the time period, rural/urban classification, and number of years of crash data examined. Using a historical analysis procedure developed at the Kentucky Transportation Center[6], each calculated crash rate can be compared to roadways of a similar type. The Critical Crash Rate represents a rate above which crashes can be said to be occurring in a non-random fashion. The ratio of Actual Crash Rate to the Critical Crash Rate is the Critical Crash Rate Factor (CCRF). Thus, a CCRF greater than 1.0 indicates that crashes may not be occurring randomly **(Table 6, p. 20)**.

However, this procedure can result in a small number of crashes being deemed significant on a low volume road such as the study corridor. Thus, a CCRF greater than 1.0 should be considered as a screening technique indicating a spot where further analysis is needed rather than as a definitive statement of a crash problem.

Individual 0.1-mile "spots" were analyzed to identify the number of crashes occurring and the statistical significance, of those numbers of crashes. Further, the types of crashes were reviewed to discover any patterns. **Appendix G** provides detailed calculations.

The highest CCRF in the study corridor (1.50) was between MPs 10.6 and 10.7 on KY 377 in Rowan County. However, only 4 crashes occurred at that location in five years, all of which were single-vehicle crashes. One involved a deer strike. At the time of this analysis, no crashes had occurred at this spot since 2010. **Appendix G** provides a listing of all crashes and CCRF calculations.

[5] http://crashinformationky.org/KCAP/KYOPS/SearchWizard.aspx
[6] www.ktc.uky.edu/projects/analysis-of-traffic-crash-date-in-kentucky-2008-2012/

Table 6: 0.1-Mile Spots with CCRF Greater Than 0.95

Descriptions	Route	Beg MP	End MP	CCRF	Total Crashes	Injury Crashes	Predominant Crash Type/Summary of Officer Comments	Alcohol or Drug Indication, or Drowsy or Distracted Driving	Single-Vehicle Crashes	Sideswipe Crashes	Roadway Condition Wet, Snowy, or Slushy	Nighttime Crashes
Just north of Dry Branch Road near Elk Lick Road	KY 377-Rowan	9.7	9.8	1.13	3	3	No pattern; all were daytime and dry roadway	2	2	1	0	0
Just south of Brookside Drive	KY 377-Rowan	10.6	10.7	1.50	4	2	All single-vehicle; one deer strike	1	4	0	1	1
Just south of Lewis County Park	KY 344	15.1	15.2	0.95	2	1	Both crashes were sideswipes where operator was distracted	2	0	2	0	1
1/2 mile north of Rock Run Road	KY 59	21.8	21.9	1.28	4	2	3 single vehicle; 2 distracted; 1 suspicion of drugs; 1 wet; 1 ice; 3 dark	2	3	0	2	3
	KY 59	21.9	22.0	0.96	3	1	2 single vehicle, 1 of which resulted in a serious injury; driver suspected of drinking	1	2	0	1	1
Just south of KY 9 intersection near Missionary Street	KY 59	22.9	23.0	1.36	5	1	2 sideswipes, including one improper passing by operator suspected of DUI; operator had no license, insurance, or registration	3	0	2	1	0
Just south of KY 9 intersection at Dry Run Branch	KY 59	23.0	23.1	1.36	5	2	2 crashes apparently occurred in off-street parking lot	3	0	1	0	0

NOTE: CCRF–Critical Crash Rate Factor: The ratio of the Actual Crash Rate to the Critical Crash Rate produces a Critical Crash Rate Factor (CCRF). If the roadway segment's or spot's Actual Crash Rate exceeds the Critical Crash Rate (i.e., the CCRF is greater than 1.0, approaching 1.0 is also in red in the table of above. Approaching 1.0 the site should be monitored for change), the section is identified for further analysis as a possible high-crash location.

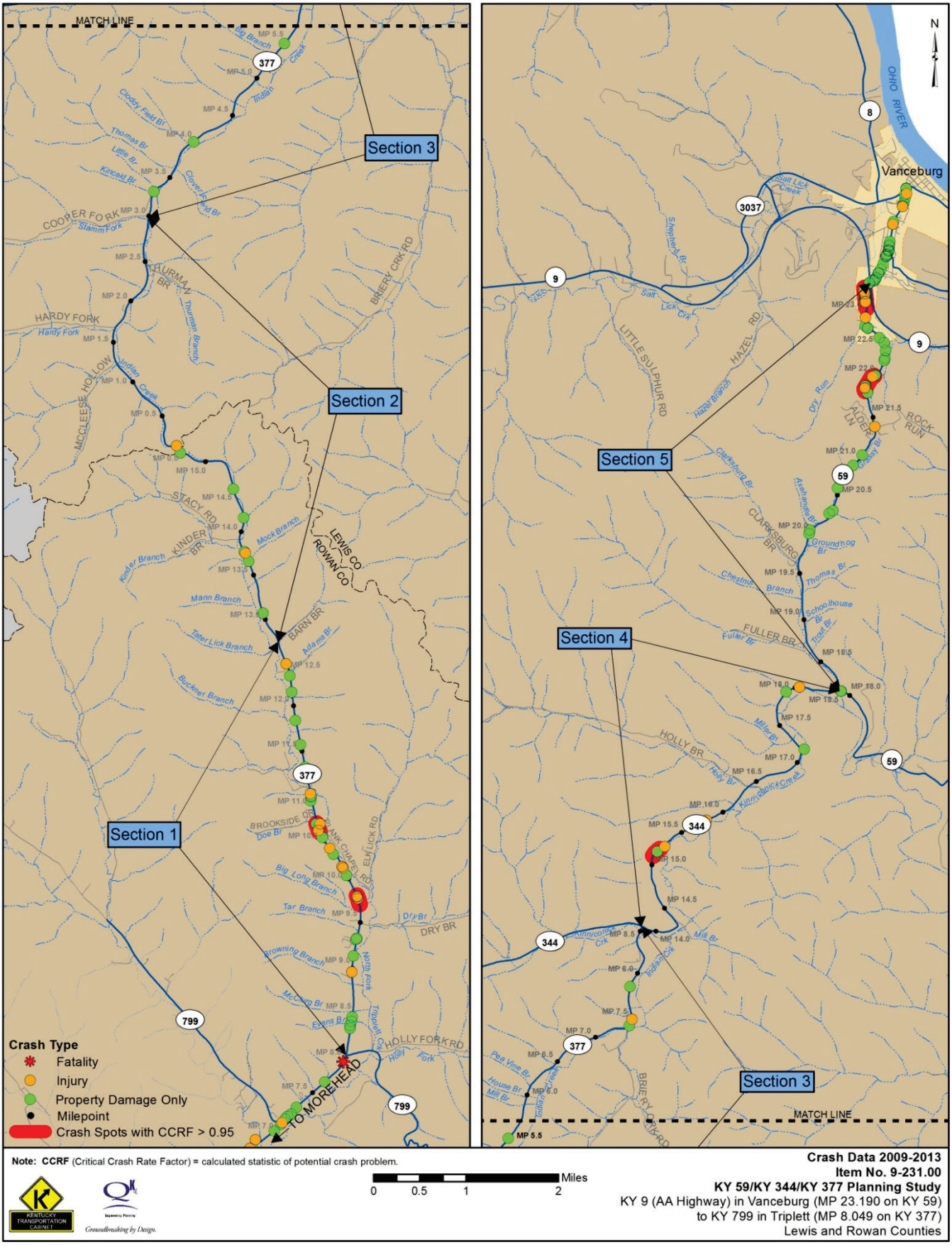


Figure 10: Crash Type and High Crash 0.1-Mile Spots

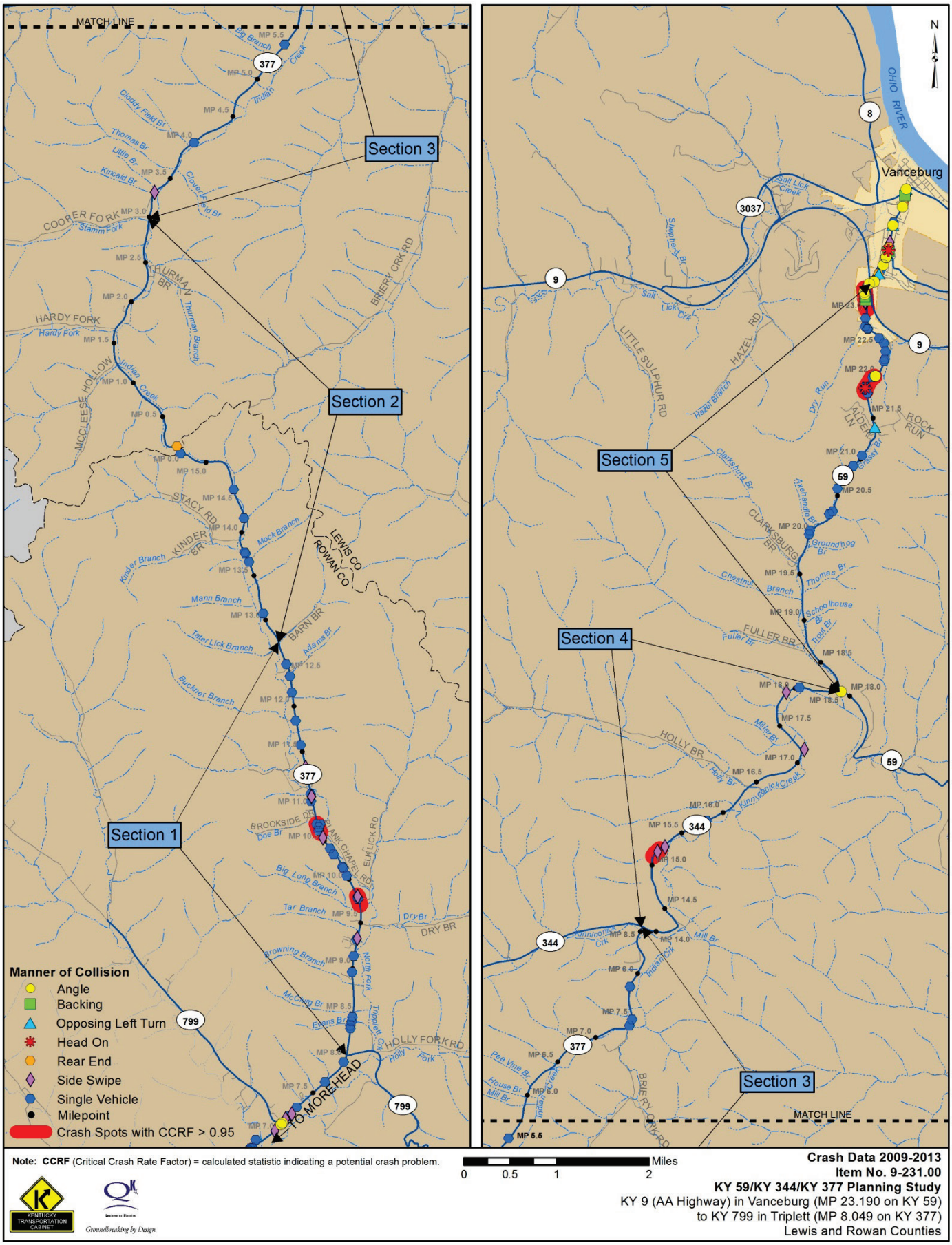


Figure 11: Manner of Collision and High Crash 0.1-Mile Spots

V. Bicycle, Pedestrians and Transit

A. Bicycle Facilities

There are no signed or designated bicycle facilities along this corridor, and it is not a designated bicycle route or part of a pre-determined bicycle tour. However, this route currently provides a direct connection from Morehead through mostly rural county to the Daniel Boone National Forest (DBNF) for both motorized and some non-motorized travel.

According to the STRAVA heat map[7] for the area, the segment of KY 377 leaving north from Morehead in Rowan County has the highest known use by local cyclists (MP 3.2–9.5). Near MP 9.5 or Dry Branch Road, cyclists appear to ride east on Holly Fork Road and Flat Fork Road. Northward, usage appears to be very minimal in the corridor. During multiple site visits, field inventory, local officials meetings, and public meetings at various times, bicyclists were not observed along the corridor.

According to the KYTC Bicycle Pedestrian Coordinator's summary **(Appendix H),** the current bicycle comfort index for the corridor is C ("A"=Best). Adding 8-foot shoulders and providing gaps in the shoulder rumble strips every 40 to 60 feet would improve the index to B.

B. Pedestrians

Based on the Statewide Interactive Map for Bicycle and Pedestrian Planning developed as part of the KYTC Bike Walk Program, there are existing sidewalks along Fairlane Drive/Lexington Avenue from Shelton Lane (Old KY 10) to KY 8 (Clarksburg Road) in Vanceburg. There is also an existing sidewalk on the west side of Fairlane Drive from Shelton Lane that ends at Washington Street, approximately 0.4 mile. Recently, as part of the Safe Routes to School project, the City of Vanceburg applied for funds to repair, replace, and expand sidewalks from Shelton Lane to KY 8. The project could also include possibly replacing an existing bridge on Fairlane Drive and providing sidewalks on a new bridge, and ultimately improving pedestrian access to Central Elementary School.

During the five-year crash analysis period, there were two pedestrians struck on KY 377 in Rowan County (MP 9.764 and MP 1.463), one of which occurred under dark conditions.

Item Number 9-8406 improvements from KY 32 to KY 799 (Big Perry Road) do not provide for sidewalks; however, they provide an 8-foot-wide paved shoulder that will better accommodate pedestrians. During site visits, pedestrians have been observed walking north along KY 59 from KY 9. At the first local officials meeting, a need was expressed for pedestrian accommodations on KY 59 from KY 9 to Fuller Branch Road.

C. Transit

Lewis County

Public transit in Lewis County is operated and maintained by Federated Transportation Services of the Bluegrass, Inc. (FTSB), which provides public transportation in the form of a Demand Response Service

[7] Strava is a data service providing where people ride and run. Millions of GPS-tracked activities are uploaded to Strava every week from around the globe. These activities create billions of data points that, when aggregated, enable deep analysis and understanding of real-world cycling and pedestrian route preferences. Strava users track their rides and runs with a smartphone or with a GPS device.

with opportunities for job and education rides within Lewis County and to Maysville. The Lewis Trans Service (L'Trans) began in 2009 and serves residents of Vanceburg and Lewis County. This transportation service is available to all individuals who need transportation to places of employment, college or GED class, job interviews, job training, etc. There is currently one park and ride shelter in the project study area located at the intersection of KY 59 and Fairlane Drive in Vanceburg.

Rowan County

FTSB provides public transportation in Rowan County by doing business as Mor'Trans. Mor'Trans provides a specialized service for individuals traveling to jobs, schools, commercial activity centers and neighborhoods for the residents of Morehead and Rowan County. Mor'Tran currently maintains 4 bus routes within Morehead and also intercity travel to Lexington and Ashland.

D. Sheltowee Trace

Sheltowee Trace is a 290-mile long trail that that begins (or ends) at a trailhead on KY 377 located along the Rowan/Lewis county line, and extends south into Tennessee. Hiking is allowed on the entire trail. Horses, mountain bikes and off-highway vehicles less than 50 inches wide are permitted only on sections designated for those uses. *(http://www.sheltoweetrace.com/)*

VI. Traffic Operations

A. Existing Traffic and Operations

Peak-hour turning movement counts were performed in March 2015 at KY 799/KY 377, KY 344/KY 59, and KY 59/KY 9 intersections. KYTC historical traffic counts and information from these 2015 intersection counts were used to estimate 2015 ADT.

Historical traffic count data are summarized in **Table 7 (p. 25)**. Truck percentages range from less than 7% on KY 59 near KY 9 to nearly 14% on KY 377 in Lewis County. For purposes of capacity analyses, KY 59, KY 344, and KY 377 were identified as Class I Highways (2010 Highway Capacity Manual). Class I two-lane highways are major intercity routes, primary connectors of major traffic generators, daily commuter routes, or major links in state or national highway networks. These facilities serve mostly long-distance trips or provide connections between facilities that serve long-distance trips.

Level of Service (LOS) is a performance measure used to determine a roadway or intersection performance. Levels of service are described according to a letter rating system ranging from LOS "A" (free flow, minimal or no delays—best conditions) to LOS "F" (stop and go conditions, very long delays—worst conditions). The LOS criteria for Class I highways are measured by Average Travel Speed (ATS) and Percent Time Spent Following (PTSF).

As shown in **Table 8 (p. 25)**, the study corridor currently operates at LOS C or D in both AM and PM peak hours, as a result of low average travel speeds and high PTSF another vehicle.

Table 9 (p. 25) depicts the traffic operations for the major corridor intersections. The levels of service for stop control and signalized intersections are measured in delay. The KY 59 / KY 9 intersection has movements currently operating at LOS C (considered the threshold for rural areas). LOS D is an indication of a potential issue and the need for improvement alternatives.

Table 7: Historical Traffic Counts

County	Count Station	Route	From		To		ADT (Year)			
			MP	Location	MP	Location				
Rowan	103001	KY 377	8.049	KY 799 East	9.522	Dry Branch Rd.	1,148 (2014)	1,170 (2011)	1,450 (2008)	1,510 (2005)
Rowan	103025	KY 377	9.522	Dry Branch Road	15.339	County Line	1,030 (2009)	1,000 (2006)	948 (2002)	932 (1998)
Lewis	068504	KY 377	0.000	County Line	8.555	KY 344	370 (2013)	486 (2010)	399 (2007)	462 (2004)
Lewis	068800	KY 344	13.843	KY 377	18.516	KY 59	598 (2014)	662 (2008)	977 (2002)	1,350 (1998)
Lewis	068799	KY 59	18.093	KY 344	21.389	Rock Run	1,169 (2014)	1,340 (2008)	1,590 (2002)	1,760 (1998)
Lewis	068A44	KY 59	21.389	Rock Run	22.647	Moore St.	1,556 (2012)	2,360 (2009)	2,530 (2002)	2,790 (1998)
Lewis	068A46	KY 59	22.647	Moore St.	23.190	KY 9	2,087 (2012)	2,650 (2008)	2,530 (2002)	2,790 (1998)

Table 8: Year 2015 Mainline Traffic Operations

Section Descriptions					2015 Existing							
					AM				PM			
Route	Beg MP Desc	Beginning MP	End MP Desc	Ending MP	LOS	PTSF	ATS (mph)	v/c Ratio	LOS	PTSF	ATS (mph)	v/c Ratio
KY 377	KY 799 East	Rowan 8.049	KY 344	Lewis 8.555	D	53.4	41.5	0.13	D	50.9	41.2	0.12
KY 344	KY 377	13.843	18.516	KY 59	C	38.2	46.2	0.05	C	33.5	46.2	0.05
KY 59*	KY 344	18.093	23.190	KY 9	C	58.2	46.2	0.17	C	61.0	45.7	0.19
KY 59**	Rock Run Road	21.389	Near Moore Street	22.679	D	47.8	44.2	0.34	D	53.9	41.3	0.53

*KY 59 from KY 9 to KY 344 **Vanceburg Hill segment only

PTSF–Percent Time Spent Following ATS–Average Travel Speed v/c–Volume to Capacity Ratio MP–Milepoint Desc–Description

Table 9: Year 2015 Intersection Traffic Operations

Intersection	Direction of Travel	2015Existing LOS			
		AM		PM	
KY 377/KY 799	KY 377 SB	LT (To KY 799 East)	THRU (To KY 799 SB)	LT (To KY 799 East)	THRU (To KY 799 SB)
		A	A	A	A
	KY 799 WB	LT (To KY 377 S)	RT (To KY 377 N)	LT (To KY 377 S)	RT (To KY 377 N)
		B	B	A	A
KY 377/KY 344 and KY 344/KY 59 Intersections	Both	A	A	A	A
KY 59/9	KY 59 NB	LT (To KY 9W)	THRU/RT (To KY 59N/KY9E)	LT (To KY 9W)	THRU/RT (To KY 59N/KY 9E)
		C	B	C	C
	KY 9	EB RT (To KY59S)	WB LT (To KY 59S)	EB RT (To KY59S)	WB LT (To KY 59S)
		A	A	A	A

B. Speed Data

Speed data collected during field reviews along the entire corridor averaged 46 mph. These data were collected with a datalogger (provided by KYTC) during non-peak times travelling a comfortable, normal speed for the corridor. This information was compared to speeds in the Statewide Travel Demand Model to see if increasing speeds in the model would result in increased assignment to study area roadways. However, the speeds in the statewide model (48 mph–55 mph) were already higher than those observed in the field. Additional traffic was not assigned for a "build scenario," although an improved corridor could attract additional traffic to and from Morehead State University as expressed by some Lewis County residents at the first public meeting, since it is the only north/south corridor between Vanceburg and Morehead.

C. 2040 Traffic Forecast

According to the 2010 U.S. Census, Lewis County has a population of 13,870 and, per the Kentucky State Data Center, a forecasted 2040 population of 13,087. Rowan County has a 2010 population of 23,333 and, per the Kentucky State Data Center, a forecasted 2040 population of 26,775. An analysis of historical KYTC traffic counts (1992 to 2014), using 2015 as the base year and 2040 as the future year, is provided in the Traffic Forecast Report in **Appendix I**. The analysis shows traffic volumes have grown very little throughout the years, with several segments showing negative growth. Generally, the roadway segments with the lower ADTs had the higher growth rates.

An overall traffic annual growth rate of 1% was approved by KYTC and was used for all future forecasting and analysis purposes for the entire corridor. For truck percentage growth, KYTC recommended 0%, i.e., the 2040 ADT and Design Hour truck percentages are expected to remain constant. Using these growth rates, forecasted traffic volumes are shown in **Table 10**.

D. 2040 No-Build Traffic Operations

Based on forecasted volumes, the mainline operating characteristics in year 2040 are shown in **Table 11 (p. 27)**. Due to the PTSF and ATS, sections of KY 377 and KY 59 (Vanceburg Hill) are expected to operate at LOS D and LOS E in 2040.

Table 10: Projected Future Traffic Volumes

County	Count Station	Route	From MP	Location	To MP	Location	ADT (Year)			
							2015	2020	2030	2040
Rowan	103001	KY 377	8.049	KY 799 East	9.522	Dry Branch Road	1,300	1,340	1,420	1,500
Rowan	103025	KY 377	9.522	Dry Branch Road	15.339	County Line	1,090	1,150	1,270	1,400
Lewis	068504	KY 377	0.000	County Line	8.555	KY 344	380	400	440	480
Lewis	068800	KY 344	13.843	KY 377	18.516	KY 59	700	740	810	900
Lewis	068799	KY 59	18.093	KY 344	21.389	Rock Run	1,180	1,240	1,370	1,515
Lewis	068A44	KY 59	21.389	Rock Run	22.647	Moore St.	1,600	1,685	1,860	2,055
Lewis	068A46	KY 59	22.647	Moore Street	23.190	KY 9	2,200	2,290	2,500	2,700

Table 11: 2040 No-Build Mainline Traffic Operations

Section Descriptions					2040 No-Build							
					AM				PM			
Route	Beg MP Desc	Beg MP	End MP Desc	End MP	LOS	PTSF	ATS (mph)	v/c Ratio	LOS	PTSF	ATS (mph)	v/c Ratio
KY 377	Rowan 8.049	KY 799 East	Lewis 8.555	KY 344	D	56.4	40.3	0.16	E	55.0	39.9	0.15
KY 344	KY 377	13.843	KY 59	18.516	C	39.9	45.7	0.07	C	37.3	45.2	0.07
KY 59*	KY 344	18.093	KY 9	23.190	C	61.6	45.8	0.19	C	64.6	45.1	0.23
KY 59**	Rock Run Road	21.389	Near Moore Street	22.679	D	52.9	43.0	0.41	E	58.2	39.5	0.66

*KY 59 segment from KY 9 to KY 344 **Vanceburg Hill segment only ATS–Average Travel Speed PTSF–Percent Time Spent Following V/C–Volume/Capacity Ratio LOS=Level of Service

Table 12 illustrates future operations for the intersections on the corridor. As shown, the KY 9/KY 59 intersection northbound left operates at LOS F and the northbound thru/right operates at LOS D due to left turns from KY 59. However, the queue length is only 4 vehicles. A right-turn lane onto KY 9 would improve LOS for that turn movement to LOS B.

Table 12: 2040 No-Build Intersection Operations

Intersection	Direction of Travel	2040 No-Build LOS			
		AM		PM	
KY 377/KY 799	KY 377 SB	LT (To KY 799 East)	THRU (To KY 799 SB)	LT (To KY 799 East)	THRU (To KY 799 SB)
		A	A	A	A
	KY 799 WB	LT (To KY 377 South)	RT (To KY 377 North)	LT (To KY 377 South)	RT (To KY 377 North)
		B	B	A	A
KY 377/KY 344 and KY 344/KY 59	Both	A	A	A	A
KY 9/KY 59	KY 59 NB	LT (To KY 9W)	THRU/RT (To KY 59N/KY9E)	LT (To KY 9W)	THRU/RT (To KY 59N/KY 9E)
		C	C	F	D/B*
	KY 9	EB RT (To KY59S)	WB LT (To KY 59S)	EB RT (To KY59S)	WB LT (To KY 59S)
		A	A	A	A

*With added right-turn lane.

VII. Environmental Overview

The purpose of an environmental overview is to assess potential key environmental resources, impacts, and issues that may be important during the future alternatives development and environmental documentation stage of this project**. Figure 12 (p. 31)** visually depicts these key environmental resources, impacts, and issues at a macro level. The following is a brief overview of anticipated key environmental areas of concern and a more detailed review of the environmental issues associated with the different alternatives will follow later in the report. The goal of the project is to avoid, minimize or mitigation impacts to all social, economic, and environmental resources of the natural and built environment.

A. Natural Resources

The corridor's natural resources were examined and are summarized in the following paragraphs.

1. Aquatic Resources

The aquatic resources assessment was completed by Redwing Ecological Services, Inc., through an in-house review of available information and a reconnaissance of the study area in March 2015.

The study area contains a mix of open/developed land, scrub-shrub habitat, mature woods habitat, and disturbed woods habitat **(Table 13)**. Open and developed areas are located on the lower, flat ground and consist of residential and commercial development, and road right of way. Flat land in the corridor is a premium and most flat areas have been heavily modified by past development activities, including stream ditching and culverting.

Table 13: Terrestrial Habitat Resources

Feature	Status	Length (miles)	Area (acres)	Number
Mature Woods Habitat	---	---	**8,995**	---
Disturbed Woods Habitat	---	---	**1,172**	---
Scrub-Shrub Habitat	---	---	**52**	---
Open/Developed	---	---	**3,236**	---
Terrestrial Habitat Total			**13,455**	---

Aquatic resources in the study area are summarized in **Table 14 (p. 29)**. The streams generally flow to the central valley and then are routed through road ditches and culverts to three major streams: Kinniconick Creek flows northeastward in the northern portion of the study area, Indian Creek flows northward in the central portion of the study area, and North Fork Triplett Creek flows southward in the southern portion of the study area.

Kinniconick Creek is designated as special use waters with the following designations: Outstanding State Resource Waters, Exceptional Waters, and Reference Reach Waters. Special use waters are rivers, streams, and lakes listed in the Kentucky Administrative Regulations (KAR) that are worthy of additional protection. Stream impacts would require permits from USACE and KDOW.

Table 14: Aquatic Resources

Feature	Status	Length (miles)	Area (acres)	Number
Ephemeral Streams	Jurisdictional	67.4	---	---
Intermittent Streams	Jurisdictional	26.7	---	---
Perennial Streams	Jurisdictional	50.8	---	---
	Stream Total	144.9	---	---
Special Use Waters	---	5.6	---	---
	Special Use Waters Total	5.6	---	---
Forested Wetlands	Jurisdictional	---	118.7	---
Scrub-Shrub Wetlands	Jurisdictional	---	9.7	---
Emergent Wetlands	Jurisdictional	---	6.7	---
Agricultural Wetlands	Jurisdictional	---	17.1	---
	Wetland Total	---	152.2	---
Ponds	Jurisdictional	---	13.1	55
	Pond Total	---	13.1	

2. Stream Mitigation Sites

The stream mitigation site located very near the KY 377/KY 344 intersection has a conservation easement. A stream mitigation site is a stream that has been restored, established, enhanced or preserved for the purpose of providing compensation for unavoidable impacts to resources permitted under Section 404 of the Clean Water Act. Impacts to this area should be avoided. USACE states in resource agency coordination correspondence **(Appendix J)** the following:

> *Please be aware that the Kinniconick and Indian Creek Stream Restoration Project was approved by the Interagency Review Team (IRT) and the project has been permanently protected through the implementation of a conservation easement (CE). The CEs are legally binding, permanent restrictions on the use, modification and development of the property. Current and future owners of the easement and the property are bound by the terms of the CEs. Therefore, any disturbance within the CE is prohibited and any impact to the project must be avoided.*

The USACE Chief of Louisville District requested an early meeting with the Project Team as study alternatives progress in the project development phase. He also stressed avoidance.

3. Floodway and Floodplain

Portions of KY 344 south of the Kinniconick community lie within the 100-year floodplain of Kinniconick Creek. Members of the public identified two areas along KY 344 (MP 17.20 and MP 17.50) that are noted for continual flooding.

4. Caves and Rockshelters

A review of mine maps, topographic quadrangle maps, and geologic maps did not show any underground or surface mines within the vicinity of the project. The majority of the project area is classified as non-karst, with small areas of low karst potential in the southern portion of the project. No caves, sinkholes, rockshelters, or other underground features were observed within the study area during the reconnaissance.

5. Threatened and/or Endangered Species

Based on coordination and review of available database information from the U.S. Fish and Wildlife Service (USFWS), the Kentucky Division of Fish and Wildlife Resources (KDFWR), and the Kentucky State Nature Preserves Commission (KSNPC), 17 federally listed threatened/endangered species are known to occur or have the potential to occur in Lewis and Rowan counties. In addition, one species that has been delisted under the Endangered Species Act, the American bald eagle (*Haliaeetus leucocephalus*), was also identified. This species is protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The species identified during the review are listed in **Table 15** and species' habitats are listed in **Table 16 (p. 32)**.

Table 15: Threatened and/or Endangered Species

Group	Scientific Name	Common Name	Federal Status	Resource Agency
Mammals	*Myotis septentrionalis*	northern long-eared bat	Threatened	USFWS, KDFWR
	Myotis sodalis	Indiana bat	Endangered	USFWS, KDFWR, KSNPC
	Myotis grisescens	gray bat	Endangered	USFWS, KDFWR
	Corynorhinus townsendii virginianus	Virginia big-eared bat	Endangered	USFWS, KDFWR, KSNPC
Mussels	*Cyprogenia stegaria*	fanshell	Endangered	USFWS, KDFWR, KSNPC
	Epioblasma obliquata obliquata	catspaw	Endangered	USFWS, KDFWR, KSNPC
	Epioblasma torulosa	northern riffleshell	Endangered	USFWS, KSNPC
	Epioblasma triquetra	snuffbox	Endangered	USFWS, KDFWR, KSNPC
	Lampsilis abrupta	pink mucket	Endangered	USFWS, KDFWR, KSNPC
	Obovaria retusa	ring pink	Endangered	USFWS, KDFWR, KSNPC
	Plethobasus cooperianus	orangefoot pimpleback	Endangered	USFWS, KDFWR, KSNPC
	Plethobasus cyphyus	sheepnose	Endangered	USFWS, KDFWR, KSNPC
	Pleurobema clava	clubshell	Endangered	USFWS
	Pleurobema plenum	rough pigtoe	Endangered	USFWS, KDFWR, KSNPC
	Quadrula cylindrica	rabbits foot	Threatened	USFWS, KDFWR, KSNPC
Plant	*Spiraea virginiana*	Virginia spiraea	Threatened	USFWS, KSNPC
Birds	*Haliaeetus leucocephalus*	bald eagle	Delisted*	USFWS, KSNPC
	Sternula antillarum athalassos	interior least tern	Endangered	KDFWR

** Although bald eagles are no longer on the USFWS's list of federally protected species, the eagles are protected under two other federal laws: the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.*

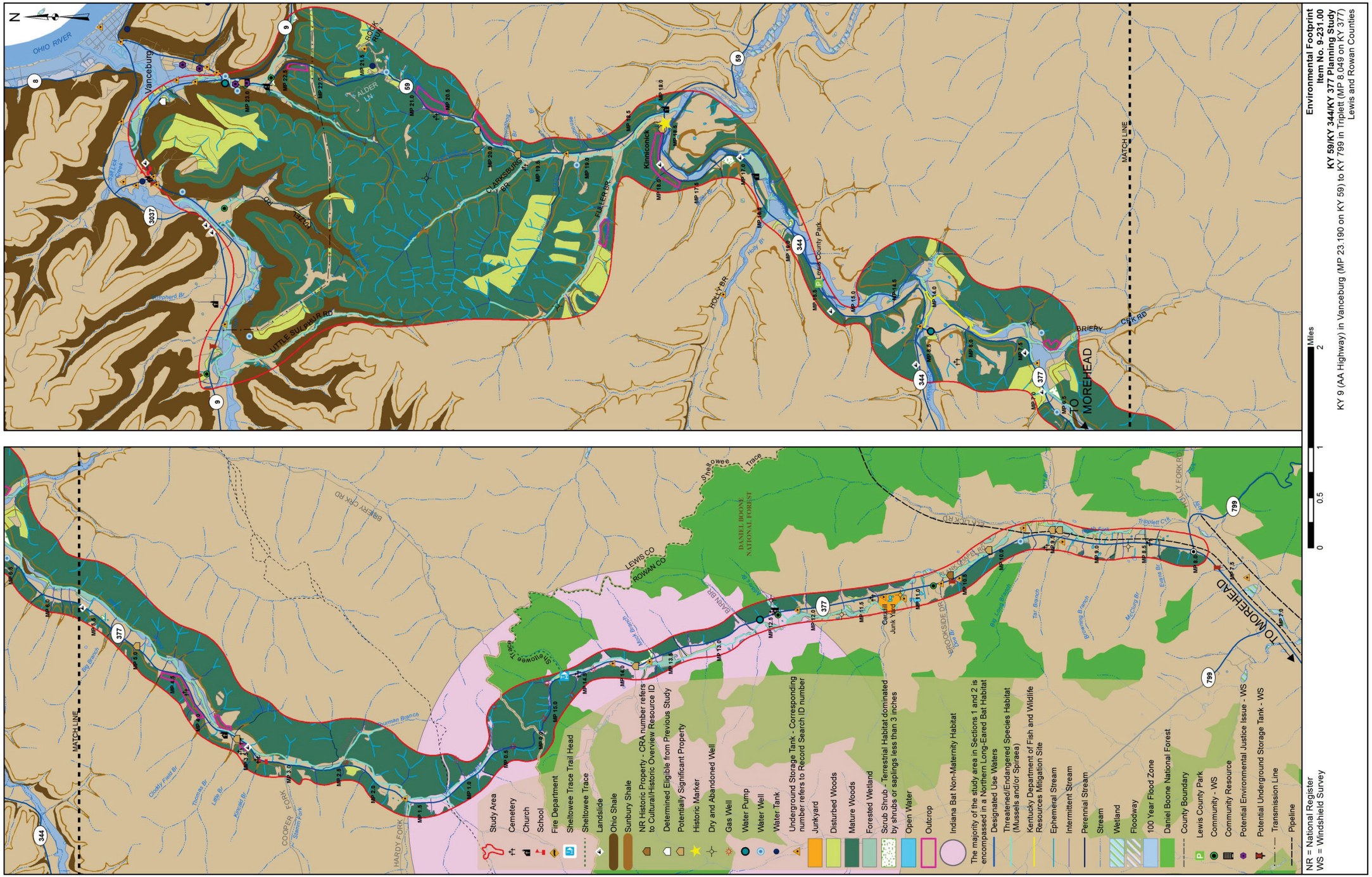


Figure 12: Environmental Footprint

The mature and disturbed woods habitats are considered potential Indiana bat and northern long-eared bat summer habitat. The wooded corridors along the perennial and intermittent streams provide potential foraging habitat for the gray bat. The southern portion of the study area is in the vicinity of known summer/maternity roosting habitat for both the northern long-eared bat (NLEB) and Indiana bat.

Table 16: Study Area Threatened and/or Endangered Species Habitat

Feature	Status	Stream Length (miles)	Area (acres)	Number
Potential Virginia Spiraea Habitat	---	24.2	---	---
Potential Mussel Habitat	---	38.9	---	---
Potential Indiana Bat/NLE Bat Summer Habitat	---	---	10,286	---
Potential VBE Bat Summer Roosting	---	---	119	---
Known Indiana Bat Habitat Zone Overlap	---	---	1,038	---
Known NLE Bat Habitat Zone Overlap	---	---	2,326	---
Rapid Bioassessment Protocol Points	---	---	---	---
Water Quality Sampling Points	---	---	---	---

6. Federally listed Species

The southern portion of the study area is located within known maternity habitat for the northern long-eared bat and non-maternity habitat for the Indiana bat. Habitat impacts and impacts to wooded habitats should be minimized to the extent possible.

Populations of Virginia spiraea and federally listed mussel species are known to occur along Kinniconick Creek downstream of the study area. It does not appear impacts to Kinniconick Creek basin streams can be totally avoided. The minimization of the proposed crossing and/or the use of the existing crossing location would minimize potential impacts to federally listed species. If a build alternative is selected as the recommended action, consultation with USFWS under Section 7 of the Endangered Species Act would be initiated prior to construction. Depending on whether there would be protected species that would be impacted by the project, the agency may require a Biological Assessment (BA) to address potential impacts and identify mitigation measures. Bald eagles remain protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Consultation with USFWS would likely be required for the protection of any bald eagle should there be one within or near the project corridor.

B. Human Resources

The human resources were examined and are summarized in the following paragraphs.

1. Noise

The study corridor is located in a mostly rural area. There are several clusters of residential dwellings, churches, and schools along the corridor **(Figure 13, p. 33)** that would likely require noise readings and impact analysis. However, given existing and projected future traffic volumes, it is not anticipated noise levels would approach or exceed Noise Abatement Criteria or be an issue.

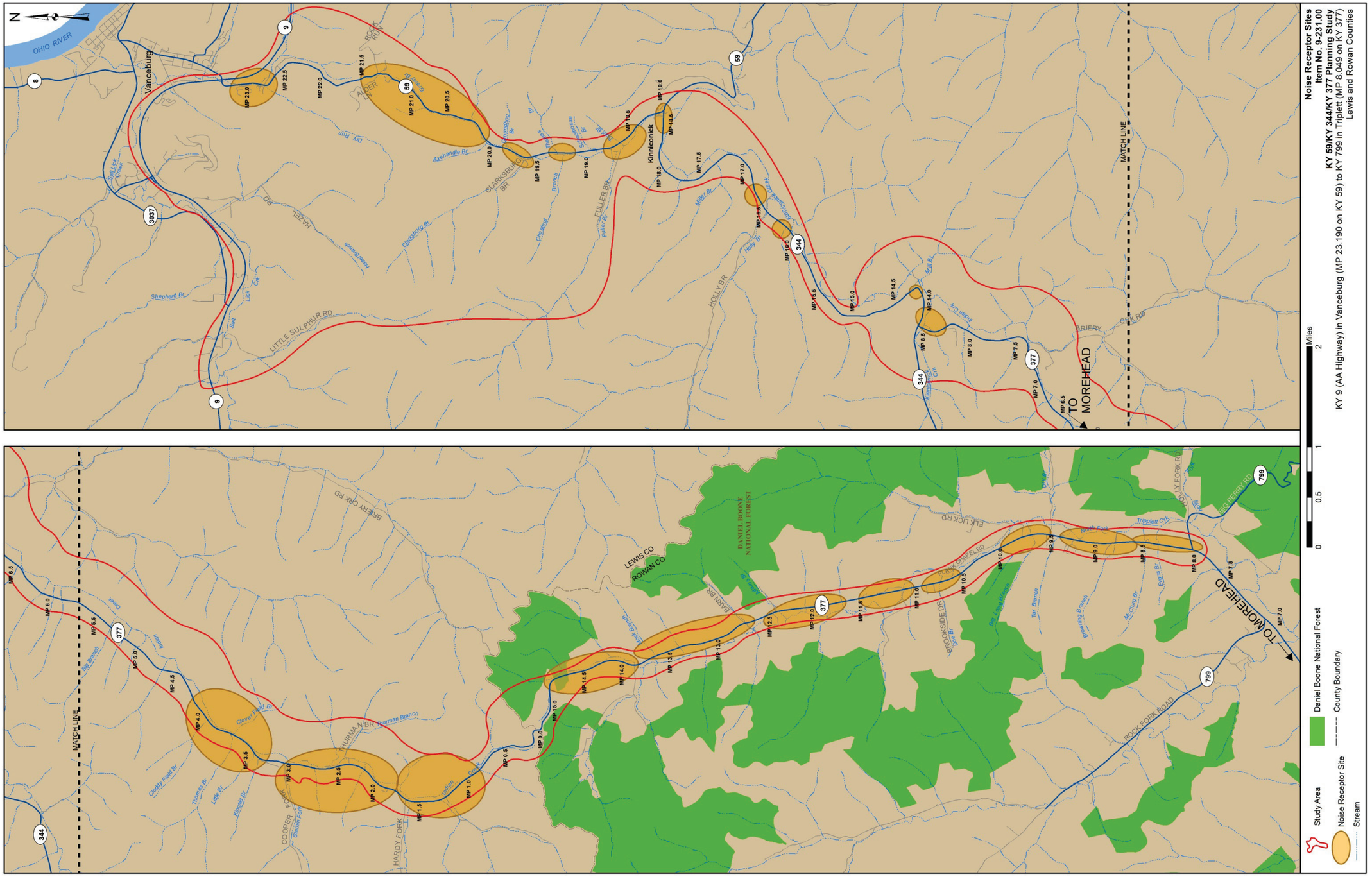


Figure 13: Noise Receptor Sites

2. Air Quality

In accordance with the U.S. Environmental Protection Agency (EPA) Green Book Nonattainment Areas for Criteria Pollutants, as of December 5, 2013, Lewis and Rowan counties are in attainment for all National Ambient Air Quality Standards (NAAQS) for the six major air quality pollutants—particulate matter (PM), sulfur dioxide (SO2), carbon monoxide (CO), ozone (03),nitrogen dioxide (NO2), and lead (Pb). Per "Kentucky Guidelines: How to address Air Quality in NEPA Documents, March 2016," a reconstruction project for this corridor would not warrant a quantitative air quality analysis for any pollutant.

Improvement alternatives are expected to generate minimal air quality impacts for Federal Clean Air Act Amendments (CAAA) criteria pollutants and not linked with any special Mobile Source Air Toxics (MSAT) concerns. Proposed alternatives would not result in significant changes in traffic volumes, vehicle mix, basic project location, or any other factor that would cause an increase in MSAT impacts greater than those of the No-Build Alternative. This project is therefore considered to be **"Exempt or Have No Potential for Meaningful MSAT Effects."**

Moreover, EPA regulations for vehicle engines and fuels will cause overall MSAT emissions to decline significantly over the next several decades. Based on regulations now in effect, an analysis of national trends with EPA's MOVES model forecasts a combined reduction of over 80% in the total annual emission rate for the priority MSAT from 2010 to 2050 while vehicle-miles of travel are projected to increase by over 100%. This will both reduce the background level of MSAT as well as the possibility of minor MSAT emissions from this project.

3. Socioeconomic Impacts

a) Environmental Justice

Executive Order 12898, Environmental Justice (EJ), requires the avoidance of disproportionately high and adverse impacts to low-income and minority populations, and that the adverse impacts of such project not be predominantly borne by such populations.

The Buffalo Trace Area Development District (BTADD) and Gateway Area Development Districts (GADD) jointly prepared a Socioeconomic Study Review, of the study corridor (**Appendix K**). Data collected for this corridor study was based on methodology outlined in KYTC's document, "Methodology for Assessing Potential Environmental Justice Concerns for KYTC Planning Studies." The primary source of data is the Kentucky State Data Center 2009–2013, U.S. Census Bureau American Community Survey.

Figure 14 (p. 36), shows the Socioeconomic Study Area and associated Census Block Groups in Rowan and Lewis counties. **Table 17 (p. 35)** shows this information as well as Block Groups where the state and county average is exceeded for a particular demographic category, including those not associated with EJ issues (such as persons with disabilities and persons speaking English less than very well).

Table 17: Demographic Indicators within the Study Area

Category	Census Tract	Block Group	Exceeds State Average	Exceeds County Average
Minority	9302	1		✓
	9302	3		✓
Hispanic or Latino Origin	9304	2		✓
	9501	1		
65 and Older	9302	1	✓	
	9302	2	✓	✓
	9501	1	✓	✓
Level of Poverty	9302	1	✓	
	9302	2	✓	✓
	9302	3	✓	✓
	9304	2	✓	✓
	9501	1	✓	✓
Population Speaking English Less Than Very Well	9302	2		✓
	9304	1		✓
Disabled Population between 16 and 64	9302	1	✓	✓
	9302	2	✓	✓
	9302	3	✓	✓
	9304	2	✓	✓
	9501	1	✓	✓

If build alternatives are advanced, a more detailed analysis of existing socioeconomic conditions and potential project-related impacts (including residential relocations) would be conducted as part of the National Environmental Policy Act (NEPA) process. In accordance with Executive Order 12898 and subsequent regulations, that analysis would assess the project's potential for causing disproportionately high and adverse effects to low income and minority populations, and identify measures to mitigate the impacts, if needed.

b) **Land Use**

The existing land use within the study corridor consists mostly of farmland, with limited rural residential and commercial developments. There are commercial and residential developments on KY 59 near the intersection with Rock Run Road near MP 21.40. KY 59 from its intersection with Leslie Street to the intersection with KY 9 is developed with commercial, residential, health care, and religious facilities, as well as transportation terminals. A major transmission line crosses KY 59 near MP 22.10. This project is not expected to induce significant land use change along the corridor.

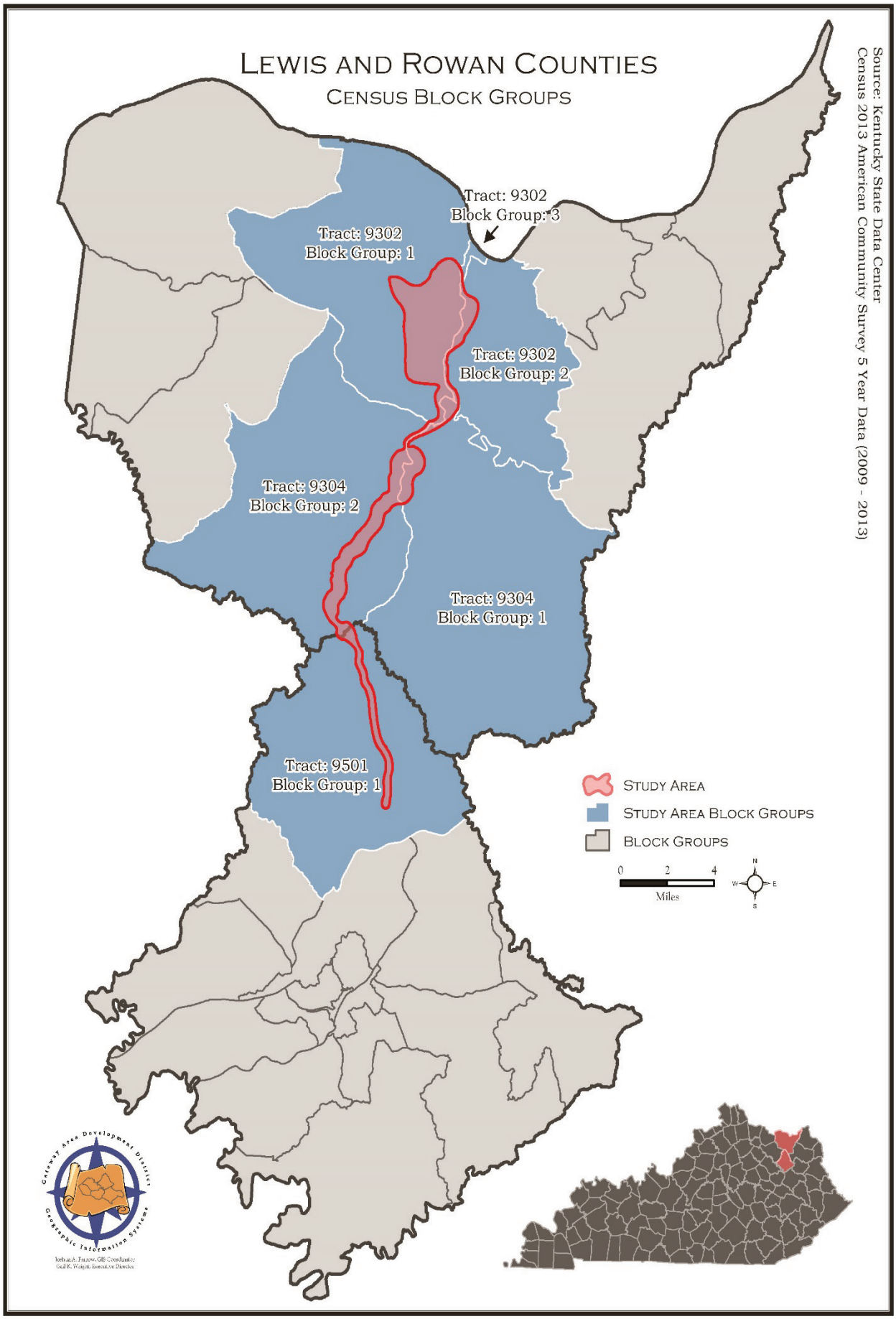


Figure 14: Census Block Groups

c) **Prime and Important Farmland**

Prime farmland is defined as land having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops. It is also used to identify how much of this land is still available for these uses. In 2004, there were approximately 36,200 acres or 11.4% of the total acreage in Lewis County that meets soil requirements for prime farmland. The majority of prime farmland in Lewis County is located in the western and northern areas.

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. The majority of soil types categorized as prime, important or unique farmland within the project study area occur primarily in four locations[8]. These locations mostly used for crops such as tobacco, corn, soybeans and hay, are identified as:

- Along both sides of KY 377 between Adams Branch and the southern terminus at KY 799
- Southeast and east side of KY 377 near the intersection of KY 344
- Along KY 344 between KY 59 and KY 377
- West of Vanceburg along KY 9

Future coordination with U.S. Department of Agriculture (USDA) will be required during project development while Impacts to associated prime/important farmland and/or hydric soils will be minimized as much as possible.

d) **Hazardous Materials**

This overview conducted by Hall-Harmon Engineers, Inc., is based upon GIS data and information provided in the DataMap Area Study by Environmental Data Resources, Inc. (EDR), a commercial provider of environmental risk information.

EDR conducted an electronic review of applicable federal, state, and local environmental databases to investigate locations that might contain underground storage tanks or hazardous materials that could pose substantial costs and liabilities for right of way acquisition and cleanup. The search consisted of 54 federal records, 19 state and local records, 5 tribal records, and 5 EDR proprietary records within the study area. The EDR database searches identified and mapped 27 listed sites occurring in multiple record searches. Records databases for the listed sites identified in the EDR DataMap Area Study are included in **Appendix K**.

Additional investigation of the orphan sites showed that except for one, all were either not locatable, or were outside the study area. Orphan sites are those sites contaminated by a release of hazardous substances that poses serious threats to human health or the environment, where the parties responsible for the contamination are unknown, unable or unwilling to pay for needed remedial actions. In addition to the records search, a windshield survey was conducted to identify additional potential hazardous sites.

[8] Custom Soil Resource Report for Lewis County, Kentucky, and Lewis and Rowan Counties, Kentucky KY 59/ KY 344/ KY 377 Study, Appendix J, p.12.

This overview did not include interviews of local representatives and records have not been field verified. It is possible that facilities are present within the study area that may provide environmental concerns. It is recommended that further investigation be performed and field verification of both the mapped sites and unmapped orphan sites identified be conducted to accurately locate sites of concern as alternatives are developed. On KY 377 in Rowan County, a very large auto junkyard lies west of KY 377 at MP 11.10. Other HAZMAT sites exist near MPs 9.20, 9.80, 10.50, 10.70, and 12.20. Although it was not flagged in any database search, an old store or repair shop on the west side near MP 8.10 might also be a HAZMAT site. All known HAZMAT sites are shown on **Figure 12 (p. 31)**.

e) **Community Resources**

Community resources in the study area were given consideration as alternatives were developed, and those resources are shown in **Figure 12 (p. 31)**. Special concern for continuous access to medical facilities near the KY 59/KY 9 intersection and Fuller Branch were noted throughout the study. Fire departments, small subdivisions, and other resources were identified throughout the corridor.

4. Archaeological and Cultural Historic Resources

Archaeological and cultural historic resources reviews of known resources in the study corridor were conducted in March 2015 by Cultural Resource Analysts, Inc. (CRA). This information was supplemented by a windshield survey. In addition, recommendations were made regarding each site's eligibility for inclusion in the National Register of Historic Places (NHRP).

a) **Archaeological Resources**

CRA performed an online search of records maintained by the NRHP, and a March 2015 on-site search of the state's Office of State Archaeology (OSA) records to:

a. Determine if the study area had been previously surveyed for archaeological resources.
b. Identify previously recorded archaeological sites situated within the study area.
c. Provide information concerning expected archaeological resources within the study area.
d. Provide a context for archaeological resources recovered within the study area.

The NRHP records revealed no NRHP-listed archaeological sites within the study area or within a 2-kilometer radius. OSA records indicated very little of the project area had been previously surveyed. Of the areas surveyed, five previously recorded archaeological sites were identified in the study area. Three sites were determined to be not eligible for the NRHP and no further work was recommended. The windshield survey (March 2015) found that two of the three sites had been destroyed by the construction of a modern housing subdivision. One site could not be observed during the windshield survey due to its location well away from the road. The stone mound is likely prehistoric and could contain human remains.

Alluvial landforms **(Figure 15, p. 40)** such as floodplains and terraces are considered to have the highest potential to produce archaeological materials. Given the majority of previously recorded sites in the project area were identified in alluvial settings, similar settings occurring within the study area should be regarded as having high archaeological potential, including

potential for intact, buried deposits. Given the presence of a possible stone mound, it is likely other stone mounds will also be present on similar landforms (e.g., bluff crest). These landforms may also have rock shelters that were previously occupied by prehistoric groups in the past. The stone mound is likely prehistoric and could contain human remains.

The archaeological overview report, associated exhibits and shape files were provided to KYTC separately.

b) **Cultural Historic/Historic Properties**

Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966 and Section 106 of the National Historic Preservation Act provide protection for NRHP-listed or -eligible sites. Records at the Kentucky Heritage Council (KHC) review performed by CRA revealed four previously surveyed properties in the study area, one in Rowan County (RW 13) and three in Lewis County:

- Seth Parker House (LW 5)
- The Grassy Creek School (LW 31)
- Walnut Grove Church (LW 33)
- RW 13 in Rowan County the #15 Plank Voting House is listed as part of the Rowan County WPA Stone Voting Houses Multiple Property Submission (MPS).

Through a windshield survey in March 2015, architectural historians noted locations of 11 additional potentially significant resources. In addition, CRA determined that LW 5 and LW 33 were not eligible, and LW 31 was not located or was incorrectly mapped.

No potential historic districts were identified by the windshield survey. In general, there were few intact cultural historic sites observed throughout the study area. The area has always been relatively sparsely populated, and many historic residences have been demolished, although a large number of historic barns and other outbuildings remain and appear to be in generally good condition. The windshield survey did not identify any barns or outbuildings that appear individually eligible for listing in the NRHP, although a more detailed survey, including examination of the building's interiors, may identify particularly old or significant examples. The remaining resources 50 years of age or older observed in the study area are generally common early- to mid-twentieth-century residences such as bungalows, ranch houses, and modest vernacular front- and side-gable frame houses. Many of these are abandoned and thus severely deteriorated or have undergone material changes that have diminished their integrity, so they are unlikely to be eligible for listing in the NRHP.

A number of cemeteries were observed throughout the study area, but most of these contained a majority of burials that are less than 50 years old, and none exhibited distinctive features likely to make them eligible for listing in the NRHP from a cultural historic perspective.

The full overview is located in **Appendix K**. Cemeteries identified through known mapping and field visits are identified on environmental footprint **Figure 12 (p. 31)**.

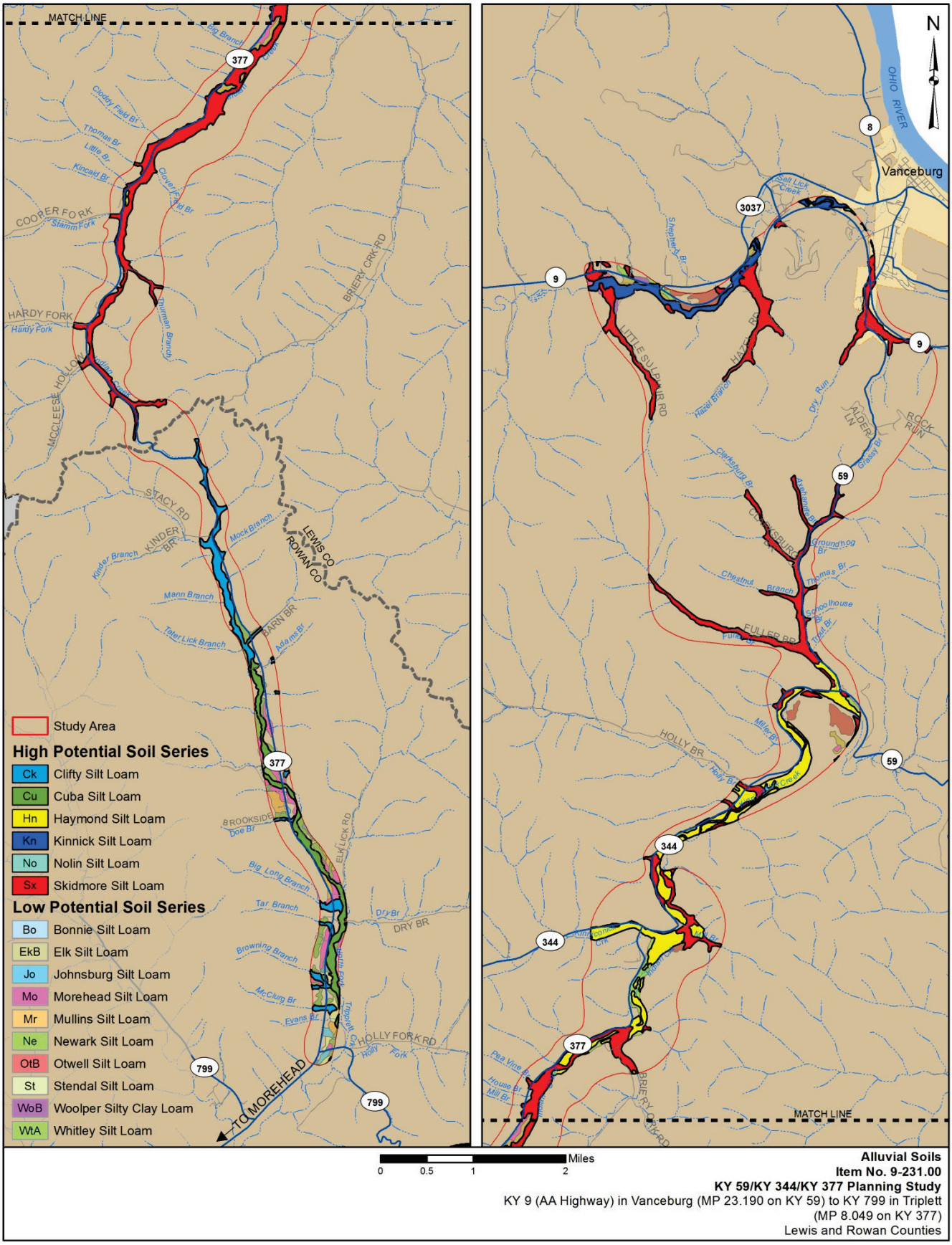


Figure 15: Archaeological Potential with Alluvial Soils

c) **Section 4(f) and Section 6(f)**

Section 4(f) of the USDOT Act of 1966 requires that, prior to the use of any of the resource types listed below, it must be determined either (1) there is no prudent and feasible alternative that avoids such use and the project includes all possible planning to minimize harm resulting from such use, or (2) the use will result in a *de minimis* (i.e., minimal) impact on the resource protected under Section 4(f). Resources protected under Section 4(f) include:

1. A publicly owned and officially designated park.
2. A publicly owned and officially designated recreation area.
3. A publicly owned and officially designated wildlife or waterfowl refuge.
4. A historic property, either publicly or privately owned, that is listed in or eligible for inclusion in the NRHP, except for archeological resources that are important chiefly because of what can be learned by data recovery and have minimal value for preservation in place. [CFR 774.13(b)(1)]

Lewis County Park is adjacent to KY 344 near MP 15.70. Lewis County Park is a Section 4(f) site, and has received Section 6(f) funds (Land and Water Conservation Funds). During the Design phase, this site should be avoided if possible; if not, efforts to minimize impacts to and use up the park must be considered. Due to Section 4(f) the County must put in writing that any use to the park will not have an adverse effect. Due to Section 6(f) any taking of the land must be replaced with adjacent land of the same area.

The Sheltowee Trace is also a designated recreation area and will be afforded some level of protection under Section 4(f). There are no other known recreational areas, wildlife or waterfowl refuges in the area.

Figures 16–19 (pp. 43–46) illustrate in more detail environmental concerns for the project corridor.

C. Geotechnical Concerns

A literature search, performed by Stantec, Inc., using a variety of sources **(Appendix L)**, identified general geotechnical and geologic characteristics of the study area. The purpose of this overview was to provide a general summary of the bedrock, soil and geomorphic features likely to be encountered within the study area, and to identify geotechnical features that may have an adverse impact on any project alignments. A thorough geotechnical exploration of the proposed alignment and grade will be required to properly anticipate and plan for special requirements necessary for the design and construction of the proposed alignment.

The potential exists for acid drainage within the project corridor. The Ohio shale and Sunbury shale are present and are known acidic stratums in the northern part of the corridor along KY 59. Particular attention should be given to the design of cut slopes and embankments near where these formations exist. Cuts and embankments within these shale formations will require special design considerations.

Cuts in acid producing shale will require the cut slope to be flattened and over-excavated a minimum of 4.5 feet and covered with clay soil or non-durable shale to prevent production of acidic run-off. Embankments that contain acid-producing shales will also require encasement.

Several landslides are noted along the existing alignments of KY 59 and KY 344. Additional costs will be associated with design and mitigation of these slide areas if disturbed.

Numerous railroad rail retaining walls exist along KY 59, KY 344, and KY 377. These walls should be surveyed and evaluated. Depending on the selected alignment, the affected walls will likely require repairs and/or replacement. Additional costs could be incurred for repair/replacement of these walls.

Oil and gas wells have been drilled near/along the study corridor. Many have reportedly been abandoned. Active wells should be inventoried and surveyed during subsequent project development phases. Additional costs could be incurred if the selected alignment disturbs a well site.

Geotechnical drilling will be needed for replacement or widened culverts, bridges and retaining walls. It is anticipated that conventional spread footing and/or pile foundation systems can be used for these structures.

VIII. Resource Agency Coordination

Resource agency coordination along with other public involvement activities was conducted to determine if there are potential environmental "show stoppers," development plans or other potential impacts that needed to be identified during the planning study. A packet of project-related existing conditions information, including mapping and project descriptions were mailed to various resource agencies by KYTC Division of Planning. These agencies provided typical responses, many related to construction; however, some provided atypical responses:

- USACE requested a planning meeting concerning the impacts to Kinniconick and Indian Creek mitigation site.
- KDOW noted the status of Kinniconick Creek as an Outstanding State Water (OSW) resource, and advised that habitat and water quality should not be degraded. KDOW stated the need to avoid or minimize impacts to Kinniconick Creek and to a Kentucky Division of Fish and Wildlife Resources (KDFWR) stream restoration project (located around the KY 377/KY 344 intersection) as alternatives are developed. The agency also noted that groundwater wells and springs are located within a 1-mile radius of the project area.
- KHC cited no major concerns at this early project stage with limited information; however, KHC expressed concerns regarding possible impacts identified at later stages of project development.
- The Office of Adventure Tourism supported bike lanes, wide shoulders, and bicycle signage.
- Mine Reclamation and Enforcement noted that, within the project area, there are gas wells and lines but no mining operations (hence no acid mine drainage). Wetlands, endangered species, water wells, springs, and Karst terrain are all present in project area.
- KDFWR recommended discussions with the Daniel Boone National Forest.

Figure 16: Environmental Footprint Sections 1 and 2

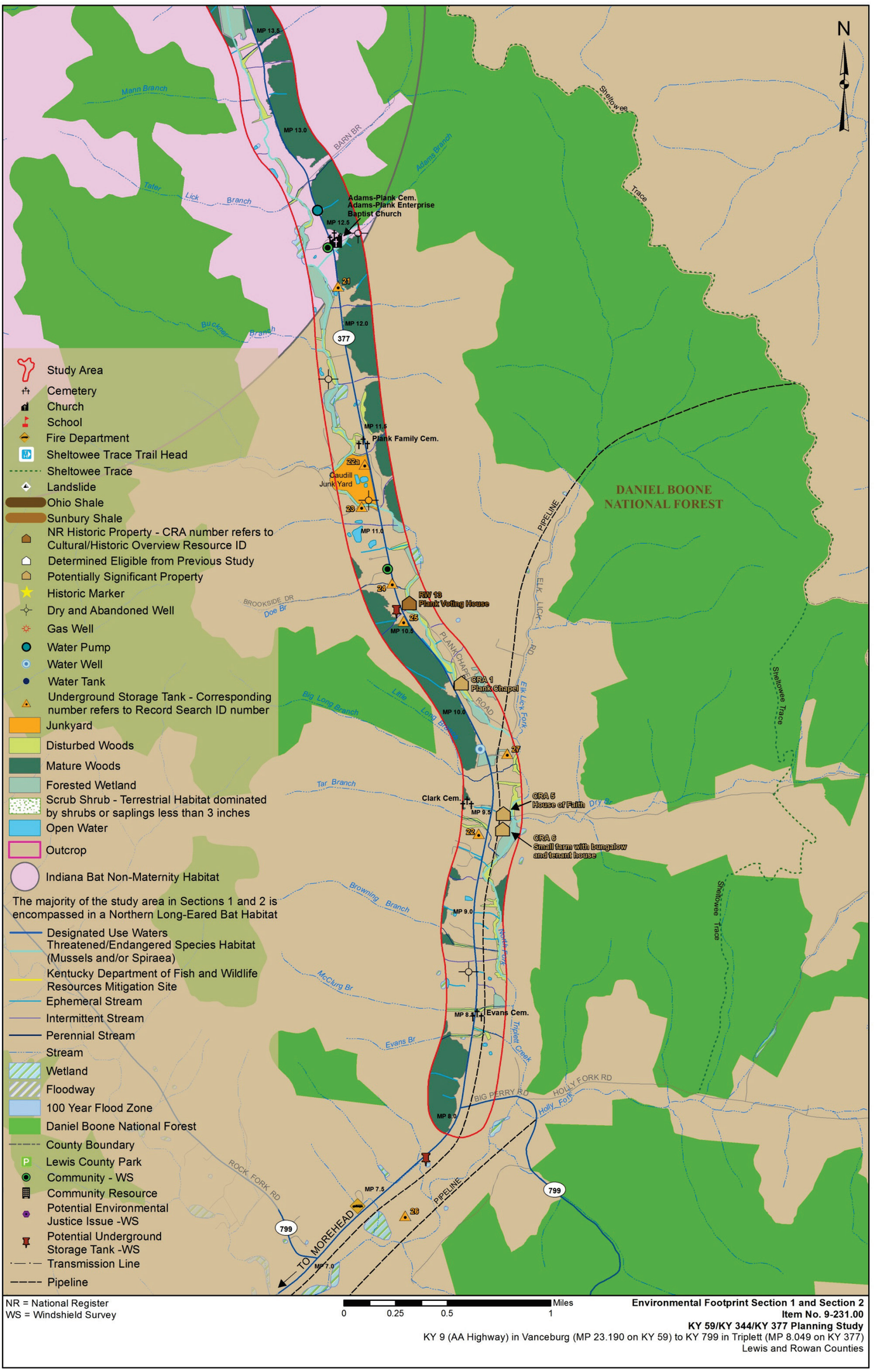
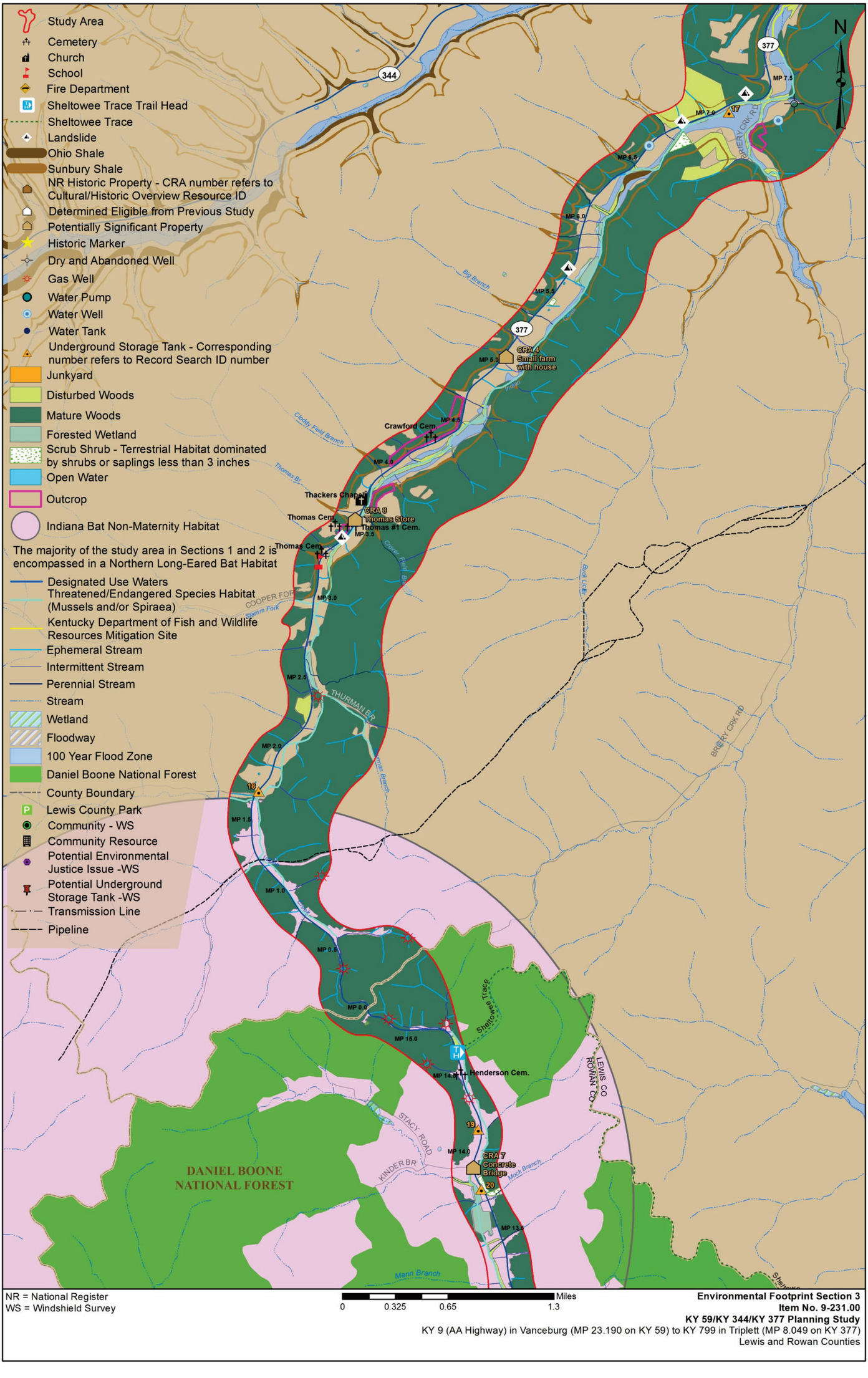


Figure 17: Environmental Footprint Section 3



Environmental Footprint Section 3
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

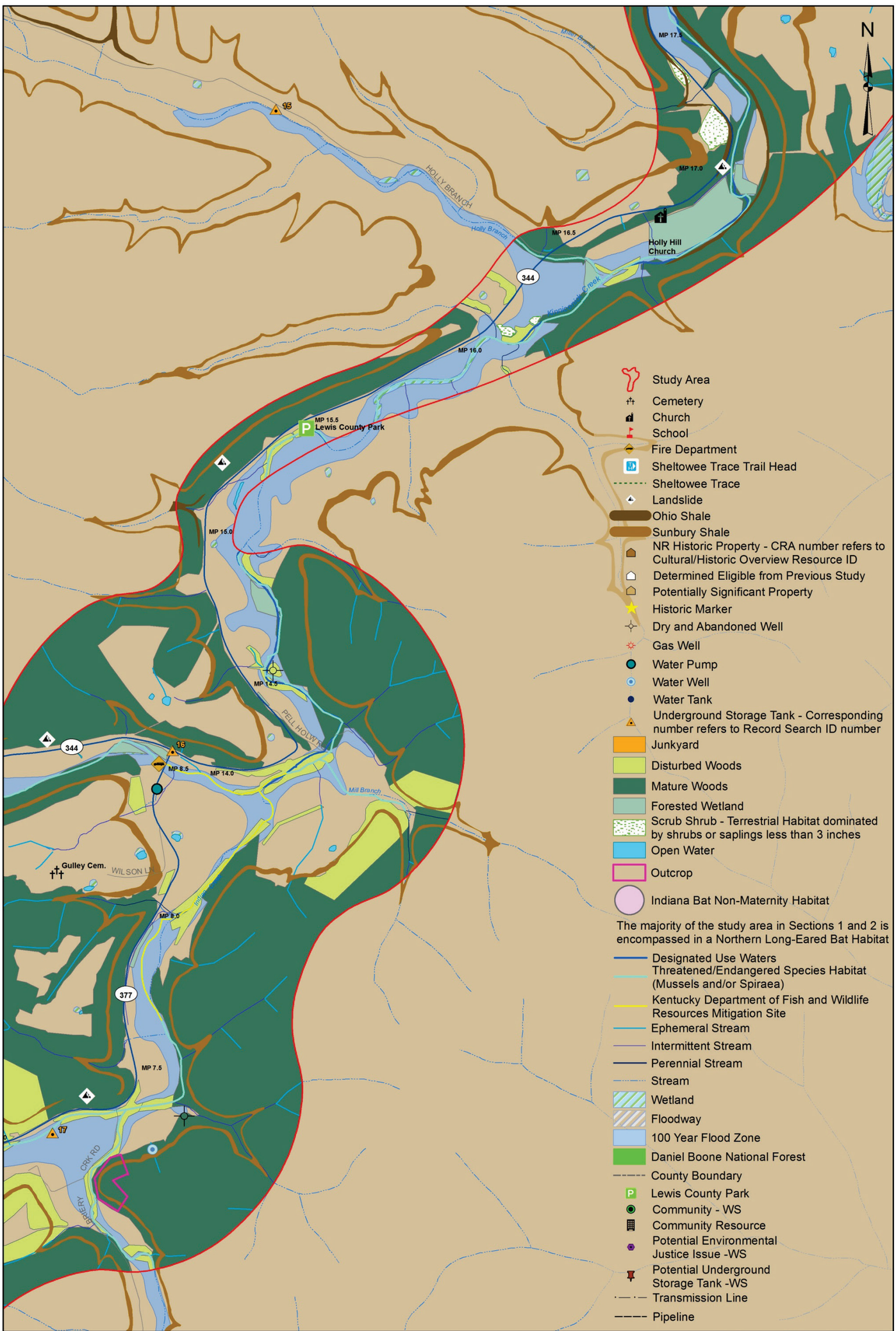
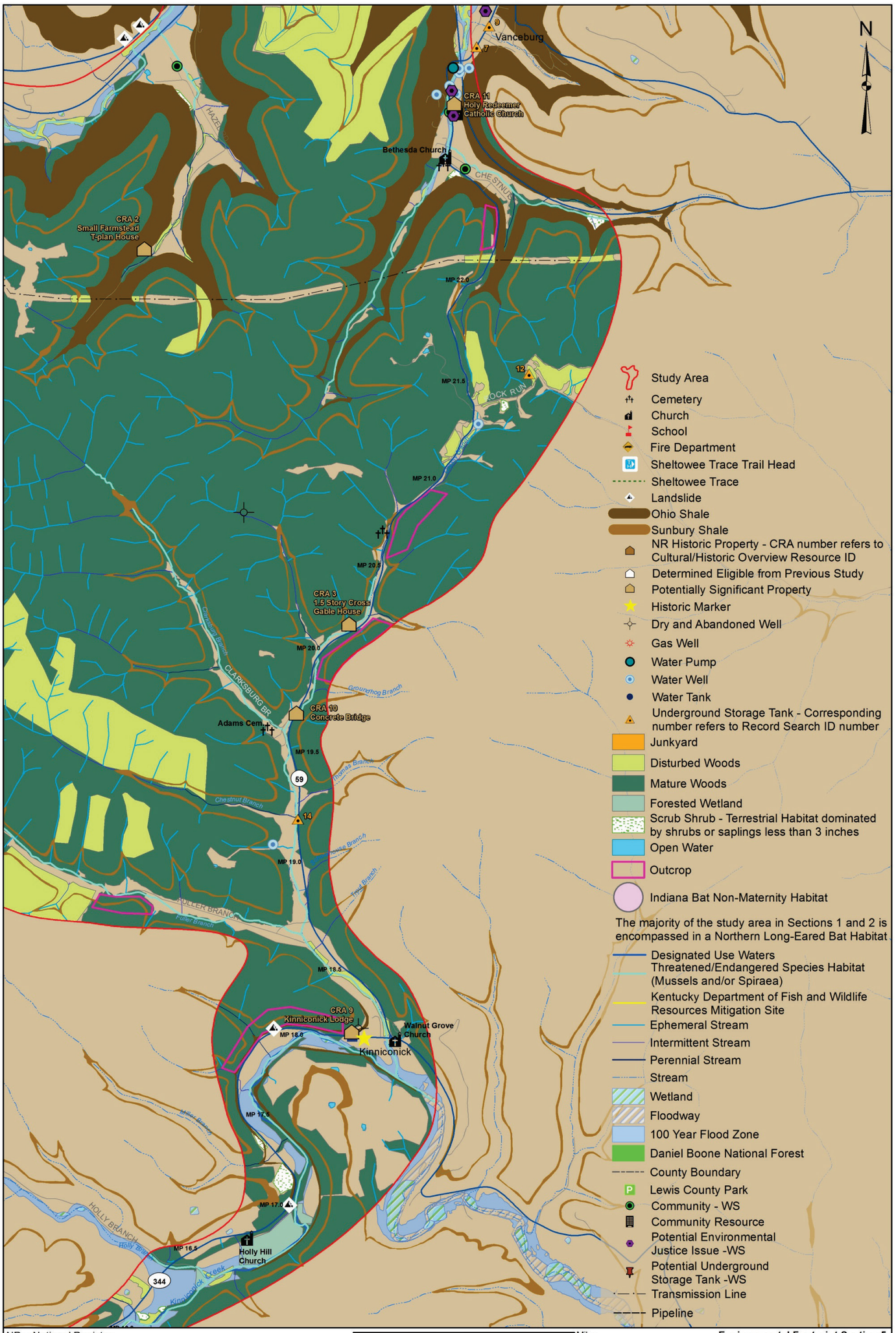


Figure 18: Environmental Footprint Section 4

Environmental Footprint Section 4
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

Figure 19: Environmental Footprint Section 5



NR = National Register
WS = Windshield Survey

0 0.25 0.5 1 Miles

Environmental Footprint Section 5
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

- KSNPC highlighted issues related to Kinniconick Creek and recommended consultation with the University of Louisville Stream Institute. KSNPC also provided a list of threatened or endangered species, including one (northern long-eared bat) proposed for addition to those lists.

- USDA, Natural Resource Conservation Service noted that soil rating points illustrate the study area has only small areas of prime farmland.

All responses are located in **Appendix J**.

IX. Early Public and Local Officials Involvement

Public and Local Official/Stakeholder meetings were held in Lewis County on July 7, 2015, and Rowan County on July 9, 2015. Safety problems with the corridor were noted that included sharp curves, the presence of large trucks, and speeding vehicles. Respondents drive the corridor for medical-related trips, shopping, and commuter trips for work–many over 20 miles each trip. Several areas of concern were identified on KY 59 and KY 344. Flooding locations on KY 344 were also cited as an issue.

In Lewis County, local officials noted Vanceburg Hill was their top priority because of safety concerns, especially for school buses. KYTC concurred that this was the priority section.

Fire Department representatives stated they respond to calls involving large trucks along several miles of KY 377 in Rowan County. The Kentucky State Police is requested to perform additional patrols; however, due to the lack of adequate shoulder space, drop offs, narrow lanes and limited visibility, it is nearly impossible to conduct any form of traffic enforcement other than being visible in a patrol car. The police also said they must drive over 10 miles after observing violations in an attempt to relocate the violator.

In both Rowan and Lewis counties, public and local officials noted areas of concern within the existing corridor including flooding, residents/family clusters, and cemeteries. Respondents mentioned students who travel to Portsmouth, Ohio, for college rather than to Morehead due to safety concerns along corridor. Several attendees suggested improvements should entirely bypass KY 344. A summary of survey responses is located in **Appendix M.**

X. Project Purpose and Need

The Purpose and Need Statement was based on an assessment of the existing conditions and input from the public and local officials. Throughout the planning study it has been refined. The Purpose of the project is to:

> *... improve safety, reliable system connectivity, and travel time from Vanceburg to Morehead for access to medical (St. Claire Regional Medical Center), educational (Morehead State University, Rowan County Branch of Maysville CTC) and shopping destinations (Kroger, Lowe's, Wal-Mart, etc.) and to enhance connectivity with I-64 in Rowan County and KY 9, the AA-Highway in Lewis County. The travel routes from Vanceburg to Morehead consist of KY 59, KY 344, KY 377, and KY 32 which collectively serve as the most direct route for travel between the cities of Vanceburg and Morehead. KY 9, the John Y. Brown AA-highway, and I-64 provide major 4-lane east-west corridors in northeastern Kentucky. However, there is no modern north-south connection, built to current design standards, linking KY 9 in or near Vanceburg (or all of Lewis County), with I-64. Therefore, part of the purpose of this project is to provide reliable system connectivity built to*

modern design standards. The current network of roads is substandard and includes areas that frequently flood, others that have poor drainage, failing shoulders, poor sight distance, limited passing opportunities, narrow bridges, and substandard intersections and horizontal and vertical curves. Providing a facility without these conditions would improve travel time and provide reliable system connectivity between KY 9 / Vanceburg and Morehead.

The need derives from narrow lanes (9 to 11 feet) and shoulders (90% are 2 feet wide or less), as well as numerous horizontal (75) and vertical (69) deficiencies according to today's highway design standards for 55 mph. Travel speeds average less than 55 mph (46 mph), and passing opportunities are infrequent (no passing 50% in Rowan County and 95% in Lewis County). Crash clusters occur near the northern and southern ends of the corridor. The corridor has flooding and slope stability issues along with shoulder drop offs.

As shown in **Figure 2 (p. 4),** the shortest route between Morehead and Vanceburg uses 26 miles of the study corridor. Residents of Vanceburg and Morehead completed surveys from the first public and local officials meetings stating 71% travel an average length of 10 miles or more in the corridor per trip; 36% between 20 and 26 miles. **Figure 20 (p. 49)** illustrates destinations mentioned above along with existing industry and recreations locations in and between the two cities.

Regarding travel time, the 2040 forecasted average travel time is 36.40 minutes between the northern and southern termini. If the entire roadway is built to current design standards with passing lanes at strategic locations, it is estimate that travel time would be reduced by approximately 6 minutes, to 30.41 minutes. This is a substantial savings in time, especially for emergency service vehicles, school busses, and other public services. Additionally, a rebuilt corridor would be expected to reduce the chance for crashes, which also cause significant travel time delays, and other incidents, such as flooding and excessive maintenance that also restrict travel time and mobility.

The meeting survey responses validate the Purpose and Need for the project.

XI. Analysis of Conditions and Improvements

Design criteria used to develop alternatives in the project corridor, with the exception of improvements to Vanceburg Hill in Section 5, are consistent with the proposed section for Item 9-8406.00 [KY 377 reconstruction from KY 32 (Flemingsburg Road) to KY 799 (Big Perry Road)] and are summarized in **Table 18**. The typical cross-section is shown in **Figure 21 (p. 50) and Appendix N**. Although shoulders are shown with full-depth pavement structure, this will only be the case on roadway sections utilizing shoulders for maintenance of traffic during construction. All other sections will have conventional shoulder structures.

Table 18: Geometric Design Criteria

CATEGORY	CRITERIA	
Design Speed	55 mph	45 mph
Minimum Horizontal Radius	960 ft.	600 ft.
Maximum Grade	7.0%	8.0%
Maximum Superelevation	8.0%	8.0%
Stopping Sight Distance	495 ft.	360 ft.

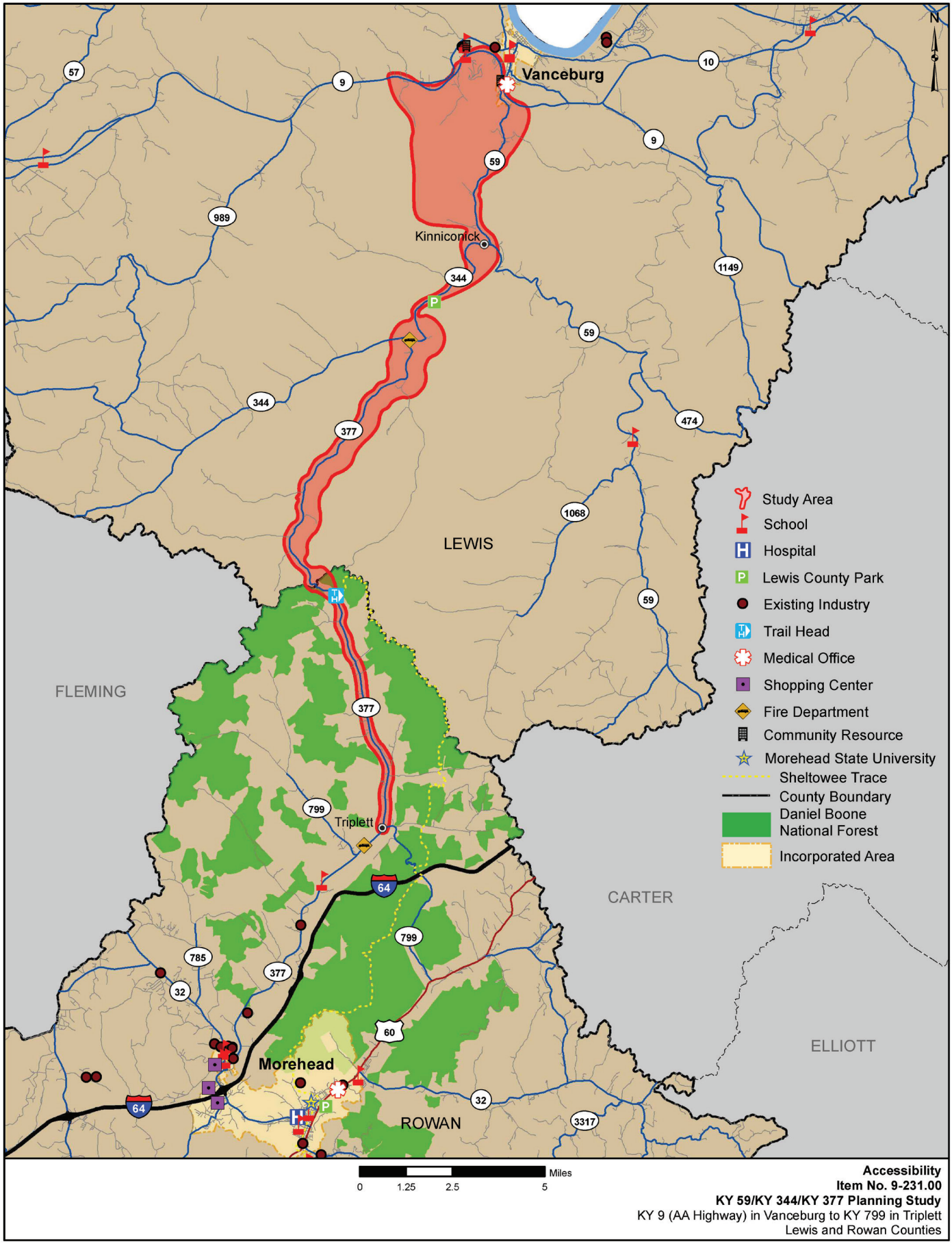


Figure 20: Accessibility

During the design phase, the Project Team should consider accommodating bicyclists on the shoulder. For example, providing gaps within the rumble strips of 10–14 feet every 40 to 60 feet may improve the bicycle index rating to B. Constructing a shoulder of 8 feet or wider without rumble gap spacing would not improve the BCI rating as the milled rumbles would make the shoulder space unusable for most cyclists. Bicycle and pedestrian accommodations for the study corridor would be provided using the typical section for the existing KY 377 project (Item 9-8406.00) with an 8-foot-wide paved shoulder.

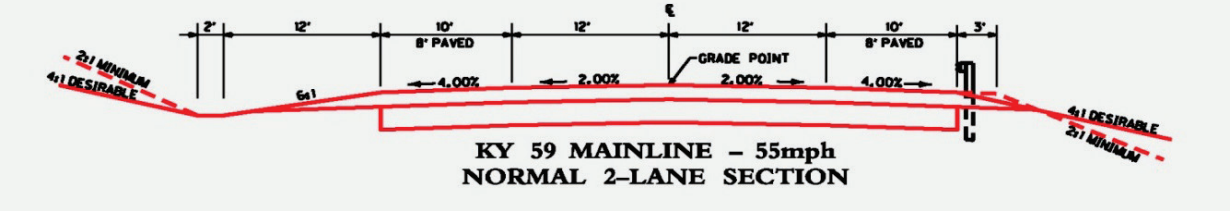


Figure 21: Typical Section

XII. Cost Estimate Methodology

For each of the build alternatives, Planning level cost estimates were developed as part of this planning study. At the Planning phase, less detail is available than will be during the Design phase. Therefore, assumptions had to be made. These assumptions were coordinated with KYTC and adjusted accordingly throughout the planning process. The Planning level cost estimates included the following phases: Design, Right of Way, Environmental Mitigation, Utility Relocation, Construction, and Maintenance:

The following assumptions were made for construction cost estimates discussed in Section XIV:

A. Design, Utility, and Construction Cost Estimates

- Design cost estimates were based on a percentage of the construction costs.
- Right of Way estimates were developed utilizing Property Valuation Administrator (PVA) information. Estimated acres impacted and an average cost per acre was calculated for each alternative or alternative segment. The average was tripled to arrive at a conservative average. An effort was made to estimate the number of business/residential impacts, and an average was similarly developed for each section. Right of Way estimates were based on the following averages:
    - House: $80,000–$150,000
    - Commercial Building: $200,000
    - Barn or Garage: $15,000
    - Acre Acquired: $3,500/acre
- Utilities estimates were developed based on the following assumptions:
    - 2% of construction costs for alternatives on new alignment
    - 8% of construction costs for alternatives along the existing corridor
- Construction cost estimates were based on the following assumptions:
    - LiDAR (Light Detection and Ranging, a method of surveying) data was available for Lewis County only. LiDAR provides more accurate topography, resulting in better earthwork quantities resulting in better cost estimates.
    - $3.50/yd^3 for earthwork volumes > 2,000,000 yd^3

- $5.00/yd^3 for earthwork volumes < 2,000,000 yd^3
- Structure quantities $120/ft.^{2} for bridges, $15/cubic foot of opening for culverts
- Pavement $60/yd^2
- Waste areas were identified and quantities calculated for alternatives in the original study area, then estimated for remaining alternatives. These estimates are provided only to recognize that waste areas will be a cost associated with any build alternative. They were estimated using the following:
  - 185,000 yd^3/acre of waste area
  - 146 linear feet of streams/acre
  - $510/average per linear foot of stream

B. Stream, Wetlands and Wooded Area "Fees In-Lieu Of (FILO)"

In accordance with Guidelines for Section 404(b) (1) of the 1972 Clean Water Act, for impacts to any jurisdictional stream or wetland, USACE requires mitigation documented in a "404 Permit" prior to construction. Further, in accordance with Section 401, KDOW required Water Quality Certification via a "401 Permit." The most common approaches to mitigating impacts are to either (a) pay "Fees In-Lieu Of (FILO)" implementing project-specific mitigation (i.e., the FILO program), or (b) purchase credits from an established stream or wetland bank that has been approved by KDOW and USACE. A third option is to implement project-specific mitigation by restoring a stream or wetland. This option is considered "last resort" and is seldom used because it requires extensive coordination, monitoring, and administrative costs.

The two most common options are discussed as follows:

1. Fees In-Lieu Of (FILO) is a dollar amount/credits paid to KDFWR, which administers the program. The amount varies by drainage basin based on actual total costs (administration, engineering, property acquisition, construction, monitoring, etc.) for existing stream/wetland mitigation projects. For streams, the method for determining the number of credits is different for the Eastern Kentucky Coalfield physiographic region (an "EIU") than for the rest of the state (an "AMU"), but for both areas the number of credits is based on the type of stream (ephemeral, intermittent, or perennial); stream length and width; and stream quality, which includes conductivity, water quality, and biodiversity, of the impacted stream. Per the Stream Team Program[9], the current cost per credit is $755 for an EIU and $300 for an AMU. Thus, the total cost of mitigation using the FILO approach would be $755 (or $300) x the number of total credits assigned to the streams impacted by the project.

   It should be noted that the project study area is within both the Upper Licking River Service Area, which uses the EIU credit method; and the Lower Licking River Service Area, which has the AMU credit method. Typically projects are not in two service areas, and it is extremely rare for a project to be in two service areas each of which uses a different credit method.

2. For stream or wetland banks, a third party (such as a local university or an environmental organization) in cooperation with USACE and KDOW will purchase, restore, and monitor a stream or wetland and, in return, gain credits from the two agencies. Then, organizations such as KYTC can purchase those credits as mitigation for the impacts from the project.

[9] http://fw.ky.gov/Fish/Pages/Stream-Team-Program.aspx

A summary of the FILO methodology for this project is located in **Appendix O**. Based on the methodology described therein, the FILO for impacts to streams as a result of the project are estimated. The resulting initial weighted averages with the 20% temporal loss multiplier required by the USACE and used to estimate the FILO for streams in this study are listed below:

- Ephemeral $346.79/ft.
- Intermittent $651.43/ft.
- Perennial $886.67/ft.

These values are somewhat conservative as they assume the unlikely scenario that all streams within the mature woods habitat are "excellent" quality. These assumptions also do not reflect the streams in the southern portion of the project area that are within the Eastern Kentucky Protocol area since they total only about 4% of the total streams within the project area.

While these costs are high, there are options to reduce expenses through stream banking. However, because of the inability to accurately predict these costs at this stage of project, the resulting mitigation costs utilizing the aforementioned procedures were included as additional costs for each alternative.

FILO impacts for wooded areas, to mitigate for forest-dwelling threatened or endangered bats, were estimated at $3,150/acre; while wetlands, which included scrub-shrub areas, were estimated to be $15,000/acre (less than KDFWR $45,840/acre).

C. Maintenance Costs

Annual maintenance costs are associated with any roadway. In this corridor, there are numerous shoulder and slope failures that require additional continual maintenance above normal resurfacing, mowing, and snow and ice removal. KYTC maintenance staff maintenance extracted annual costs for the corridor from KYTC's Operations Management System (OMS)[10] for 2010-2014 **(Table 19)**. Alternatives on new alignment will likely leave the existing roadway in place for local access. The cost to maintain the existing roadway, including present maintenance issues that will not be corrected, was based on the present worth of $100,000 per mile annually for 25 years. These costs are conservative because leaving the existing roadway in place with this scenario will likely leave only local traffic on the old road, which may result in the need for less maintenance.

Table 19: Annual Maintenance Costs

Year	Maintenance Costs	$/mile
2010	$ 65,206	$ 2,687
2011	$ 48,150	$ 1,984
2012	$ 97,345	$ 4,012
2013	$ 151,024	$ 6,224
2014	$ 131,027	$ 5,400
Average: $ 98,550 ($ 4,061/mi.) rounded to $100,000/mi.		

D. Cost Estimates and Summary of Impacts

Detailed cost estimates and preliminary impact summaries for every alternative (ALT) segment are located in **Appendix P**. Alternatives outside the original study area did not have data to determine all potential impacts.

[10] A software package that maintains a computer database of the **KYTC** maintenance operations.

XIII. Initial Screening of Alternatives for Sections 3, 4, and 5

For development of alternatives, the corridor was divided into manageable sections. Each section is discussed in the following paragraphs beginning with a short summary of the existing conditions, then total reconstruction alternatives, and lastly, spot improvements were identified. Section 3 begins on KY 377 just south of the Rowan/Lewis County Line, Section 5 ends at KY 9 with Section 4 between the two.

Based on the feedback from the first public and local official/stakeholder meetings (July 2015), attendees felt there should be a new road bypassing all deficiencies and issues in Sections 3, 4, and 5 (Lewis County KY 377, KY 344, and KY 59). Resource agencies urged avoidance of Kinniconick Creek and the current KDFWR preservation easement/stream restoration project. Consequently, the Project Team elected to study several alternatives/segments outside the original study area. Alternatives were developed to bypass portions of KY 59 in addition to Alternatives 5A and 5B, KY 344 in its entirety, and a part of KY 377 toward Morehead in Lewis County as shown in **Figure 22 (p. 54)**.

Due to the length of the corridor, on and off-alignment alternatives were studied at various locations, with numerous combinations. With the exception of KY 59 at Vanceburg Hill, each alternative would have a 55 mph design speed and 2:1 slopes. The Vanceburg Hill section would have a 45 mph design speed.

A. Section 3–3A, 3B, 3C, 3D

Following Project Team Meeting #2 **(Appendix Q)**, KYTC staff and Qk4 representatives met with the Forest Service in Morehead to discuss all alternatives in Section 3 and their relation to the Daniel Boone National Forest (DBNF). The Forest Service stated their first alternative preference is along either Alternative 3A or 3B (close to the existing roadway) since these have minimal impacts to the DBNF. Their next alternative preference was Alternative 3D-1 over 3E-1, because Alternative 3D-1 would:

- Provide opportunities to access areas of the DBNF that are presently inaccessible.
- Not bisect long stretches of the Sheltowee Trace.
- Split only a small portion of the DBNF.

Alternatives 3A and 3B, ALTS 3D-1 and 3D-2 (also now 3D-3 and 3D-4) were advanced for further consideration. ALTS 3E-1 and 3E-2 were also eliminated following the meeting with the Forest Service. The minutes of the meeting with the Forest Service are located in **Appendix R**.

B. Section 4–4A, 4B, 4C, 4D

4C-1, 4C-2, 4D-1 and 4D-2 were not recommended for further study due to earthwork quantities, stream impacts, and high total costs. Alternatives 4A and 4B remain viable alternatives in Section 4.

C. Section 5–5A, 5B, 5B-1, 5C, 5D, and 5E

After discussion of each of the alternatives in Section 5, the Project Team concluded corridors further from the existing alignment would not be recommended for additional study **(Table 20 row colors correspond to Figure 22, p. 54).** These decisions were due to earthwork quantities, stream impacts, and high total costs. **Table 21 (p. 55)** illustrate each alternative (ALT) segment and their corresponding impacts and costs. **Table 22 (p. 56)** provides combinations of those alternative segments in Section 3, 4, and 5.

Table 20: Section 5 Alternatives Eliminated from Consideration

ALTS
5A-3
4D1-5E2 Connector
5E1
5E2
5E2-5D2 Connector
5D-1
5D-2
5C-EAST

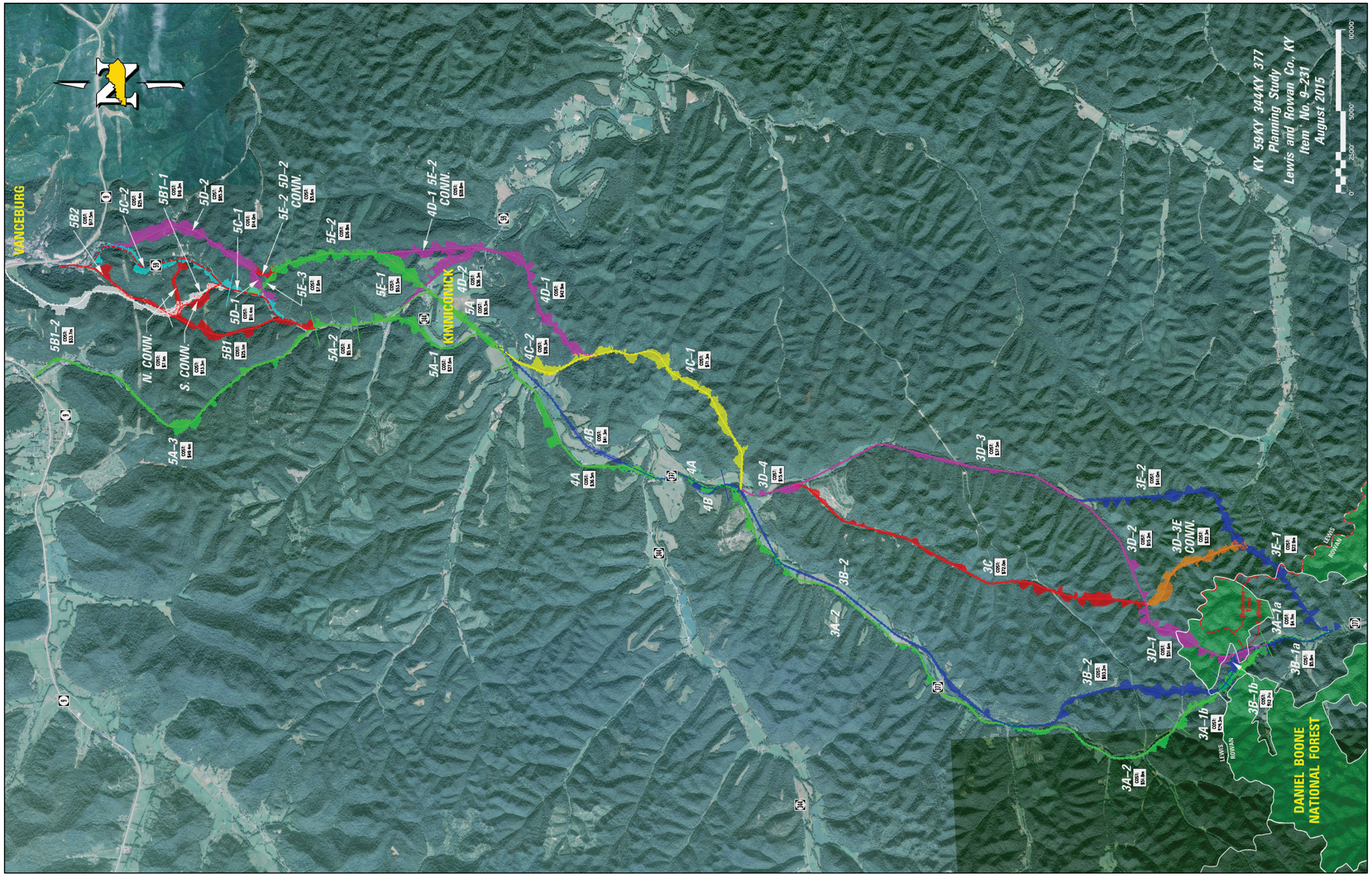


Figure 22: Initial Screening of Alternatives for Sections 3, 4, and 5

Table 21: Initial Screening of Sections 3, 4, and 5 Alternatives Segments (Out of Study Area)

INITIAL SCREENING OF SECTIONS 3, 4, AND 5 ALT SEGMENTS (OUTSIDE OF STUDY AREA)

			Right of Way			Utilities	Environmental		Construction					
ALTS	Length Miles	Design $	Approx. Relocations #	Approx. R/W Acquired Acres	R/W Cost $	Utility Costs $	Blue Line Stream Impacts Linear Feet	Environmental Fees In-Lieu Of $	Earthwork CY	Estimated Construction Cost $	Construction Cost per Mile $	Maintenance Cost for Existing Road When on New Alignment $	Total Cost $	Total Cost per Mile $
ALT 3C	4.45	$4,400,000	1	158	$700,000	$9,700,000	7,975	$8,900,000	4,500,000	$33,000,000	$7,400,000	$15,320,000	**$72,020,000**	**$16,200,000**
ALT 3D-1	2.55	$2,600,000	1	97	$400,000	$800,000	3,432	$4,900,000	6,300,000	$37,600,000	$14,800,000	$5,260,000	**$51,560,000**	**$20,300,000**
ALT 3D-2	1.53	$1,500,000	0	36	$200,000	$300,000	1,416	$1,400,000	400,000	6,000,000	$3,900,000	$5,780,000	**$15,180,000**	**$9,900,000**
ALT 3D-3	3.48	$3,500,000	2	77	$500,000	$9,700,000	3,230	$3,100,000	650,000	$12,700,000	$3,700,000	$8,020,000	**$37,520,000**	**$10,800,000**
ALT 3D-4	0.65	$800,000	0	19	$100,000	$600,000	1,357	$1,400,000	925,000	$10,100,000	$15,600,000	$2,420,000	**$15,420,000**	**$23,900,000**
ALT 3D - 3E Connector	1.46	$1,500,000	0	81	$300,000	$1,200,000	1,362	$1,900,000	4,125,000	$22,700,000	$15,500,000	$4,700,000	**$32,300,000**	**$22,100,000**
ALT 3E-1	1.54	$1,500,000	2	71	$600,000	$800,000	3,070	$3,100,000	1,650,000	$14,800,000	$9,600,000	$2,140,000	**$22,940,000**	**$14,900,000**
ALT 3E-2	2.39	$2,400,000	NO DATA	100	$400,000	$1,300,000	5,900	$6,300,000	4,000,000	$24,400,000	$10,200,000	$6,200,000	**$41,000,000**	**$17,100,000**
ALT 4C-1	2.73	$2,700,000	0	144	$600,000	$2,700,000	4,860	$7,200,000	8,775,000	$53,300,000	$19,500,000	$4,840,000	**$71,340,000**	**$26,100,000**
ALT 4C-2	1.27	$1,400,000	1	52	$400,000	$1,000,000	3,058	$3,100,000	1,275,000	$18,400,000	$14,500,000	$3,980,000	**$28,280,000**	**$22,300,000**
ALT 4D-1	1.99	$2,000,000	0	97	$400,000	$1,400,000	4,292	$5,300,000	4,125,000	$26,500,000	$13,300,000	$7,300,000	**$42,900,000**	**$21,500,000**
ALT 4D-2	1.25	$1,400,000	2	58	$600,000	$1,300,000	1,868	$6,900,000	4,000,000	$24,300,000	$19,400,000	$1,760,000	**$36,260,000**	**$28,900,000**
ALT 5D-1	0.47	$600,000	0	30	$200,000	$500,000	828	$1,100,000	1,450,000	$8,100,000	$17,300,000	$900,000	**$11,400,000**	**$24,300,000**
ALT 5D-2	1.86	$2,000,000	4	128	$500,000	$3,400,000	6,528	$8,600,000	13,275,000	$66,900,000	$36,000,000	$3,940,000	**$85,340,000**	**$45,900,000**
ALT 4D-1 - 5E-2 Connector	1.28	$1,400,000	0	81	$300,000	$900,000	4,023	$4,700,000	3,100,000	$17,500,000	$13,700,000	$4,000,000	**$28,800,000**	**$22,500,000**
ALT 5E-1	0.87	$900,000	0	64	$300,000	$2,300,000	980	$3,900,000	8,050,000	$44,100,000	$50,500,000	$1,960,000	**$53,460,000**	**$61,300,000**
ALT 5E-2	1.20	$1,200,000	0	72	$300,000	$900,000	2,834	$3,800,000	3,100,000	$17,600,000	$14,700,000	$3,000,000	**$26,800,000**	**$22,300,000**
ALT 5E-3	0.44	$500,000	0	22	$100,000	$300,000	832	$1,100,000	775,000	$4,800,000	$10,900,000	$980,000	**$7,780,000**	**$17,700,000**
ALT 5E-2 - 5D-2 Connector	0.34	$500,000	0	15	$100,000	$200,000	868	$900,000	425,000	$2,700,000	$8,000,000	$1,180,000	**$5,580,000**	**$16,600,000**

Table 22: Initial Screening of Alternative Combinations for Sections 3, 4, and 5

ALTERNATIVES	Length	Design	Right of Way			Utilities	Environmental		Construction		Construction Cost per Mile	Maintenance Cost for Existing Road When on New Alignment	Total Cost	Total Cost per Mile
			Approx. Relocations	Approx. R/W Acquired	R/W Cost	Utility Costs	Blue Line Stream Impacts	Environmental Fees In-Lieu Of	Earthwork	Estimated Construction Cost				
	Miles	$	#	Acres	$	$	Lin Feet	$	CY	$	$	$	$	$
SECTION 3 COMBINATIONS														
ALT 3D-1 +3D-2 + 3D-3 + 3D-4	8.19	$8,400,000	3	229	$1,200,000	$11,400,000	$9,435	$10,800,000	8,275,000	$66,400,000	$8,100,000	$21,480,000	**$119,680,000**	**$14,600,000**
ALT 3D-1 +3C + 3D-4	7.64	$7,800,000	2	274	$1,200,000	$11,100,000	$12,764	$15,200,000	11,725,000	$80,700,000	$10,600,000	$23,000,000	**$139,000,000**	**$18,200,000**
ALT 3E-1 +3E-2 +3D-3 +3D-4	8.05	$8,200,000	4	267	$1,600,000	$12,400,000	$13,557	$13,900,000	7,225,000	$62,000,000	$7,700,000	$18,780,000	**$116,880,000**	**$14,500,000**
ALT 3E-1 + D-E Conn+ 3D-2 + 3D-3 + 3D-4	8.65	$8,800,000	4	284	$1,700,000	$12,600,000	$10,435	$10,900,000	7,750,000	$66,300,000	$7,700,000	$23,060,000	**$123,360,000**	**$14,300,000**
ALT 3E-1 + D-E Conn+ 3C + 3D-4	8.09	$8,200,000	3	329	$1,700,000	$12,300,000	$13,764	$15,300,000	11,200,000	$80,600,000	$10,000,000	$24,580,000	**$142,680,000**	**$17,600,000**
SECTION 4 COMBINATIONS														
ALT 4C-1 + ALT 4C-2	4.00	$4,100,000	1	196	$1,000,000	$3,700,000	$7,918	$10,300,000	10,050,000	$71,700,000	$17,900,000	$8,820,000	**$99,620,000**	**$24,900,000**
ALT 4C-1 + ALT 4D-1 + ALT 4D-2	5.98	$6,100,000	2	299	$1,600,000	$5,400,000	$11,020	$19,400,000	16,900,000	$104,100,000	$17,400,000	$13,900,000	**$150,500,000**	**$25,200,000**
SECTION 4 - SECTION 5 COMBINATIONS														
ALT 4C-1 + ALT 4D-1 + 4D-1 5E-2 Connector + ALT 5E-2 + ALT 5E-3	7.64	$7,800,000	0	416	$1,700,000	$6,200,000	$16,841	$22,100,000	19,875,000	$119,700,000	$15,700,000	$20,120,000	**$177,620,000**	**$23,200,000**
ALT 4C-1 + ALT 4D-1 + 4D-1 5E-2 Connector + ALT 5E-2 + 5E-2- 5D-2 Connector + ALT 5D-2	9.40	$9,800,000	4	537	$2,200,000	$9,500,000	$23,405	$30,500,000	32,800,000	$184,500,000	$19,600,000	$24,260,000	**$260,760,000**	**$27,700,000**
ALT 5D-1 + 5D-2 (Vanceburg Hill East ALT)	2.33	$2,600,000	4	158	$700,000	$3,900,000	$7,356	$9,700,000	14,725,000	$75,000,000	$32,200,000	$4,840,000	**$96,740,000**	**$41,500,000**
INITIAL SCREENING ALTERNATIVE COMBINATIONS MATRIX (ORIGINAL STUDY AREA)														
ALT 3A	8.72	$8,700,000	17	217	$3,000,000	$4,200,000	14,555	$9,800,000	3,323,708	$56,300,000	$6,500,000	$2,800,000	**$84,800,000**	**$9,700,000**
ALT 3B	8.82	$8,800,000	11	104	$2,200,000	$10,300,000	18,124	$13,600,000	4,848,223	$62,000,000	$7,000,000	$14,820,000	**$111,720,000**	**$12,700,000**
ALT 4A	3.55	$3,600,000	2	114	$700,000	$600,000	4,150	$3,700,000	2,611,344	$25,600,000	$7,200,000	$2,300,000	**$36,500,000**	**$10,300,000**
ALT 4B	3.52	$3,500,000	1	105	$600,000	$600,000	4,046	$3,600,000	2,439,765	$27,200,000	$7,700,000	$5,800,000	**$41,300,000**	**$11,700,000**
Alternative 5A	6.65	$6,800,000	6	194	$2,000,000	$1,200,000	17,910	$14,800,000	4,994,700	$48,800,000	$7,300,000	$11,200,000	**$84,800,000**	**$12,800,000**
Alternative 5A-1	6.56	$6,600,000	7	199	$2,000,000	$1,100,000	19,326	$15,400,000	5,360,700	$45,800,000	$7,000,000	$11,200,000	**$82,100,000**	**$12,500,000**
Alternative 5B	5.90	$6,200,000	5	191	$2,000,000	$1,200,000	15,446	$9,300,000	5,213,662	$48,800,000	$8,300,000	$10,540,000	**$78,040,000**	**$13,200,000**
Alternative 5B with North Connector	6.63	$7,000,000	5	215	$2,200,000	$1,300,000	18,416	$10,800,000	5,572,013	$53,300,000	$8,000,000	$10,540,000	**$85,140,000**	**$12,800,000**
Alternative 5B with South Connector	6.59	$7,000,000	5	219	$2,200,000	$1,500,000	16,800	$10,300,000	6,600,234	$59,800,000	$9,100,000	$10,540,000	**$91,340,000**	**$13,900,000**
Alternative 5B-1	6.81	$7,300,000	9	255	$2,600,000	$1,400,000	17,334	14,000,000	7,596,530	$65,300,000	$9,600,000	$8,780,000	**$99,380,000**	**$14,600,000**
Alternative 5C Rural/Urban with a 10-foot Clear Zone and Truck Climbing Lane for Vanceburg Hill	5.90	$6,200,000	14	185	$3,200,000	$2,100,000	9,406	$9,500,000	4,923,122	$49,200,000	$8,300,000	$4,600,000	**$74,800,000**	**$12,700,000**
Alternative 5B + 5B1-1 (ALTS 5A + 5A-2 + 5C-1 + 5B1-1 + 5B2)	6.04	$6,500,000	9	193	$2,300,000	$1,200,000	10,751	$10,200,000	5124137.00	$54,900,000	$9,100,000	$8,140,000	**$83,240,000**	**$13,800,000**
Alternative 5B1 + 5B1-2 (ALTS 5A + 5A-2 + 5C-1 + 5B1 + 5B1-2)	6.67	$7,000,000	5	253	$2,300,000	$1,400,000	22,029	$13,100,000	7,686,055	$59,200,000	$8,900,000	$11,180,000	**94180000**	**$14,100,000**
KY 59 FROM APPROXIMATELY MP 19.5 TO MP 23.0														
ALTS 5D-1 + 5D-2 + Spot Vanceburg Hill	3.87	$4,300,000	8	214	$1,200,000	$5,200,000	9,268	$11,600,000	16,408,755	$91,200,000	$23,600,000	$4,840,000	**$118,340,000**	**$30,600,000**
ALT 5B1 and 5B2 + North Connector	3.95	$4,100,000	4	139	$1,600,000	$700,000	15,246	$7,400,000	3,161,313	$29,600,000	$7,500,000	$6,340,000	**$49,740,000**	**$12,600,000**
ALTS 5C-1 + 5B1-1 + 5B2	3.36	$3,600,000	8	117	$1,700,000	$600,000	7,581	$6,800,000	2713437.00	$31,200,000	$9,300,000	$3,940,000	**$47,840,000**	**$14,200,000**
ALTS 5B1 + 5B2	3.22	$3,300,000	4	115	$1,400,000	$600,000	12,276	$5,900,000	2802962.00	$25,100,000	$7,800,000	$6,340,000	**$42,640,000**	**$13,200,000**
VANCEBURG HILL (KY 59 FROM APPROXIMATELY MP 20.7 TO MP 23.0)														
5B1-1 + 5B1-2	2.98	$3,200,000	3	136	$1,000,000	$600,000	11,826	$8,300,000	4,438,965	$32,300,000	$10,800,000	$4,580,000	**$49,980,000**	**$16,800,000**
5C-2	2.07	$2,100,000	8	66	$1,600,000	$1,300,000	3,898	$3,800,000	1,765,557	$16,200,000	$7,800,000	$400,000	**$25,400,000**	**$12,200,000**

To the west of KY 59, Alternative 5A-3 was also not recommended for further study due to its distance from Vanceburg (over 2 miles). Due to the elimination of both Alternatives 4D-1 and 5E-2, the Connector between these alternatives was also eliminated. The additional costs do not provide a benefit over the other alternatives.

D. Alternative 5C East–Eliminated from Further Study

Alternative 5C East (not shown on Figure 22, p. 55) ran concurrent with ALT 5A, ALT 5A-2, and ALT 5C-1 until MP 20.20, and then followed an alignment east of, and generally parallel to, existing KY 59. It then tied to KY 9 approximately one mile east of the existing KY 9/KY 59 intersection. Alternative 5C East was 5.66 miles long.

Alternative 5C East was eliminated from further consideration at the first Project Team meeting due to its intersection with KY 9 (in a downhill grade), and steep 9.1% grades in portions of the alignment. A cost estimate was not developed for this alternative. Approaching KY 9, grades were approximately 7.7%.

E. Alternative 5B Connectors

If Alternative 5B were constructed, providing additional access from new alignment to parcels along existing KY 59 may be desired. Direct access to each parcel along the new roadway was determined not feasible due to terrain, the number of parcels to access, and the length each access point would require. Therefore, two connectors from Alternative 5B were examined.

North Connector–$7,100,000–0.73 Mile–would connect Alternative 5B to the existing roadway near MP 21.40 at the KY 59 intersection with Rock Run Road and connect with Alternative 5B approximately 1.25 miles north of existing MP 22.60. This connector, if built, should be added to the cost of Alternative 5B. Preliminary grades reach 7%.

South Connector–$13,300,000–0.69 Mile–would connect Alternative 5B to the existing roadway near MP 20.80 and connect with Alternative 5B approximately 1.25 miles north of existing MP 22.60. This connector, if built, should be added to the cost of Alternative 5B. The Southern Connector is nearly twice the cost of the Northern Connector, and preliminary grades reach 8%.

The cost for the South Connector was nearly twice the total cost of the North Connector, and utilized 8% grades. Additionally, when Alternative 5B-1 (ALT 5B1-1 and ALT 5B1-2) was developed, the South Connector was very similar to ALT 5B1-1. For these reasons, the South Connector was eliminated from further consideration.

F. Other Combinations

Other alternative combinations were initially developed using segments of each of the alternatives that were advanced. These combinations were eliminated from further consideration due to extensive earthwork, project costs, and stream impacts. These alternatives are abbreviated below.

1) 1.09 miles of ALT 5A, ALT 5E-1, ALT 5E-2, ALT 5E-3, Vanceburg Hill Spot Improvement and Leslie Street/Chestnut Street Spot Improvement = $131,090,000 (5.69 Miles)
2) 1.09 Miles of ALT 5A, ALT 5E-1, ALT 5E-2, ALT 5E-2-5D-2 Connector, ALT 5D-2, Leslie Street/Chestnut Street Spot Improvement = $192,630,000 (5.91 Miles)

3) 1.09 Miles of ALT 5A, ALT 5E-1, ALT 5E-2, ALT 5E-3, 0.90 Mile of ALT 5B1-1, ALT 5B1-2 = $145,020,000 (6.18 Miles)
4) 1.09 Miles of ALT 5A, ALT 5E-1, ALT 5E-2, ALT 5E-3, 0.90 Mile of ALT 5B1-1, ALT 5B2 = $128,880,000 (5.41 Miles)

XIV. Spot Improvements

Given the horizontal and vertical deficiencies, recurring maintenance issues, high-crash locations, shoulder failures, local official and public input, and the major investment of total reconstruction, spot improvements were identified along the corridor. A decision matrix was developed to identify the spot improvement locations **(Figures 23–24, pp. 59–60)**. Due to the number of corridor deficiencies and consideration of funding, a threshold of 35 mph was used to identify spot improvements based on vertical and horizontal geometrics. Improved geometry and cost estimates were then based on a 45 mph design criteria **(Table 18, p. 48)**. Spot improvements were given an associated name known to the communities along the corridor and are shown on **Figure 25 (p. 61).** Associated spot improvement impacts are summarized in **Table 23 (p. 63)** and photos are shown on **Figure 26 (p. 62)**.

XV. Alternatives

Each section is discussed in the following paragraphs beginning with a short summary of the existing conditions, then remaining total reconstruction alternatives, and lastly, spot improvements were identified. Each discussion is followed by alternative corridor exhibits and their corresponding environmental footprints.

A. No-Build Alternative

There is a No-Build Alternative for Sections 1–5. "No-Build" indicates existing conditions would remain without new construction improvements and only future maintenance of the roadways would take place. The No-Build Alternative will be carried through to the next project development phase.

B. Section 1

Section 1 begins on KY 377 in Rowan County just south of the southern terminus of the project study area (MP 7.90 near KY 799 known as Big Perry Road) and ends at MP 12.38 near the KY 377 intersection with Plank Lane. Section 1 has 9-foot-wide lanes and 3-foot-wide (average) shoulders with multiple steep shoulder drop-offs. All horizontal and vertical curves meet 55 mph design criteria. It is projected to carry between 1,400 and 1,500 vpd in 2040, and is a candidate for widening along the existing alignment. There is one structure (built in 1948) considered functionally obsolete due to either the design no longer meeting current standards or is no longer adequate to serve its purpose. The bridge has a sufficiency rating of 73.1.

There are two 0.1-mile spots resulting in a CCRF> 1.0–between MP 9.7 and MP 9.8 (3 crashes), and MP 10.6 and MP 10.7 (4 crashes), during the five-year analysis period. These spots are between Brookside Drive and Elklick Road. Comments from local EMS and police at early local officials' meetings indicated most crashes at these locations are due to the combination of narrow lanes and shoulders together with guardrail that leave motorists feeling constricted for space. There are multiple environmental issues that affected the location of alternatives. The NRHP database includes the Plank Voting House No. 15, located at 815 Plank Chapel Road. In addition, four potentially eligible sites are near MPs 9.60 and 10.20. A very large auto junkyard lies west of KY 377 near MP 11.3.

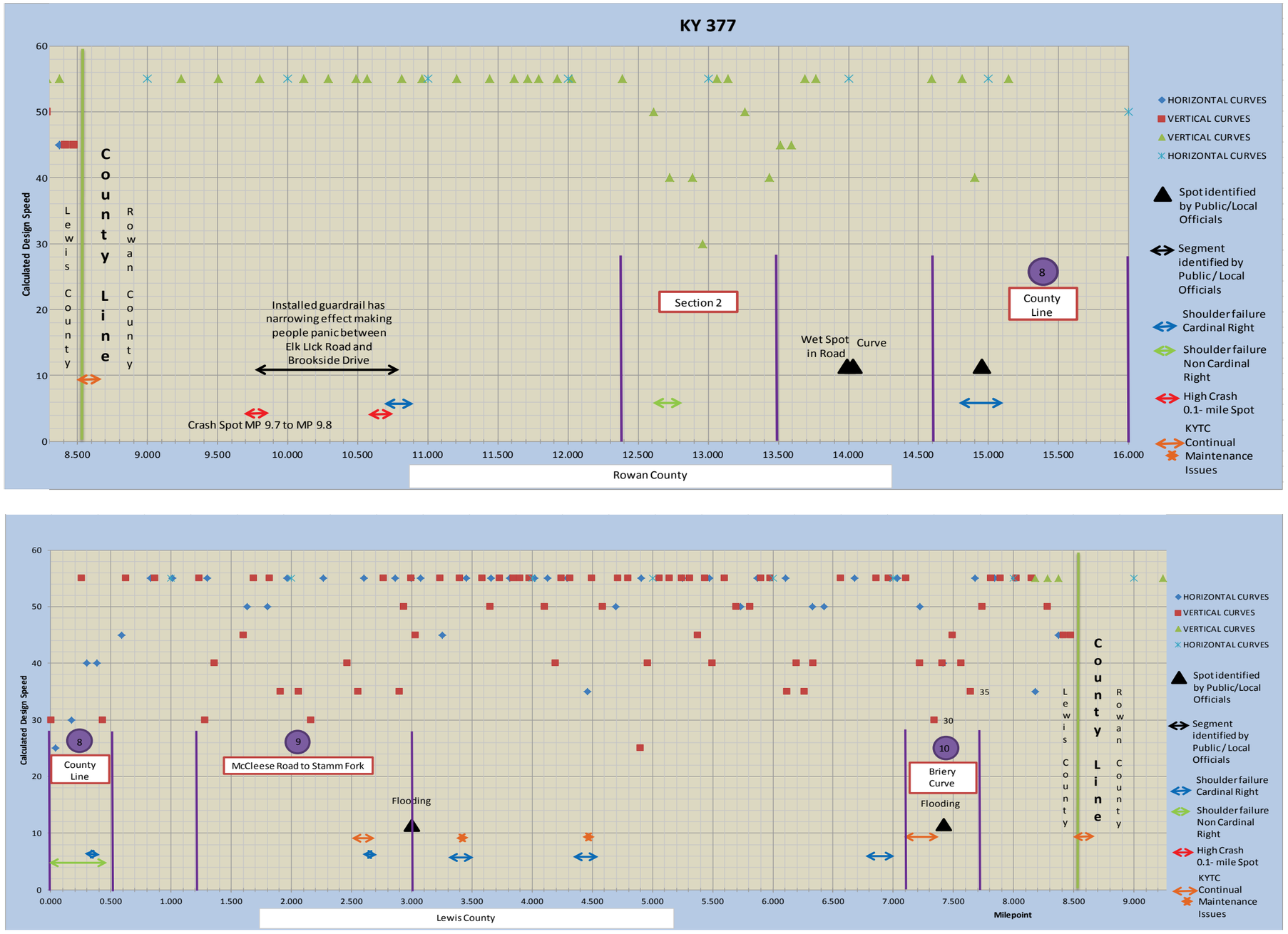
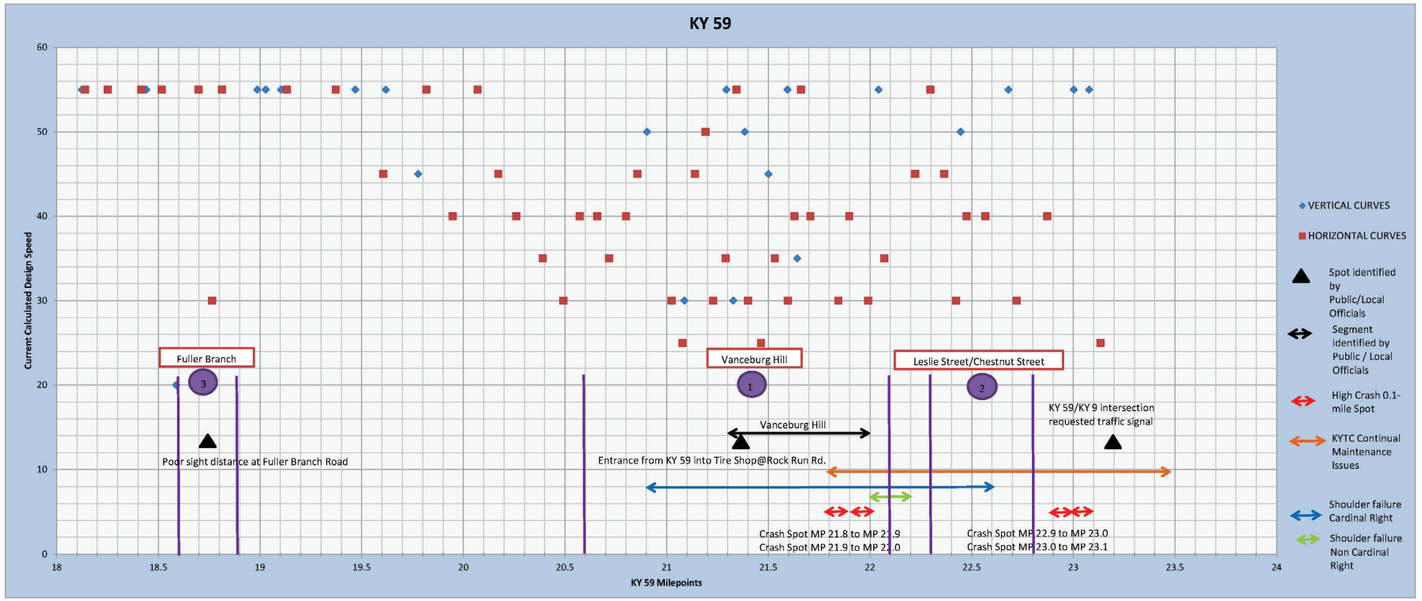


Figure 23: KY 377 Spot Improvement Identification



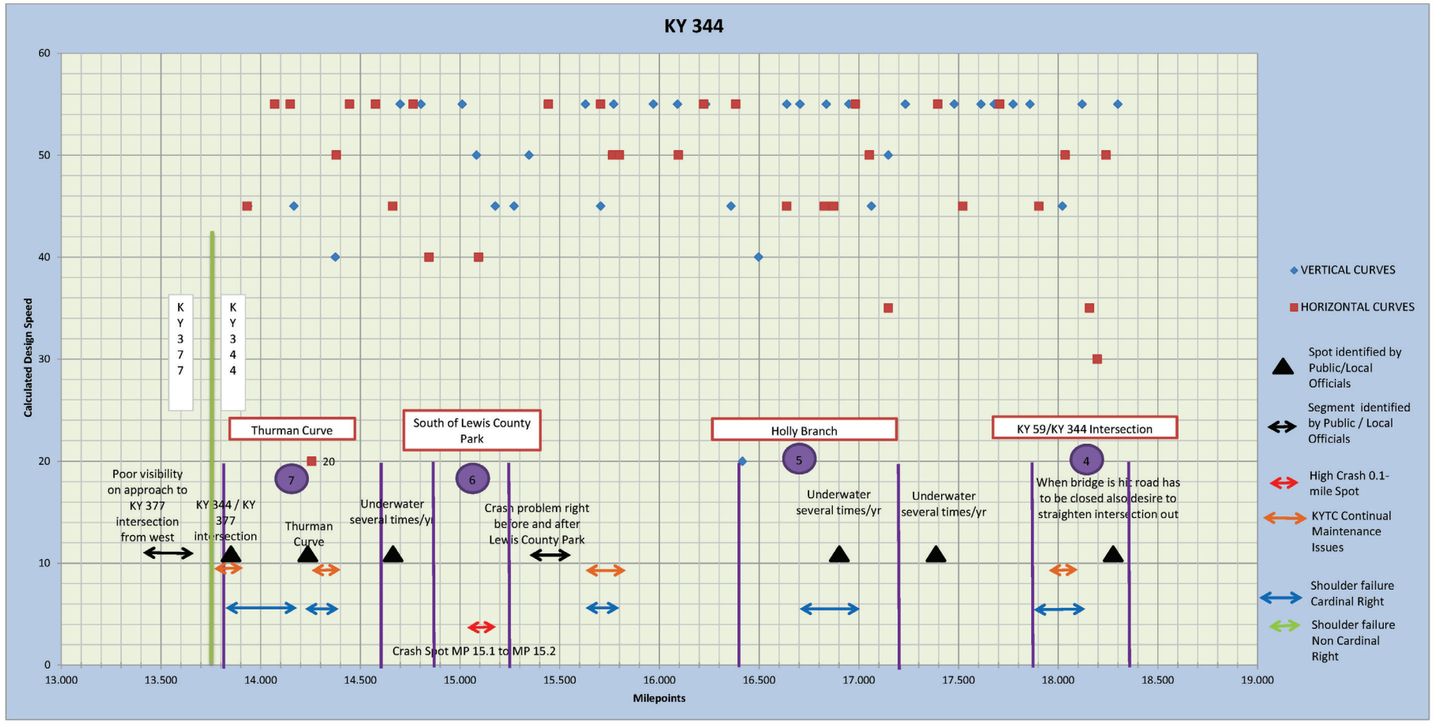


Figure 24: KY 344 and KY 59 Spot Improvement Identification

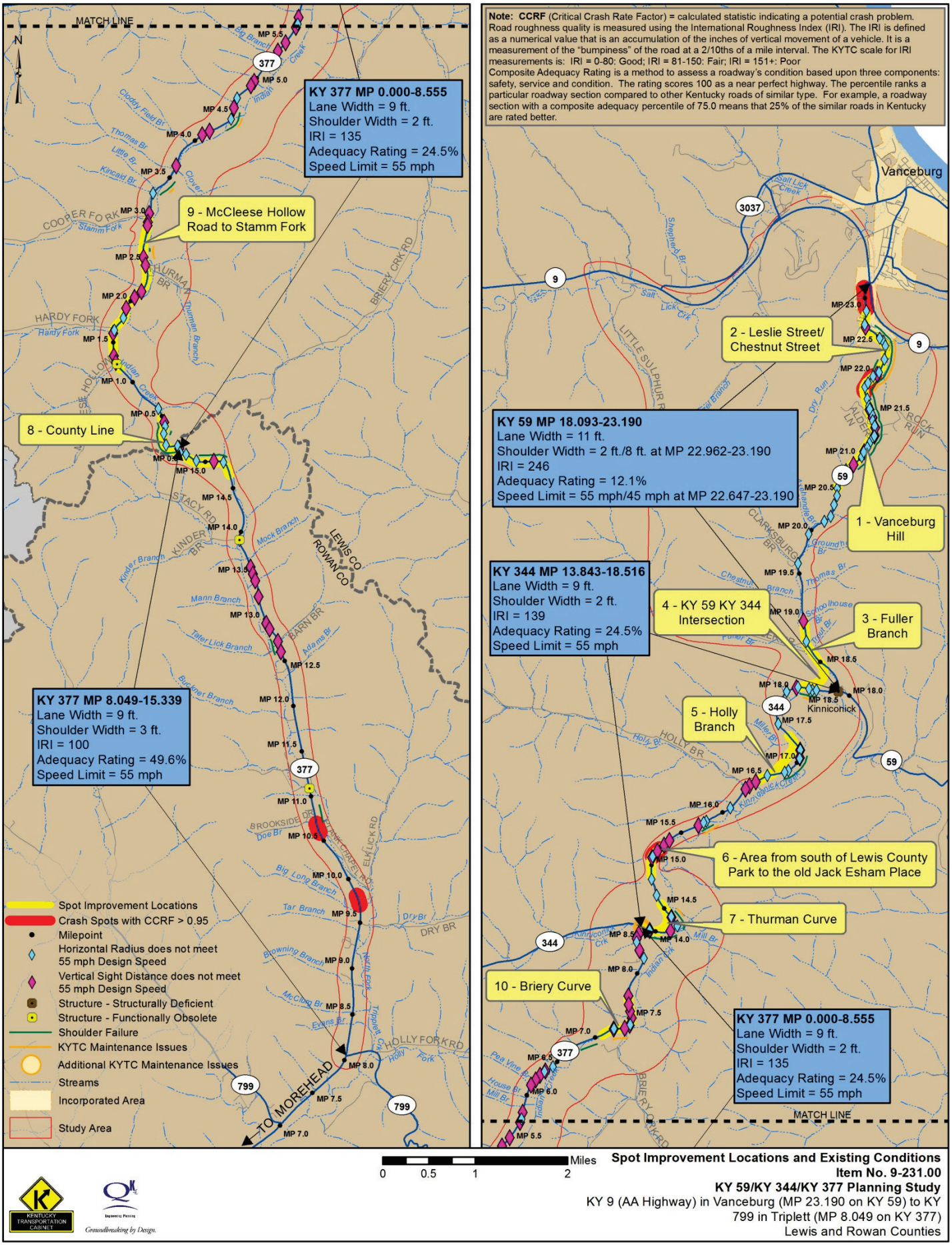


Figure 25: Spot Improvement Locations and Existing Conditions

Figure 26: Spot Improvement Photos

Table 23: Spot Improvement Matrix

SPOTS	Length	Design	Right of Way			Utilities	Environmental		Construction		Construction Cost per Mile	Maintenance Cost for Existing Road When on New Alignment	Total Cost	Total Cost per Mile	Horiz & Vert. Deficiencies	Crash Spots	Public Sentiment (ALTs 1-3 scale) Spots (1-6 scale) Arithmetic Mean	Structurally Deficient Bridges or Culverts	Functionally Obsolete Bridges or Culverts	Farms	DBNF Property	KYTC Mitigation Site	Historic Properties Affected	Flooding	KYTC Recurring Maintenance Locations	Shoulder or Slope Instability or Failures	Brought up at First Public Meeting
			Approx Relocations	Approx. R/W Acquired	R/W Cost	Utility Costs	Blue Line Stream Impacts	Environmental In-Lieu Fees	Earthwork	Estimated Construction Cost																	
	Miles	$	#	Acres	$	$	Linear Feet	$	CY	$	$	$	$	$	#	#		#	#	#	Acres	lf	#				
Spot 1 - Vanceburg Hill	1.54	$1,700,000	4	56	$500,000	$1,300,000	1,912	$1,900,000	1,683,755	$16,200,000	$10,500,000	$0	$21,600,000	$14,000,000	25	1	4.50	0	0	4	0	0	0		X	X	
Spot 2-Leslie Street/Chestnut Street	0.55	$600,000	5	12	$1,100,000	$300,000	851	$900,000	200,924	$3,400,000	$6,200,000	$0	$6,300,000	$11,500,000	5	0	2.70	0	0	1	0	0	0				
Spot 3-Fuller Branch	0.37	$500,000	1	5	$200,000	$100,000	861	$700,000	1,700	$1,000,000	$2,700,000	$0	$2,500,000	$6,800,000	1	0	3.20	0	0	3	0	0	0				X
Spot 4 - KY 59/KY 344 Intersection	0.56	$600,000	1	24	$250,000	$300,000	349	1,000,000	1,588,859	$14,500,000	$25,900,000	$1,060,000	$17,710,000	$31,600,000	4	0	3.69	0	0	2	0	0	0		X	X	X
Spot 5 - Holly Branch	0.81	$900,000	2	21	$350,000	$200,000	175	700,000	739,729	$7,600,000	$9,400,000	$1,200,000	$10,950,000	$13,500,000	9	0	2.44	0	0	4	0	0	0			X	
Spot 6- Area from South of Lewis County park to the Old Jack Esham Place	0.43	$500,000	0	5	$50,000	$100,000	650	600,000	27,828	$1,300,000	$3,000,000	$0	$2,550,000	$5,900,000	4	1	3.17	0	0	3	0	0	0		X	X	X
Spot 7-Thurman Curve	0.54	$600,000	2	14	$250,000	$200,000	418	400,000	563,580	$5,400,000	$10,000,000	$840,000	$7,690,000	$14,200,000	6	0	3.86	0	0	2	0	0	0		X	X	X
Spot 8-County Line	1.14	$1,200,000	2	38	$300,000	$300,000	3,317	1,900,000	1,089,889	$10,400,000	$9,100,000	$0	$14,100,000	$12,400,000	11	0	4.00	0	0	1	4	0	0			X	X
Spot 9-McCleese Hollow Road to Stamm Fork	1.78	$1,800,000	3	31	$500,000	$200,000	2,524	2,000,000	143,961	$6,800,000	$3,800,000	$0	$11,300,000	$6,300,000	12	0	3.38	0	1	8	0	0	0	X	X	X	X
Spot 10-Briery Curve	0.65	$800,000	1	12	$100,000	$100,000	1,110	1,100,000	111,662	$2,500,000	$3,800,000	$0	$4,600,000	$7,100,000	7	0	4.21	0	0	3	0	0	0	X	X		X

The wooded areas are potential habitat for Indiana and northern long-eared bats. A natural gas pipeline runs parallel to, and 250–300 feet east of, the existing KY 377 alignment. Other HAZMAT sites exist near MPs 9.20, 9.80, 10.50, 10.70, and 12.20. Although it was not flagged in any database search, an old store or repair shop on the west side near MP 8.10 might also be a HAZMAT site.

1. Total Reconstruction Alternatives

The straight horizontal alignment and wide landscape of KY 377 yielded two alternatives for widening along the existing alignment. These alternatives are shown in **Figure 27 (p. 65)** with a corresponding Environmental Footprint shown in **Figure 28 (p. 66)**. Total Reconstruction Alternatives were developed and estimated using 55 mph design criteria.

a) **Alternative (ALT) 1A**

Alternative 1A begins on KY 377 near MP 7.90 near the intersection of KY 799 (Big Perry Road) and terminates at MP 12.40. It follows the existing alignment, with the new centerline offset 12–13 feet utilizing as much of the existing pavement as possible. The Alternative 1A corridor crosses the existing road multiple times. This will present maintenance of traffic issues during construction that would need to be addressed in future project phases if this alternative is advanced. Alternative 1A is 4.45 miles in length and has an estimated cost of $24.5 million.

b) **Alternative (ALT) 1B**

As with Alternative 1A, Alternative 1B begins on KY 377 at MP 7.90. The new centerline is offset 30 feet from the existing centerline and crosses the existing road multiple times before terminating at MP 12.40. This would present maintenance of traffic issues during construction that will need to be addressed in future project development phases if this alternative is advanced. Alternative 1B is 4.50 miles in length and has an estimated cost of $24.8 million.

Total estimated costs are similar between the two alternatives ($24.5 million for Alternative 1A, $24.8 million for Alternative 1B); however, Alternative 1B is expected to have more right of way impacts. It is important to note that these estimates and impacts were developed using less than accurate digital elevation models since LiDAR data is not available for this area.

2. Spot Improvements

The Project Team agreed KY 377 did not lend itself to spot improvements due to the almost continuous presence of steep slopes and shoulder drop-offs. Therefore, Section 1 does not include spot Improvements.

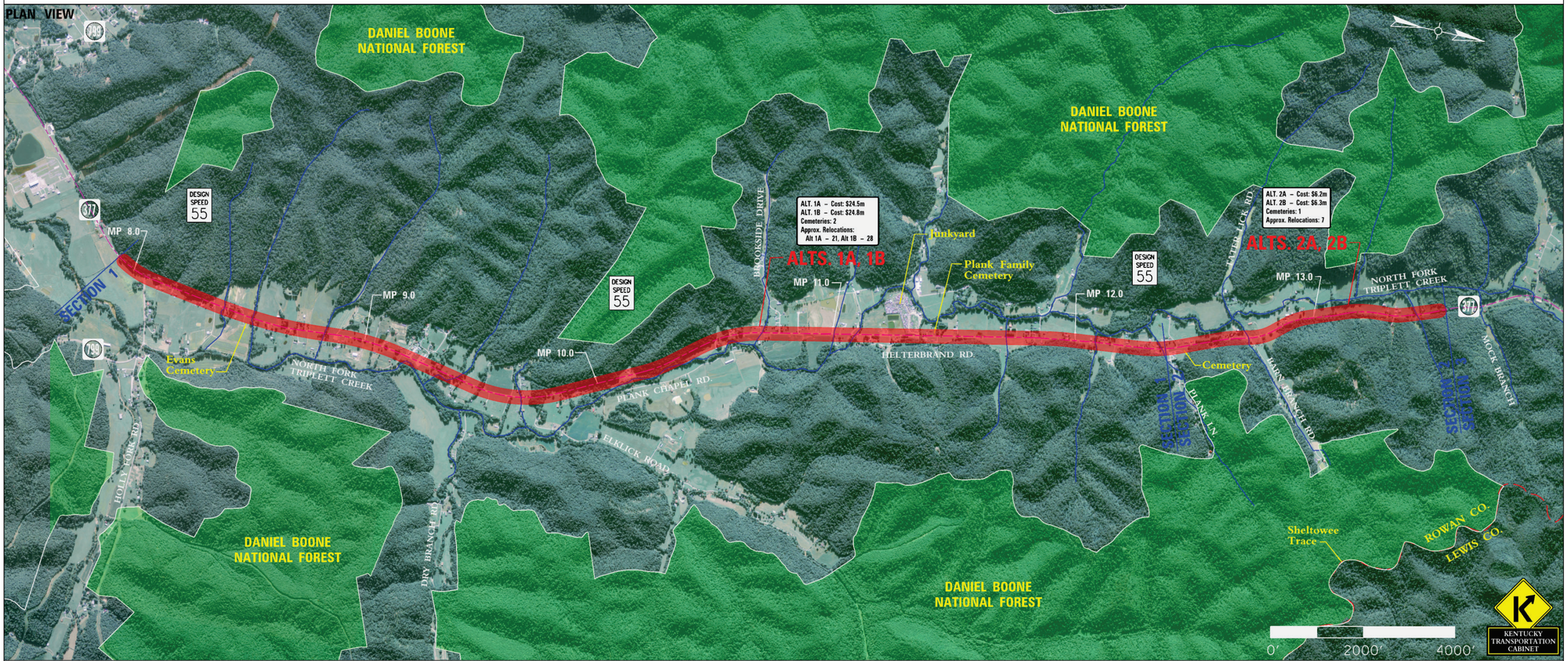
C. Section 2

Section 2 begins on KY 377 in Rowan County at MP 12.38 and ends near MP 13.50 and is projected to carry 1,400 vpd**)**. As with Section 1, Section 2 has 9-foot-wide lanes and 3-foot-wide (average) shoulders and all horizontal curves meet 55 mph design criteria; however, 6 vertical curves do not meet 55 mph design criteria. There are no functionally obsolete or structurally deficient structures in Section 2, nor are there any statistically significant high-crash locations.

ALTERNATIVES 1A, 1B and 2A, 2B

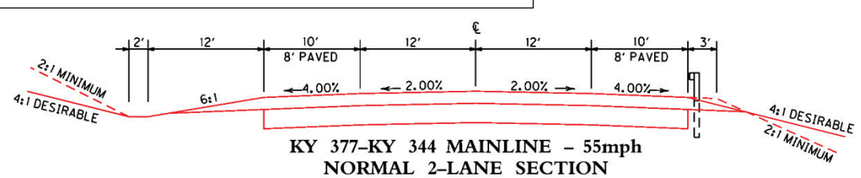
TOTAL ESTIMATED COST:
ALT 1A $24,500,000 ALT 1B $24,800,000
ALT 2A $6,200,000 ALT 2B $6,300,000

PLAN VIEW



TYPICAL SECTIONS

Although shoulders are shown with full-depth pavement structure, only roadway sections that utilize the shoulders for maintenance of traffic during construction will be such. All other sections will have conventional shoulder structures.



KY 377–KY 344 MAINLINE – 55mph
NORMAL 2–LANE SECTION

KENTUCKY DEPARTMENT OF HIGHWAYS

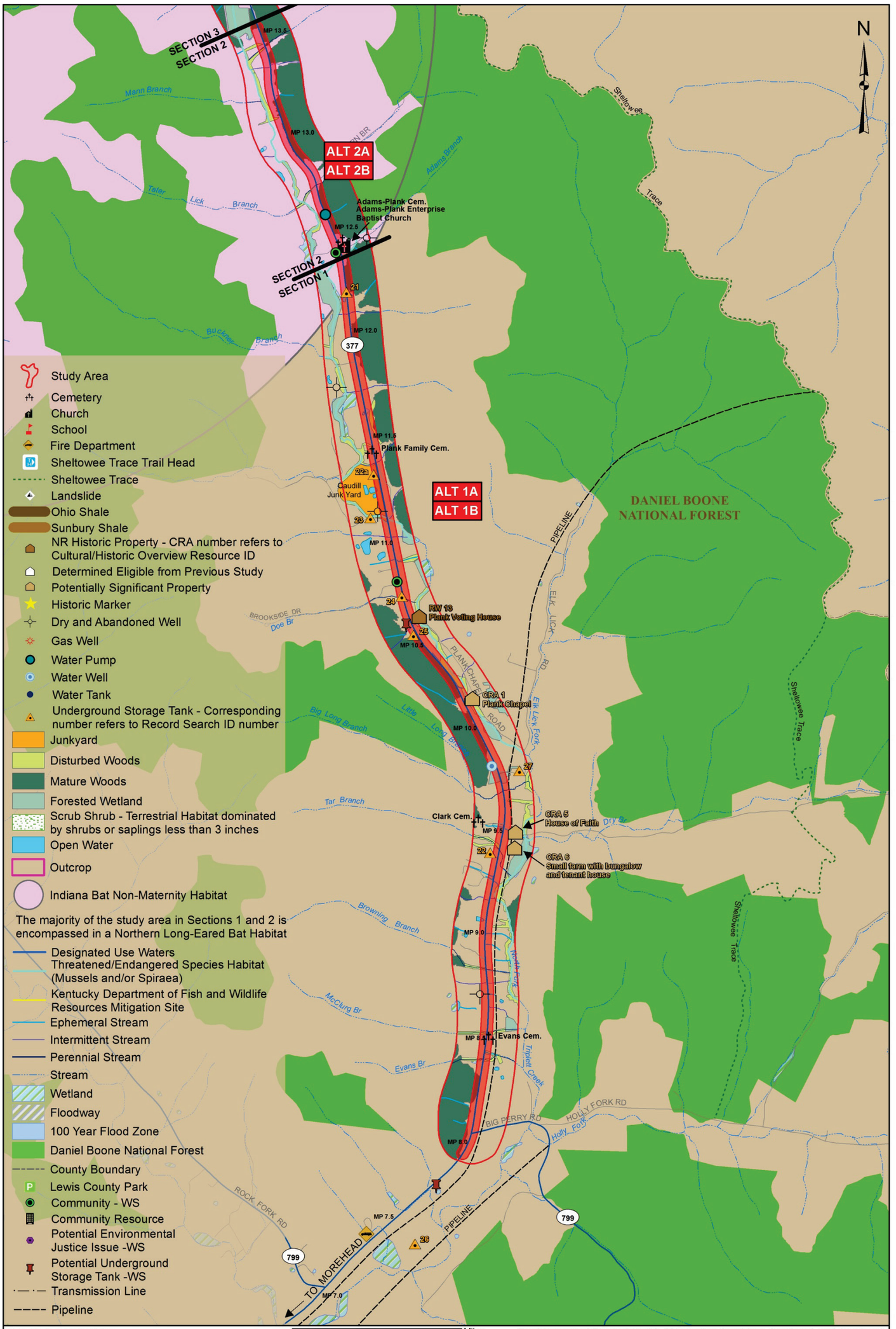
KY 59/KY 344/KY 377
PLANNING STUDY
KY 377
SECTIONS 1 & 2

PREPARED BY

ROWAN COUNTY

Figure 27: Alternatives 1A, 1B and 2A, 2B

Figure 28: Sections 1 and 2 Environmental Footprint with Alternatives



Environmental Footprint with Alternative Corridors Section 1 and Section 2
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

Environmental issues affecting the corridor locations include streams parallel corridor streams that may contain Virginia spiraea and mussels, bat habitat, a small community, and a water pump. There are two areas that are potentially noise sensitive, one of which overlaps Section 1. The DBNF abuts both sides of the roadway.

1. Total Reconstruction Alternatives

The straight horizontal alignment and wide landscape of KY 377 yielded two alternatives (2A and 2B) for widening along the existing alignment. These alternatives are shown in **Figure 27 (p. 65)** with a corresponding Environmental Footprint shown in **Figure 28 (p. 66)**. Total Reconstruction Alternatives were developed and estimated using 55 mph design criteria.

a) Alternative (ALT) 2A

Alternative 2A begins at MP 12.40 and terminate at MP 13.50. Alternative 2A, similar to Alternative 1A, is offset 12–13 feet from the existing alignment. The Project Team did not see a need to look at alternatives within Section 2 that did not closely follow the existing alignment. Alternative 2A is 1.2 miles in length and has an estimated cost of $6.2 million.

b) Alternative (ALT) 2B

Alternative 2B begins at MP 12.40 and terminate at MP 13.50. Alternative 2B, similar to Alternative 1B, is offset 30 feet. Alternative 2B will also likely have more right of way impacts than Alternative 2A. As previously stated, the Project Team did not see a need to look at alternatives within Section 2 that didn't closely follow the existing alignment. Alternative 2B is 1.20 miles in length and has a total estimate cost of $6.3 million.

2. Spot Improvements

Initially, consideration was given to a 45 mph spot improvement between MPs 12.65 and 13.40, due to a history of shoulder failures and vertical curves that reduced the safe travel speed. The Project Team determined this spot improvement was similar in length to ALTS 2A and 2B, therefore could be eliminated as a spot improvement. Thus, Section 2 does not have spot improvements and could be a standalone project.

D. Section 3

Section 3 begins near MP 13.50 on KY 377 in Rowan County and extends north to approximately MP 7.6 in Lewis County, terminating just south of the KY 377/KY 344 intersection. Section 3 is projected to carry between 480 and 1,400 vpd in 2040 and has 9-foot-wide lanes with 2–3-foot shoulders. In Section 3, 20 horizontal curves and 35 vertical curves do not meet 55 mph design criteria; most are located near the Rowan/Lewis County line. Further, feedback at the local official and public meetings indicated the lack of sunlight along the county line due to the rock cuts creates a slick roadway in the winter. Two structures in Section 3 are considered functionally obsolete (FO) due to their designs no longer meeting current standards or are no longer adequate; their sufficiency ratings are 60.4 (MP 13.91 Rowan County) and 76.9 (MP 1.26 Lewis County), respectively. The culvert in Rowan County over Nickles Hollow Branch near Kinder Branch Road is potentially eligible for the NRHP. In addition, KYTC identified four recurring maintenance locations **(Locations 6, 7, 8, and 9, Table 4, p. 9)** with slope/shoulder stability where KY 377 is adjacent to Indian Creek.

An old store near MP 3.60 in Lewis County and a small farmstead near MP 5.00 may also be potentially NRHP-eligible sites. HAZMAT sites exist near MPs 13.80 and 14.20 in Rowan County and

MP 7.20 in Lewis County. Section 3 includes four areas of potential noise receptors. The DBNF abuts both sides of the roadway in Section 3, and the Sheltowee Trace (following the Rowan/Lewis County line) northern trailhead is just east of the roadway near MP 14.60 in Rowan County. Nearby are the Henderson, Thomas, and Crawford cemeteries. There is no statistically significant high-crash locations located in Section 3. Beginning at MP 3.00 in Lewis County and continuing north, alternatives may encounter Sunbury/Ohio shale. Landslide deposits appear between MPs 5.70 and 6.90.

Major natural gas line crossings near MP 1.50 in Lewis County were estimated to be $1.0 million for each line crossed in the existing corridor, and $3.0 million for each natural gas line crossing on new alignment. These estimates were provided by KYTC District 9 staff based on experience with the adjacent section improvements on KY 377. Also, a gas field (cluster of oil and gas wells) is located just south of the gas line crossing.

Existing conditions were not assessed for alternatives outside the original study area.

1. Total Reconstruction Alternatives

Multiple alternatives were developed for Section 3 **(Figures 29–30, pp. 70–71)**. Two alternatives (3A and 3B) were within the study area: ALT 3A stays near the existing alignment and ALT 3B minimizes DBNF impacts. Alternative 3D follows natural valleys and is mostly outside the original study area. Total Reconstruction Alternatives were developed and estimated using 55 mph design criteria.

a) **Alternative 3A (ALT 3A-1a, ALT 3A-1b, ALT 3A-2)**

Alternative 3A (ALT 3A-1a, ALT 3A-1b, ALT 3A-2) follows closely along the existing KY 377 alignment improving horizontal and vertical curves that do not meet 55 mph. It is comprised of smaller segments (ALTS) that could serve as smaller construction projects. ALT 3A-2, due to its proximity to the existing alignment, could potentially be segmented further. Alternative 3A is 8.70 miles in length and has an estimated cost of $84.8 million.

b) **Alternative 3B (ALT 3B-1a, ALT 3B-1b, ALT 3B-2)**

Alternative 3B (ALT 3B-1a, ALT 3B-1b, ALT 3B-2) follows the existing KY 377 corridor closely through the DBNF and then Thurman Branch. Near MP 3.00, Alternative 3B parallels Indian Creek to the west in an attempt to minimize earthwork; however, by minimizing earthwork, farmland impacts may be a concern. This alternative also has more stream crossings. Alternative 3B is 8.80 miles in length and has an estimated cost of $111.7 million. Structure, FILO, and maintenance costs comprise the majority of the difference in cost for this alternative.

c) **Alternative 3D (ALTS 3D-1, 3D-2, 3D-3, AND 3D-4)**

Alternative 3D (ALT 3D-1, 3D-2, 3D-3, AND 3D-4) quickly turns on new alignment, bisects a portion of the DBNF and follows Briery Creek Road to KY 344. Because Alternative 3D is on new alignment, the cost for additional mileage to maintain the existing road makes the estimated total cost more than Alternative 3A. Alternative 3D is also outside the study area and additional environmental work would be necessary in future project development phases. Alternative 3D is 8.2 miles in length and has an estimated cost of $119.7 million.

The Forest Service stated their first preference for Section 3 would be along either Alternative 3A or 3B, which have minimal impacts to the forest. If Alternative 3A or 3B does not meet KYTC's project

purpose and goals, Alternative 3D-1 would be sufficient as it would provide opportunities to reach current inaccessible areas of the forest; furthermore, it does not bisect long stretches of the Sheltowee Trace, and splits only a small portion of the forest.

KYTC District 9 staff met with representatives of the Sheltowee Trace Association on September 20, 2017 to provide project update and discuss impacts this study, in particular Section 3, could have on the Trace. Representatives agreed Alt 3D-1 would be the most favorable due to its compatibility with the Trace's long-term plans to extend the trail toward Jenny Wiley Trail in South Portsmouth Kentucky. In addition, the remaining Section 3 Alts would be acceptable if impacts to the trail are properly mitigated to allow the trailhead to function as it currently does. KYTC agreed to mitigate impacts to the trailhead. If Alt 3A-1 is preferred, KYTC agreed a section of KY 377 would remain in place to provide access to the existing trailhead or some other form of mitigation considered. Meeting minutes are in **Appendix S**.

All three alternatives are considered viable for a future design phase.

2. Spot Improvements

Three 45 mph spot improvements were identified in Section 3 **(Figure 25, p. 61)**.

a) **Spot Improvement 8–County Line**

Spot Improvement 8 would realign KY 377 at the Lewis/Rowan County line between MP 14.60 in Rowan County and MP 0.50 in Lewis County where there are numerous horizontal and vertical deficiencies and shoulder failures; and, as previously noted, this spot does not receive direct sunlight. Spot Improvement 8 is 1.14 miles in length, includes 7.2% and 8.6% grades, and has an estimated cost of $14.1 million. In future project development phases, an additional alternative alignment study may be necessary in this area.

b) **Spot Improvement 9–McCleese Road to Stamm Fork**

KY 377 from McCleese Road (near MP 1.20) to Stamm Fork (MP 3.00) addresses a 30 mph sharp horizontal curve, a recurring maintenance issue **(Location 9, Table 4, p. 9)**, and flooding. Spot Improvement 9 is nearly 1.78 miles in length and has an estimated cost of $11.3 million.

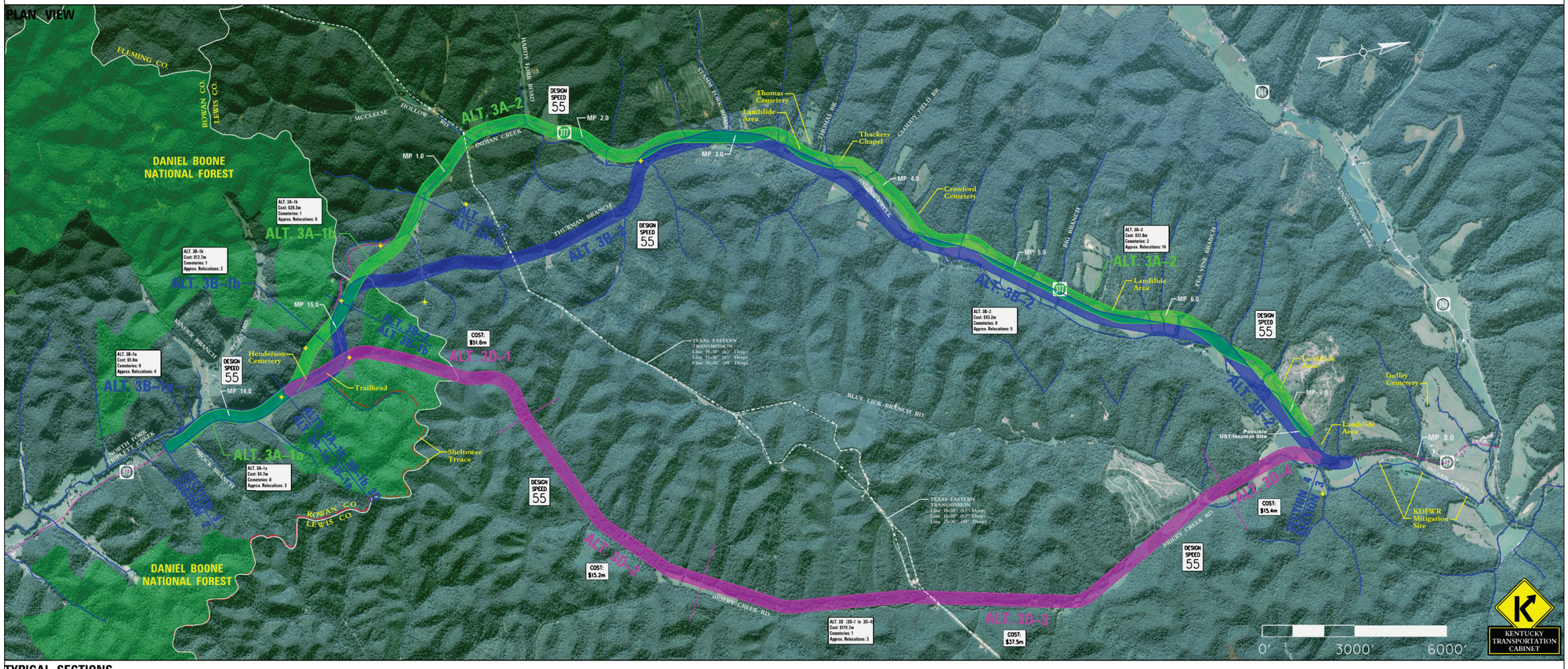
c) **Spot Improvement 10–Briery Curve**

Briery Curve was mentioned several times at the first local officials and public meeting as a spot with flooding issues. This location (MP 7.10 to MP 7.70) also has a 30 mph curve, and is a KYTC recurring maintenance location **(Location 6, Table 4, p. 9)**. This spot improvement is approximately 0.65 mile in length and has a total estimated cost of $4.6 million.

ALTERNATIVES 3A, 3B, and 3D

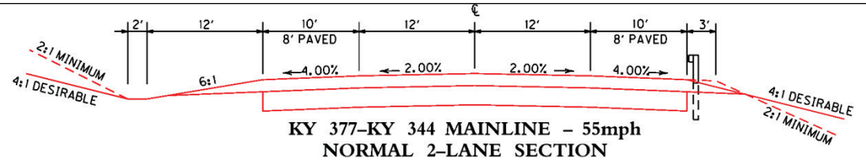
TOTAL ESTIMATED COST:
ALT 3A $84,800,000
ALT 3B $111,720,000
ALT 3D $119,680,000

PLAN VIEW



TYPICAL SECTIONS

Although shoulders are shown with full-depth pavement structure, only roadway sections that utilize the shoulders for maintenance of traffic during construction will be such. All other sections will have conventional shoulder structures.



KY 377–KY 344 MAINLINE – 55mph
NORMAL 2–LANE SECTION

KENTUCKY DEPARTMENT OF HIGHWAYS

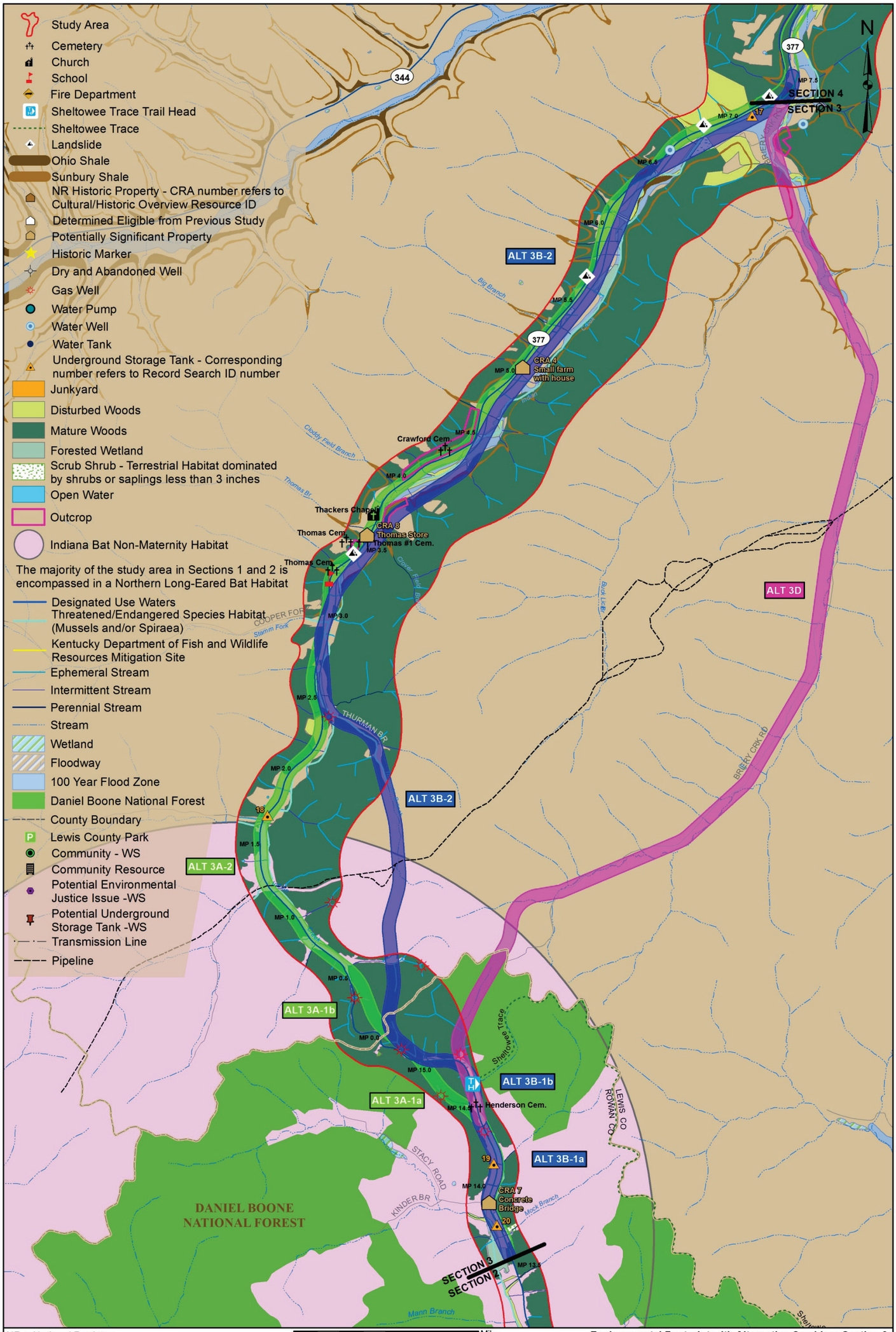
KY 59/KY 344/KY 377
PLANNING STUDY
KY 377
SECTION 3

PREPARED BY

ROWAN COUNTY
LEWIS COUNTY

Figure 29: Alternatives 3A, 3B, and 3D

Figure 30: Section 3 Environmental Footprint with Alternatives



NR = National Register
WS = Windshield Survey

0 0.275 0.55 1.1 Miles

Environmental Footprint with Alternative Corridors Section 3
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

E. Section 4

Section 4 begins on KY 377 just south of the KY 377/KY 344 intersection (MP 7.2, some overlap with Section 3 for one alternative) in Lewis County and ends at MP 16.60 on KY 344 and is projected to carry between 480 and 900 vpd in 2040. Both routes have 9-foot-wide lanes and 2-foot-wide shoulders. In this section 11 horizontal curves and 16 vertical curves do not meet 55 mph design criteria. Section 4 has one crash location that should be monitored due to a CCRF just less than 1.0 (0.95). There are no structurally deficient or functionally obsolete structures in this section.

Even though Section 4 is one of the shorter corridor sections, it has many environmental resources. The over 5-mile KDFWR Indian and Kinniconick stream mitigation site is located at the KY 377/KY 344 intersection. The stream site is protected and must be avoided. Lewis County Park along the east side of KY 344 is considered to be a potential Section 4(f) and 6(f) resource. The 100-year floodplain along the creeks and their tributaries (also synonymous with alluvial soil locations) should be noted. Potential habitat for the Indiana and the northern long-eared bat (NLEB) summer habitat, Virginia spiraea and mussels may exist throughout woods and streams in Section 4. On KY 344 between MP 14.25 and MP 14.40, KYTC has identified three recurring maintenance issues due to slope/shoulder stability issues where Kinniconick Creek is adjacent to the roadway **(Location 4, Table 4, p. 9)**. Section 4 contains four potential areas of noise sensitive receptors; landslide areas; potential for having areas of Sunbury and Ohio shales; several USTs; a fire department facility; and Gulley Cemetery.

1. Total Reconstruction Alternatives

Total Reconstruction Alternatives were developed and estimated using 55 mph design criteria **(Figures 31–32, pp. 73–74)**.

a) Alternative 4A

Alternative 4A begins at approximately MP 7.20 on KY 377 and ends at approximately MP 16.50 on KY 344. Alternative 4A crosses KY 377 at several locations in an effort to straighten deficient horizontal curves and minimize stream impacts. At the KY 377/KY 344 intersection, Alternative 4A crosses the stream, straightens the curve on KY 344, and addresses the vertical deficiencies leading into and out of that curve. Due to the proximity of the stream and the stream mitigation project, it is prudent to veer from the existing roadway to the west on new alignment at that location. At MP 15.00, the corridor is offset to the west to minimize stream impacts and the alternative ends at approximately MP 16.50. Alternative 4A is 3.60 miles in length and has an estimated cost of $36.5 million.

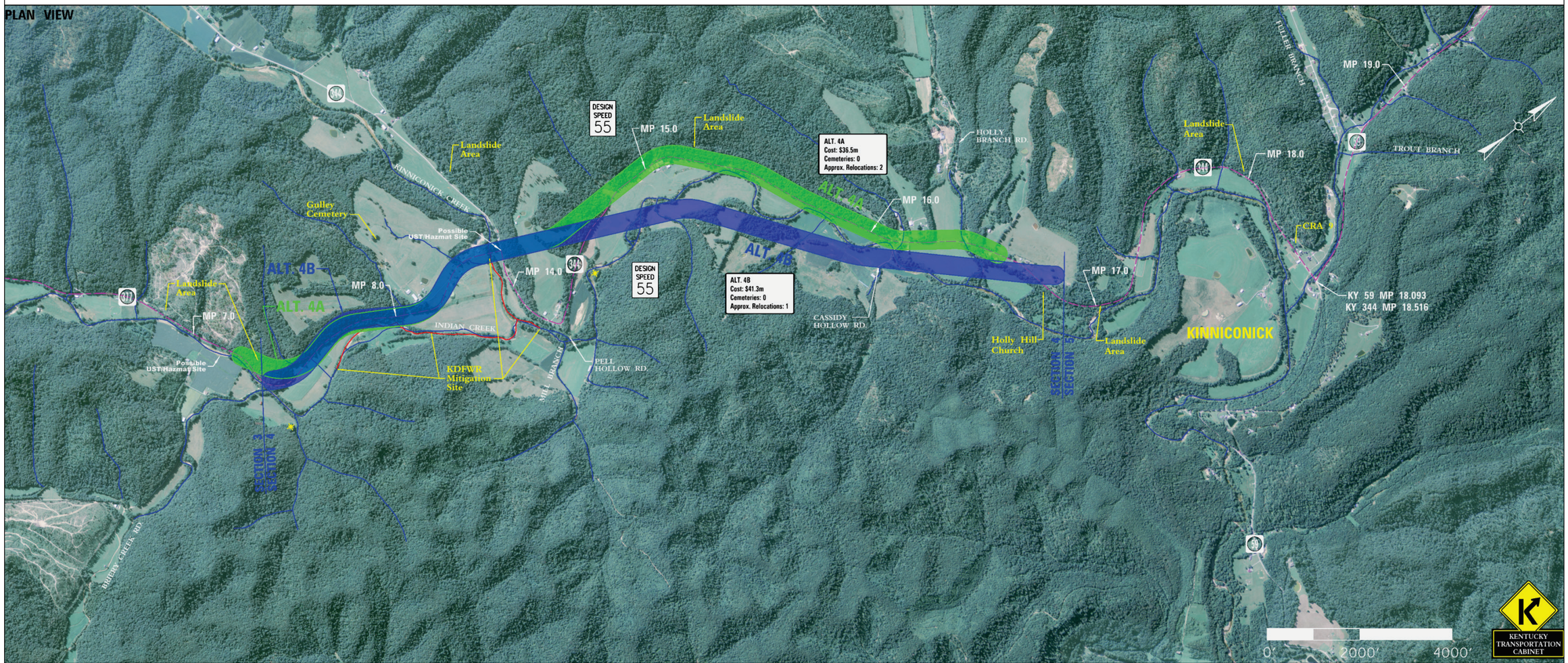
b) Alternative 4B

Alternative 4B begins at approximately MP 7.30, remains very close to Alternative 4A, until the KY 377/KY 344 intersection. Alternative 4B crosses the stream, straightens the curve on KY 344, and flattens two grades leading into and out of the curve. As with Alternative 4A, Alternative 4B is on new alignment west of the stream mitigation site, then crosses the stream close to MP 14.90 and follows flatter land where possible. At approximately MP 16.10 Alternative 4B again crosses the stream to join Section 5 at approximately MP 16.80. Alternative 4B is 3.50 miles in length and has an estimated cost of $41.3 million.

ALTERNATIVES 4A and 4B

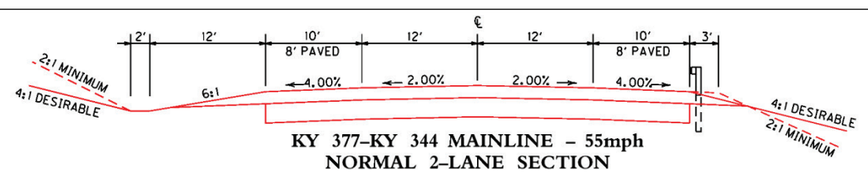
TOTAL ESTIMATED COST:
ALT 4A $36,500,000
ALT 4B $41,300,000

PLAN VIEW



TYPICAL SECTIONS

Although shoulders are shown with full-depth pavement structure, only roadway sections that utilize the shoulders for maintenance of traffic during construction will be such. All other sections will have conventional shoulder structures.



KY 377–KY 344 MAINLINE – 55mph
NORMAL 2–LANE SECTION

Figure 31: Alternatives 4A and 4B

KENTUCKY DEPARTMENT OF HIGHWAYS

KY 59/KY 344/KY 377
PLANNING STUDY
KY 377 to KY 344
SECTION 4

PREPARED BY

LEWIS COUNTY

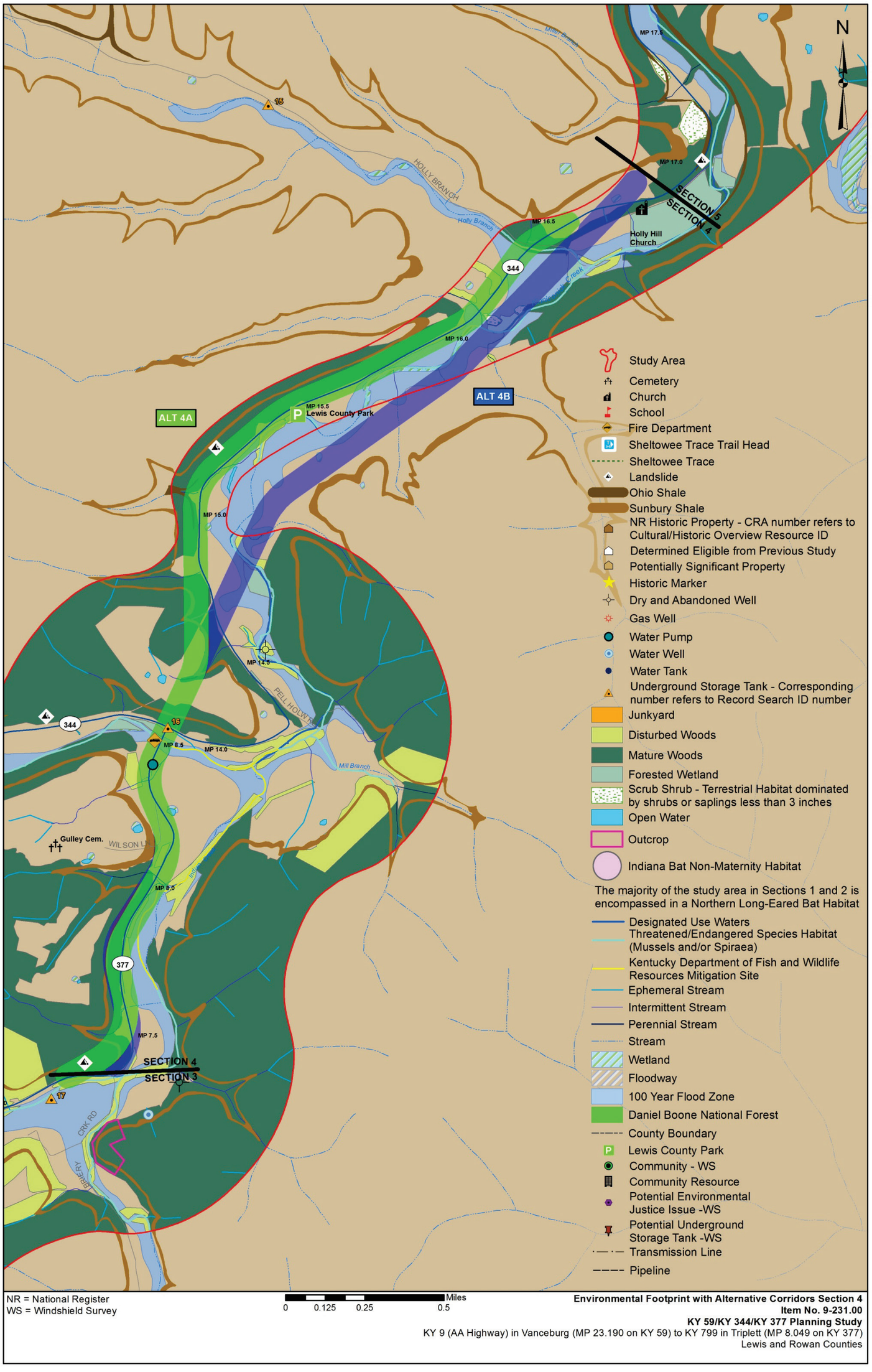


Figure 32: Section 4 Environmental Footprint with Alternatives

2. Spot Improvements

Three 45 mph spot improvements were identified in Section 4 **(Figure 25, p. 61)**.

a) **Spot Improvement 5–Holly Branch**

Spot Improvement 5 (MP 16.40 to MP 17.30) on KY 344 near Holly Branch was identified at the first public meeting as a spot with flooding issues several times a year and also has one horizontal curve and two vertical curves that do not meet current design criteria for 45 mph. Spot Improvement 5 is 0.81 mile in length and has an estimated cost of $11.0 million.

b) **Spot Improvement 6–South of Lewis County Park to Esham Place**

Spot Improvement 6 (MP 14.90 to MP 15.30), on KY 344 south of the Lewis County Park, was identified as a 0.1-mile high-crash location, and has several horizontal curves that do not meet current criteria. Spot Improvement 6 is approximately 0.43 mile in length and has an estimated cost of $2.6 million.

c) **Spot Improvement 7–Thurman Curve**

Thurman Curve on KY 344 (MP 13.80 to MP 14.60) is signed for 15 mph, encompasses one KYTC recurring maintenance issue due to slope/shoulder stability issues where Kinniconick Creek is adjacent to the roadway **(Location 4, Table 4, p. 9)**, and was identified by the public as a safety concern. Spot Improvement 7 is approximately 0.54 mile in length and has an estimated cost of $7.7 million.

F. Section 5

Section 5 begins at MP 16.50 (some overlap with Section 4) on KY 344 and ends at MP 23.19 on KY 59 and is projected to carry between 900 and 2,700 vpd in 2040. As indicated earlier, the Project Team identified Section 5 as the priority section for this study due to the poor geometric alignment (44 horizontal and 12 vertical curves that do not meet 55 mph), narrow lanes (9 to 11 feet wide) and shoulders (2 to 8 feet wide), recurring maintenance issues **(Locations 1 and 2, Table 4, p. 9)**, statistically significant crash history (4 high-crash spots), infrequent or non-existent passing opportunities, location of community destinations, development near KY 9, higher traffic volumes, and slower travel speeds and a structurally deficient bridge.

Regarding environmental resources, the International Style-influenced residence (LWV 25) is eligible for listing in the NRHP. During the windshield survey, CRA's architectural historians noted the locations of five previously unreported and potentially significant resources. Additional cemeteries noted through field review or public involvement are:

- Adams Cemetery—west side of KY 59, 0.1 mile north of MP 19.50
- Cemetery near MP 22.70—west side of KY 59, south of Bethesda Assembly Church
- Cemetery near MP 20.70—50 feet west of KY 59 (identified at Public Meeting #2)

Sunbury and Ohio shales will be encountered with each alternative, and slope instability is a major issue over Vanceburg Hill.

1. Total Reconstruction Alternatives

Each alternative was developed with 55 mph design criteria, with the exception of the existing corridor from Rock Run Road at MP 21.40 to approximately MP 22.70. In this section, the existing roadway widens to 11 feet, with 8-foot-wide shoulders near Leslie Street; thus, 45 mph design criteria and an urban (curb and gutter) typical section are proposed. Each alternative was divided into constructible sections (indicated as ALT).

Each alternative discussed is segmented into smaller manageable sections and are referred to as ALTS. In keeping with the vision to make the corridor continuous, ALTS 5A and 5A-1 provide options for realignment of the KY 344/KY 59 intersection (southern terminus of Section 5). ALTS 5A and 5A-1 were developed to avoid the Tannery/Kinniconick Lodge (locally known as "the Hotel") area, minimizes excavation, and minimizes impacts to Kinniconick Creek. Either intersection ALT can be utilized with each proposed Section 5 alternative. The differences in total length and cost are 0.9 mile and $200,000 (ALT 5A is the longest and most expensive). ALT 5A was used for discussion purposes in each of the alternatives and corresponding tables.

ALT 5A-2 begins at MP 19.00, the northern terminus of ALTS 5A and 5A-1. ALT 5A-2 follows existing KY 59 to the southern branch of Clarksburg Branch Road (MP 19.50). This tangent ALT, as with the other ALTS, can be a standalone project and is a part of every Section 5 alternative.

Total Reconstruction Alternatives were developed and estimated using 55 mph design criteria.

a) **Alternative 5B (ALTS 5A, 5A-2, 5B1, 5B2)**

There are several short valleys on KY 59 that provide an opportunity to reconstruct Vanceburg Hill on new alignment in an attempt to minimize earthwork, minimize relocations, prevent impacts to a major transmission line, and maintain traffic on the existing road before tying into KY 9 at the bottom of the hill.

Alternative 5B is concurrent with ALTS 5A and 5A-2 south of the southern branch of Clarksburg Branch Road. From that point, Alternative 5B joins with existing KY 59 (ALT 5A-2) until MP 19.90 (ALT 5B1) before diverging to the west along Axehandle Branch, through Dry Run Creek Hollow (ALT 5B2), and under a major transmission line before tying into existing KY 59 just north of KY 9. At this point, it rejoins existing KY 59 near MP 22.60, taking advantage of the rebuilt approach to KY 9. The design speed is 45 mph as it approaches KY 9. If combined with Alternative 5A, Alternative 5B would use 1.70 miles of existing KY 59. Alternative 5B would leave 5.40 miles of existing KY 59 to be maintained. Alternative 5B was split (ALTS 5B1 and 5B2) to facilitate the potential crossing of another alternative. The steepest grade is 5%. Alternative 5B is 5.90 miles in length with an estimated total cost of $78.0 million **(Figure 33, p. 78)**.

If Alternative 5B was constructed, providing additional access from new alignment to parcels along existing KY 59 may be desired. Direct access to each parcel along the new roadway was not feasible due to terrain, the number of parcels to access, and the length each access point would require. Therefore, Alternative 5B includes a North Connector to provide access to existing KY 59 (see **Section XII. E**.).

- **North Connector**—This connector ties to existing KY 59 near MP 21.40 at the intersection with Rock Run Road, and connects with Alternative 5B approximately

1.25 miles north of existing MP 22.60. This connector, if built, should be added to the cost of Alternative 5B. Preliminary grades reach 7%. The North Connector is 0.73 mile in length and has an estimated total cost of $7.1 million.

b) **Alternative 5B-1 (ALTS 5A, 5A-2, 5C-1, 5B1-1, 5B1-2)**

Added at Project Team Meeting #2, Alternative 5B-1 begins on existing KY 344 near MP 16.50, south of Kinniconick and the KY 344/KY 59 intersection. It then bypasses all substandard horizontal curvature south of the KY 344/KY 59 intersection (ALT 5A), and follows existing KY 59 (ALT 5A-2 and ALT 5C-1) alignment until approximately MP 20.80 on KY 59. At that point, it diverges west of existing KY 59 (ALT 5B1-1). ALT 5B1-2 traverses northwesterly to follow an existing hollow and crosses under a transmission lane before terminating at KY 9 across from Shelton Lane. Alternative 5B-1 utilizes 1.15 miles of existing KY 59. Approximately 5.96 miles of existing KY 59 would remain to be maintained. This alternative crosses two significant mountains and utilizes grades of 7% to better manage earthwork. Alternative 5B-1 is 6.8 miles in length and has an estimated total cost of $99.4 million **(Figure 34, p. 79)**.

c) **Alternative 5C + 5B1-1 (ALTS 5A, 5A-2, 5C-1, 5B1-1, 5B2)**

This alternative is a combination of Alternatives 5B and 5B-1. Added by local officials, this alternative begins on existing KY 344 near MP 16.50, south of Kinniconick and the KY 344/KY 59 intersection. This alternative bypasses all substandard horizontal curvature south of the KY 344/KY 59 intersection (ALT 5A), and follows existing KY 59 (ALT 5A-2 and ALT 5C-1) alignment until approximately MP 20.75. As with Alternative 5B-1, it diverges west of existing KY 59 for 0.81 miles (ALT 5B1-1) until it merges with Alternative 5B. The final leg (ALT 5B2) ties in to KY 9 with a 45 mph design speed. This alternative also has 7% grades. This alternative is 6.04 miles long and has an estimated cost of $83.2 million **(Figure 35, p. 80)**.

d) **Alternative 5C (ALTS 5A, 5A-2, 5C-1, 5C-2)**

Alternative 5C begins on existing KY 344 near MP 16.50 south of Kinniconick and the KY 344/KY 59 intersection. This alternative bypasses all substandard horizontal curvature south of the KY 344/KY 59 intersection (ALT 5A), and follows existing KY 59 (ALT 5A-2) alignment to the southern branch of Clarksburg Branch Road at MP 19.50. It then follows the existing alignment (ALTS 5C-1 and 5C-2) to MP 23.00 just north of the KY 59/KY 9 intersection.

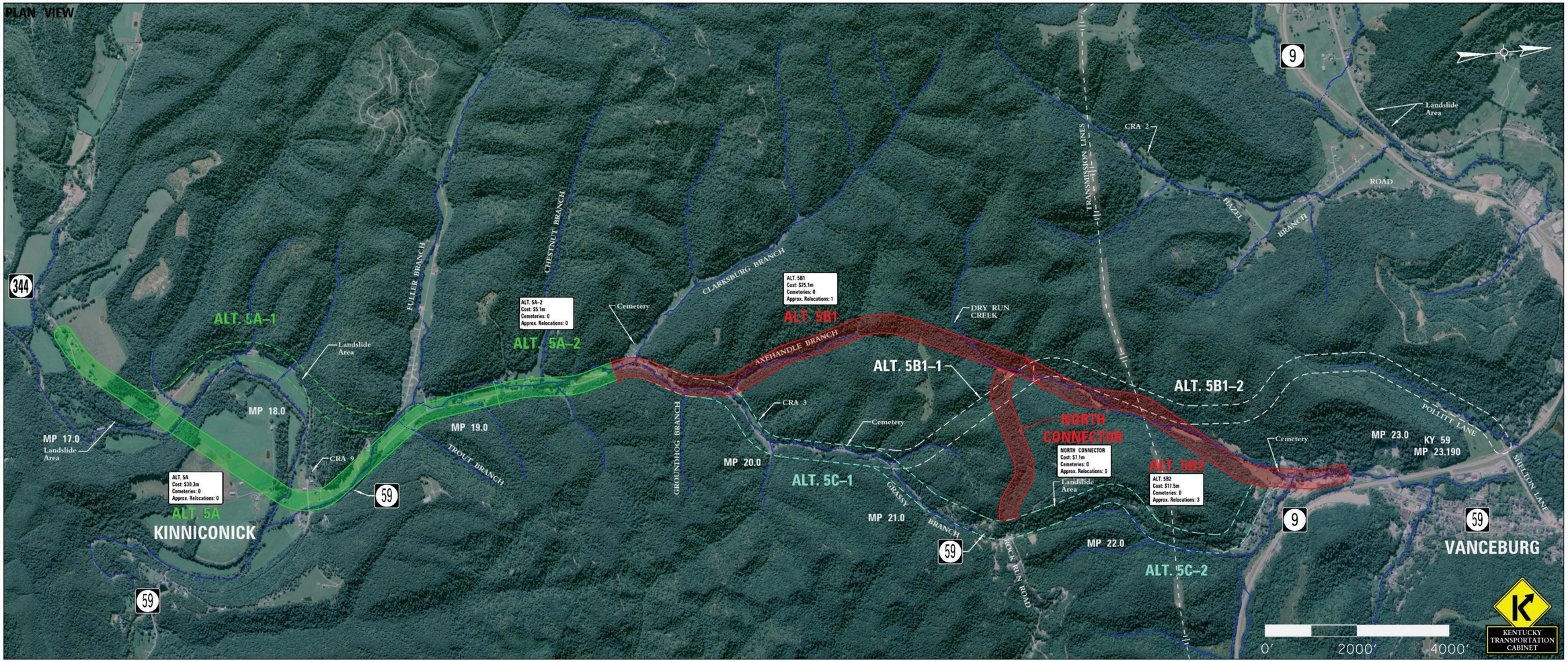
Alternative 5C was studied in detail to gain an understanding of how improvements to existing KY 59 could be implemented. This portion of the corridor has 4 high-crash locations, 12 vertical and 44 horizontal deficiencies, has recurring maintenance issues and was identified by local officials, the public, and KYTC as this corridor's number one priority.

Any improvements to existing KY 59 along Vanceburg Hill requires matching existing grades, and may require a lesser design speed in order to maintain traffic on existing KY 59. One KYTC concern was advancing alternatives avoiding this area would leave the substandard road and its pre-existing issues in place. If this were to be done, KYTC would likely be required to maintain both the old and new KY 59 in the future, unless large sections of the existing road could be removed from service.

ALTERNATIVE 5B (ALTS 5A, 5A–2, 5B1, 5B2, and North Connector)

TOTAL ESTIMATED COST: $85,100,000

PLAN VIEW



TYPICAL SECTIONS

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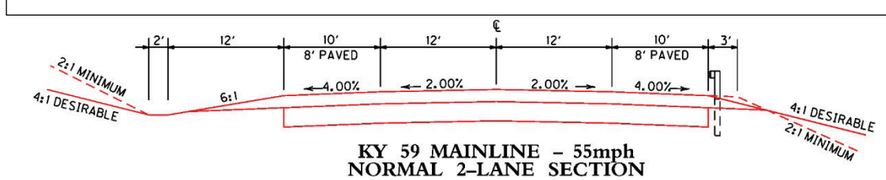
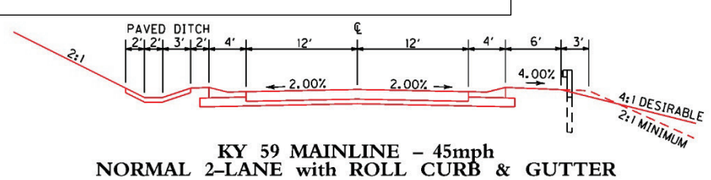


KY 59 MAINLINE – 55mph
NORMAL 2–LANE SECTION



KY 59 MAINLINE – 45mph
NORMAL 2–LANE with ROLL CURB & GUTTER

KENTUCKY DEPARTMENT OF HIGHWAYS

KY 59/KY 344/KY 377
PLANNING STUDY
SECTION 5 – KY 344 to KY 9

PREPARED BY

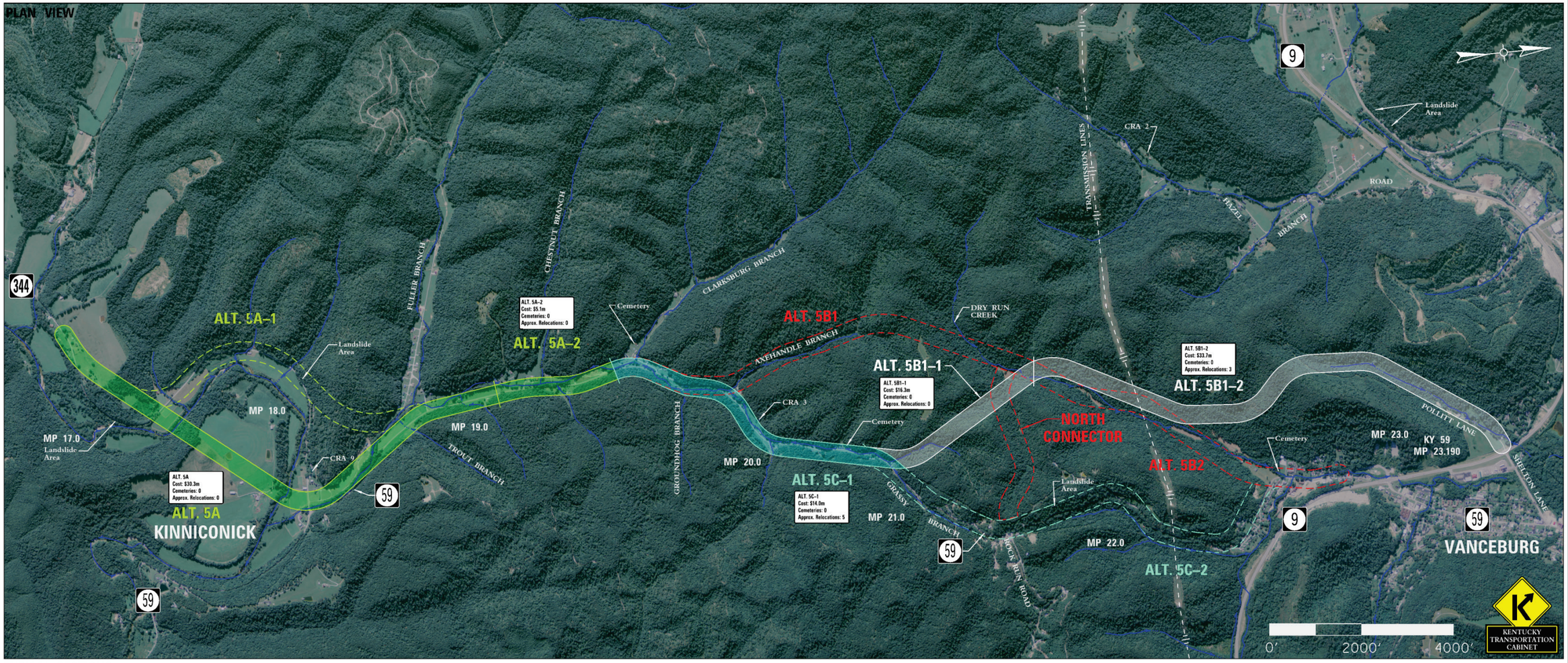
LEWIS COUNTY

Figure 33: Alternative 5B (ALTS 5A, 5A-2, 5B1, 5B2, and North Connector)

ALTERNATIVE 5B–1 (ALTS 5A, 5A–2, 5C–1, 5B1–1, and 5B1–2)

TOTAL ESTIMATED COST: $99,380,000

PLAN VIEW



TYPICAL SECTIONS

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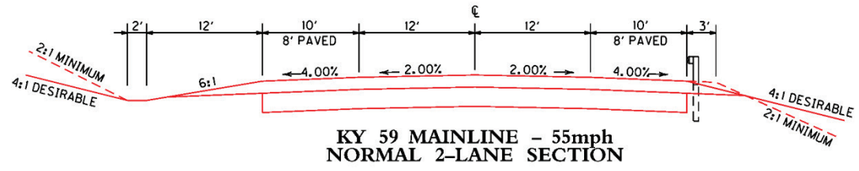
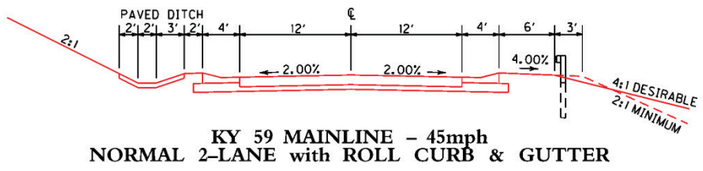


KY 59 MAINLINE – 55mph
NORMAL 2–LANE SECTION



KY 59 MAINLINE – 45mph
NORMAL 2–LANE with ROLL CURB & GUTTER

Figure 34: Alternative 5B-1 (ALTS 5A, 5A-2, 5C-1, 5B1-1 and 5B1-2)

KENTUCKY DEPARTMENT OF HIGHWAYS

KY 59/KY 344/KY 377
PLANNING STUDY
SECTION 5 – KY 344 to KY 9

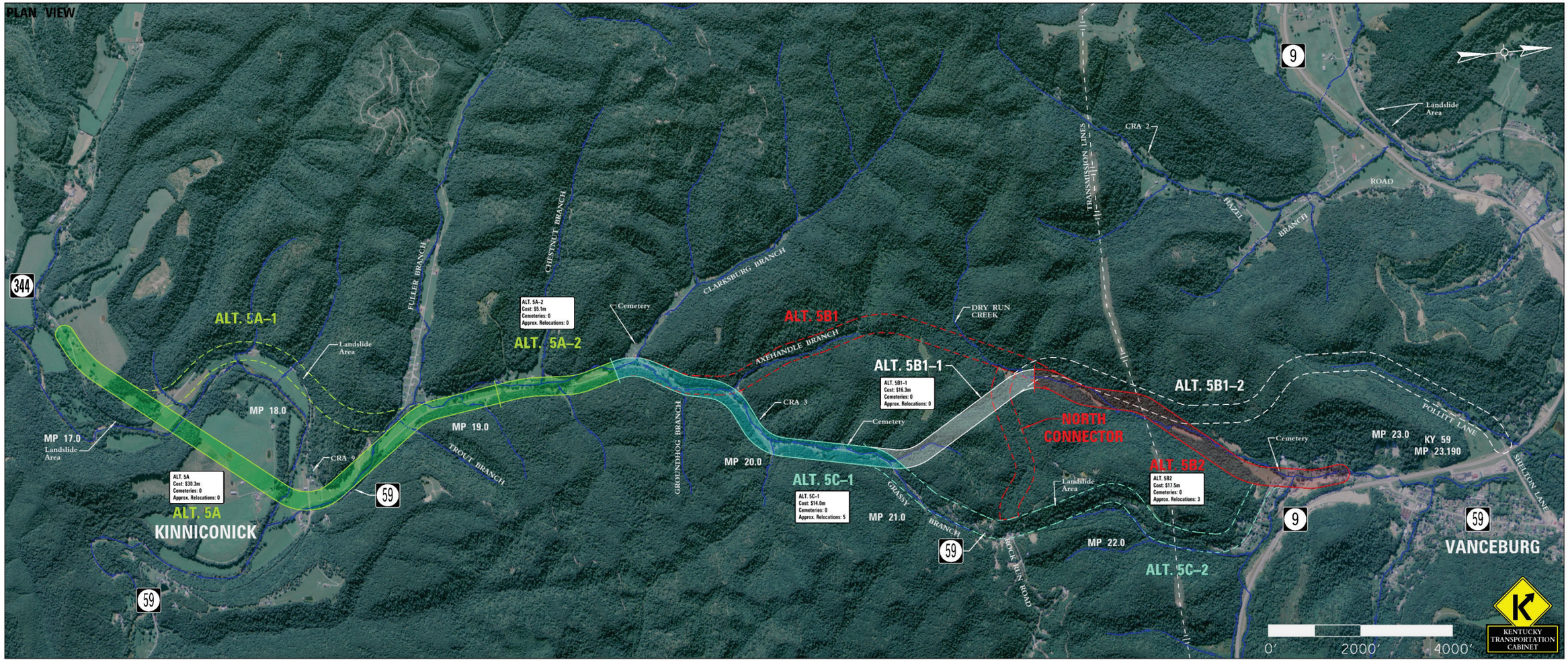
PREPARED BY

LEWIS COUNTY

ALTERNATIVE 5C + 5B1–1 (ALTS 5A, 5A–2, 5C–1, 5B1–1, and 5B2)

TOTAL ESTIMATED COST: $83,240,000

PLAN VIEW



TYPICAL SECTIONS

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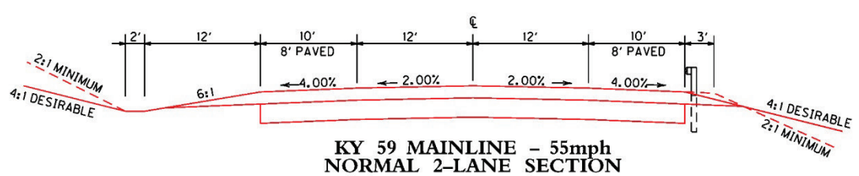
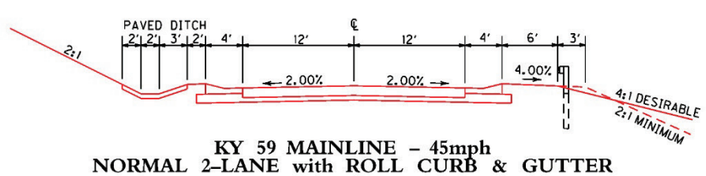


KY 59 MAINLINE – 55mph
NORMAL 2–LANE SECTION



KY 59 MAINLINE – 45mph
NORMAL 2–LANE with ROLL CURB & GUTTER

Figure 35: Alternative 5C + 5B1-1 (ALTS 5A, 5A-2, 5C-1, 5B1-1 and 5B2)

KENTUCKY DEPARTMENT OF HIGHWAYS

KY 59/KY 344/KY 377
PLANNING STUDY
SECTION 5 – KY 344 to KY 9

PREPARED BY

LEWIS COUNTY

Therefore, Alternative 5C reflects rebuilding existing KY 59 along the existing corridor. This alternative utilizes a 45 mph design speed from Rock Run Road north to approximately MP 23.00, and provides truck climbing lanes in both directions. This alternative would provide access to existing properties along KY 59 and reduce, if not eliminate, additional mileage to be maintained **(Figure 36, p. 82)**.

Table 24 shows various Alternative 5C typical sections examined and their corresponding reduction in estimated construction costs. The estimated construction cost savings, ranging from $0.2 million to $2.3 million, were relatively small compared to the priority corridor total costs. Alternative 5C with a 10-foot-wide clear zone was carried forward.

Table 24: Reduced Design Criteria Considered for Alternative 5C

DESIGN CRITERIA	REDUCTION IN CONSTRUCTION COST FROM 55 MPH 16-FOOT WIDE CLEAR ZONE TEMPLATE
Rural/Urban typical section with rolled curb, truck climbing lanes and a clear zone of 10 feet	$600,000
Rural/Urban typical with rolled curb, passing lanes, and a clear zone of 10 feet	$2,300,000
Rural typical with truck climbing lanes and a clear zone of 22 feet	$200,000
Rural typical with passing lanes with a clear zone of 22 feet	$1,300,000

For cost estimating and impact purposes, the shoulder width was reduced to four feet through truck climbing and passing lane areas. Options for typical sections at the Vanceburg tie-in include providing curb and gutter north to KY 9 or the utilization of the existing rural typical section. There are additional typical section options that will be determined during Phase I Design that may reduce earthwork and improve safety.

Due to the presence of truck climbing lanes, left- and right-turn lanes should be considered at Rock Run Road even though they may not meet warrants.

Alternative 5C is 5.9 miles in length and has an estimated total cost of $74.8 million.

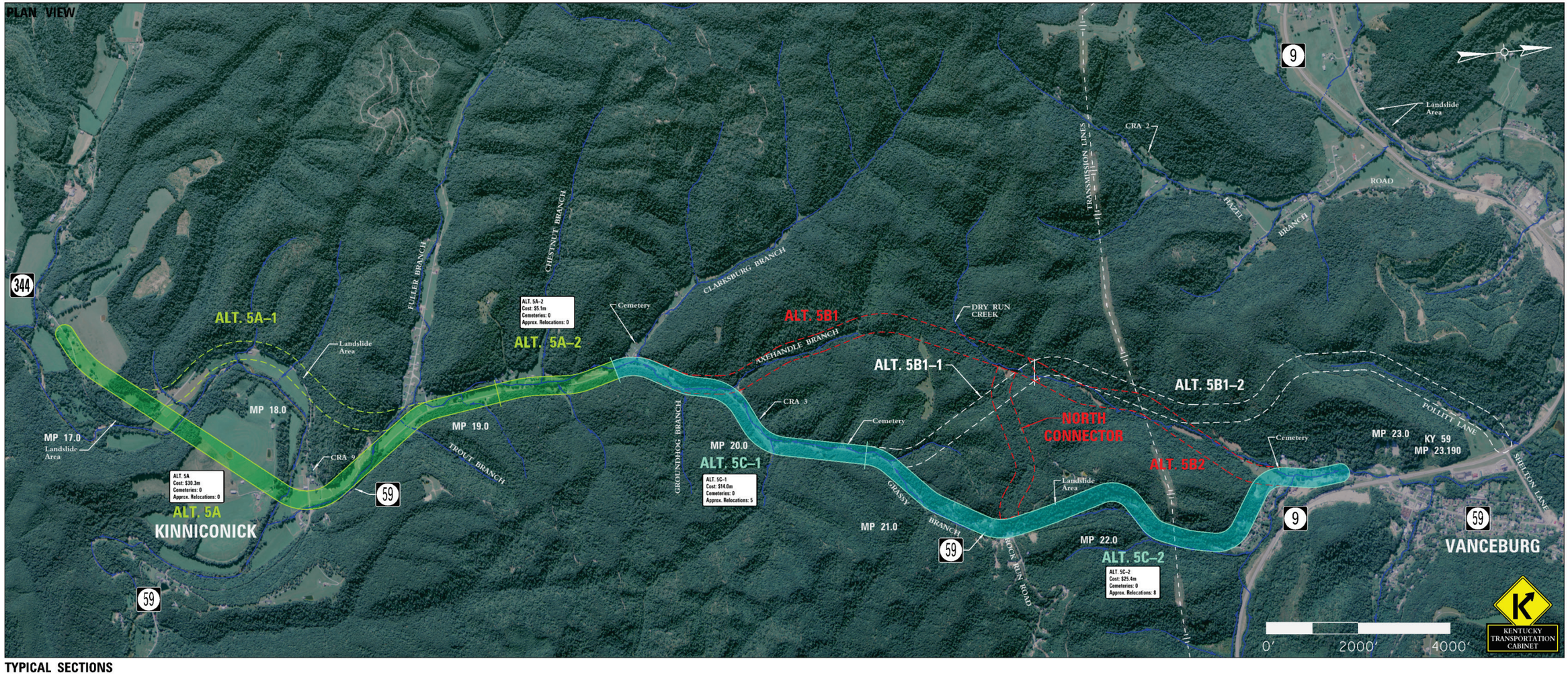
Again, it is important to note that each alternative in Section 5 was segmented (ALTS) into buildable construction segments (for example 5A, 5A-2, 5C-1, and 5C-2).

All Section 5 alternatives and potential impacts are shown in **Figure 37 (p. 83)**.

ALTERNATIVE 5C (ALTS 5A, 5A–2, 5C–1, and 5C–2)

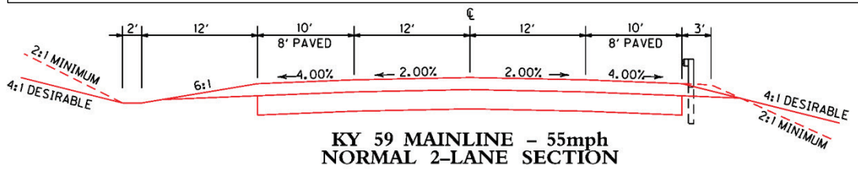
TOTAL ESTIMATED COST: $74,800,000

PLAN VIEW

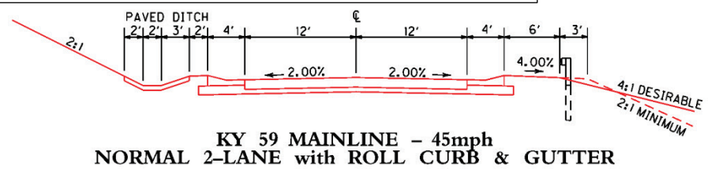


TYPICAL SECTIONS

Although shoulders are shown with full-depth pavement structure, only roadway sections that utilize the shoulders for maintenance of traffic during construction will be such. All other sections will have conventional shoulder structures.



KY 59 MAINLINE – 55mph
NORMAL 2–LANE SECTION



KY 59 MAINLINE – 45mph
NORMAL 2–LANE with ROLL CURB & GUTTER

KENTUCKY DEPARTMENT OF HIGHWAYS

KY 59/KY 344/KY 377
PLANNING STUDY
SECTION 5 – KY 344 to KY 9

PREPARED BY

LEWIS COUNTY

Figure 36: Alternative 5C (ALTS 5A, 5A-2, 5C-1 and 5C-2)

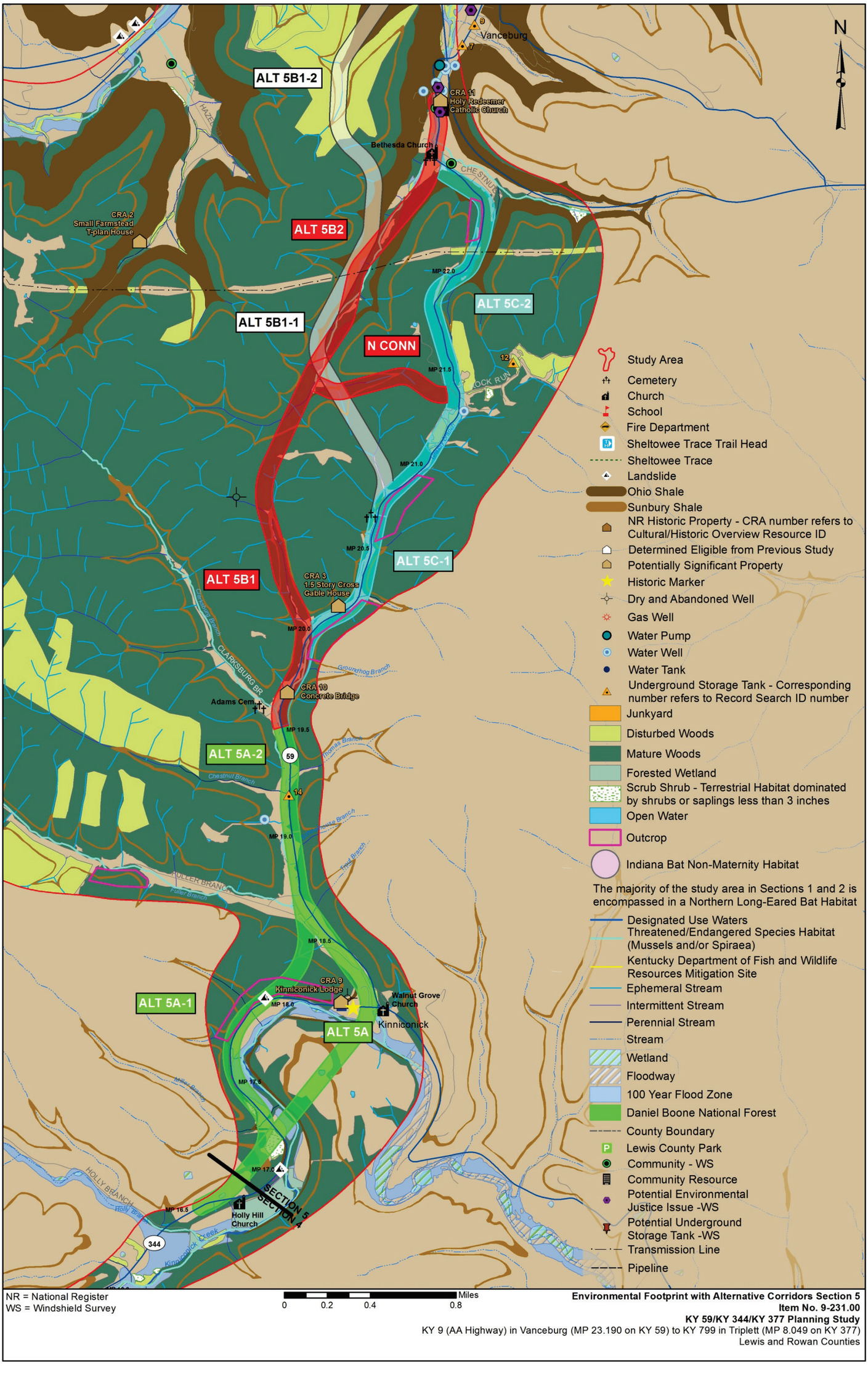


Figure 37: Section 5 Environmental Footprint with Alternatives

Environmental Footprint with Alternative Corridors Section 5
Item No. 9-231.00
KY 59/KY 344/KY 377 Planning Study
KY 9 (AA Highway) in Vanceburg (MP 23.190 on KY 59) to KY 799 in Triplett (MP 8.049 on KY 377)
Lewis and Rowan Counties

2. Spot Improvements

Three 45 mph spot improvements were identified in Section 5 **(Figure 25, p. 61)**:

a) **Spot Improvement 1–Vanceburg Hill**

KYTC requested a special focus on fixing high maintenance areas. If a new alignment along Vanceburg Hill is advanced, options to improve existing KY 59 should be considered, even if it is a separate project. Spot Improvement 1 addresses KY 59 between MP 20.60 and 22.10 with curb and gutter, passing lanes, and a 45 mph design speed. It would address the approach to two 0.1-mile high-crash locations, 21 horizontal and 4 vertical curve deficiencies, shoulder failures, and locations with recurring maintenance issues due to slope stability issues. KYTC maintenance crews clean areas of KY 59 where the cut slopes are falling into the roadway and/or this is shoulder instability **(Location 1, Table 4, p. 9)**. This spot improvement is identified as Vanceburg Hill Spot Improvement 1 and is 1.54 miles in length with an estimated cost of $21.6 million.

b) **Spot Improvement 2–Leslie Street/Chestnut Street**

Spot Improvement 2 addresses KY 59 between MP 22.30 and 22.80 with curb and gutter and a 45 mph design speed. This spot improvement would address 5 horizontal curve deficiencies, shoulder failures, and continues to address the recurring maintenance issues (slope/shoulder stability) identified in Spot Improvement 1 **(Location 1, Table 4, p. 9)**. This spot improvement is identified as Leslie Street/Chestnut Street. Spot Improvement 2 is approximately 0.55 mile length with a total estimated cost of $6.3 million.

c) **Spot Improvement 3–Fuller Branch**

Spot Improvement 3 addresses KY 59 between MP 18.60 and 19.00 near Fuller Branch Road. This section has a 45 mph design speed and a rural cross-section. The need for this spot improvement was identified from public feedback. Currently, a mirror is in place on KY 59 across from Fuller Branch Road as a countermeasure in an attempt to address inadequate vertical sight distance. Spot Improvement 3 is approximately 0.4 mile in length and has a total estimated cost of $2.5 million.

d) **Spot Improvement 4–KY 59/KY 344 Intersection**

Spot Improvement 4 from MP 18.00 (KY 344) to MP 18.60 (KY 59) improves the KY 59/KY 344 three-legged intersection to provide a continuous flow movement from KY 344 (Morehead) to the north leg of KY 59 (Vanceburg). KY 59 to and from Olive Hill would be stop controlled. Tractor trailers traveling south on KY 59 turning west onto KY 344 have hit the bridge railing numerous times because the bridge is narrow and close to the intersection. This improvement requires two bridges and extensive excavation. However, one bridge may be addressed by a new bridge replacement project that has been submitted by KYTC. This spot improvement also addresses a recurring maintenance issue near the Kinniconick Hotel at Kinniconick Creek **(Location 2, Table 4, p. 9)**. Spot Improvement 4 is 0.56 mile in length and has an estimated cost of $17.7 million.

XVI. Cost Estimates

Cost estimates for each spot improvement and potential impacts are shown in **Table 23 (p. 63)**. These meet 45 mph design criteria and total $99.4 million. **Tables 26–27 (pp. 86–87)** summarize major elements and provide a cost breakdown for all alternatives to be carried forward. The total reconstruction cost estimate to improve the entire corridor to 55 mph design criteria, except along Vanceburg Hill, ranges from $226 to $284 million.

XVII. 2040 Build Traffic Operations

A. Mainline

Utilizing projected volumes developed for design year 2040 from Chapter VI, projected capacity analysis for one build alternative for each route (KY 377, KY 344, and KY 59). This approach is conservative recognizing alternatives on new alignment would operate better due to some percentage of traffic remaining on the existing road. Due to the vertical grades, Build traffic operations for truck climbing lanes on Vanceburg Hill only are also included.

Even though 2040 No-Build and Build Traffic are the same, the average travel speed improves for KY 344, KY 59, and Vanceburg Hill. In addition, KY 344 improves to LOS B over the No-Build Alternative due to wider lanes, shoulders, and more passing opportunities. 2040 No-Build Traffic Operations were shown in **Table 11 (p. 27)**. The resulting LOS for 2040 Build Traffic Operations are shown in **Table 25**.

Utilizing current year traffic, the corridor does not meet warrants for truck climbing lanes; however, in the design year 2040 forecasted traffic volumes on Vanceburg Hill show truck climbing lanes meet minimum volume warrants for a truck climbing lane **(Table 11, p. 27)**. There are 200 upgrade cars in the peak direction in the AM and 260 in the PM. The minimum warrant is 20 trucks. A truck percentage of 11% translates to 22 trucks in the AM and 29 trucks in the PM. Also, one of the following three criteria would need to be met:

1)A 10 mph or greater speed reduction for a heavy truck (very possible, not observed).

2)LOS E or F on the grade (met).

3)A reduction of two or more levels of service when moving from the approach segment to the grade.

Table 25: 2040 Mainline Build Traffic Operations

Descriptions					2040 Build							
					AM				PM			
Route	Beginning MP Desc	Beginning MP	Ending MP Desc	Ending MP	LOS	PTSF	ATS (mph)	v/c Ratio	LOS	PTSF	ATS (Mph)	v/c Ratio
KY 377	KY 799 East	Rowan 8.049	KY 344	Lewis 8.555	C	56.4	49.8	0.16	C	55.0	49.5	0.15
KY 344	KY 377	13.843	KY 59	18.516	B	39.9	54.1	0.07	B	37.3	53.7	0.07
KY 59*	KY 344	18.093	KY 9	23.190	C	50.6	49.8	.19	C	53.5	49.0	0.23
KY 59**	Rock Run Rd	21.389	Near Moore St	22.679	C	32.9	49.2	.41	D	41.8	41.9	0.66

*KY 59 segment from KY 9 to KY 344 with truck climbing lane on Vanceburg Hill **Vanceburg Hill segment only with truck climbing lane

Table 26: Remaining Alternative (Segments)

REMAINING ALTS (OUTSIDE OF STUDY AREA)

ALTS	Length	Design	Right of Way			Utilities	Environmental		Construction		Construction Cost per Mile	Maintenance Cost for Existing Road When on New Alignment	Total Cost	Total Cost per Mile	Horiz & Vert. Deficiencies	Crash Spots	Public Sentiment (ALTs 1-3 scale) Spots (1-6 scale) Arithmetic Mean	Structurally Deficient Bridges or Culverts	Functionally Obsolete Bridges or Culverts	Farms	DBNF Property	KYTC Mitigation Site	Historic Properties Affected	Flooding	KYTC Recurring Maintenance Locations	Shoulder or Slope Instability or Failures	Brought up at First Public Meeting
			Approx Relocations	Approx. R/W Acquired	R/W Cost	Utility Costs	Blue Line Stream Impacts	Environmental In-Lieu Fees	Earthwork	Estimated Construction Cost																	
	Miles	$	#	Acres	$	$	Linear Feet	$	CY	$	$	$	$	$	#	#		#	#	#	Acres	lf	#				
ALT 3D-1	2.55	$2,600,000	1	97	$400,000	$800,000	3,432	$4,900,000	6,300,000	$37,600,000	$14,800,000	$5,260,000	$51,560,000	$20,300,000	1	0	1.69 Some Liked due to flooding on old road, ease of construction and getting trucks off "local road"	0	0	1	38	0	0				X
ALT 3D-2	1.53	$1,500,000	0	36	$200,000	$300,000	1,416	1,400,000	400,000	$6,000,000	$3,900,000	$5,780,000	$15,180,000	$9,900,000	0	0	1.69 Some Liked due to flooding on old road, ease of construction and getting trucks off "local road"	0	0	1	0	NO DATA	NO DATA				X
ALT 3D-3	3.48	$3,500,000	2	77	$500,000	$9,700,000	3,230	$3,100,000	650,000	$12,700,000	$3,700,000	$8,020,000	$37,520,000	$10,800,000	0	0	1.69 Some Liked due to flooding on old road, ease of construction and getting trucks off "local road"	0	0	2	0	NO DATA	NO DATA				X
ALT 3D-4	0.65	$800,000	0	19	$100,000	$600,000	1,357	$1,400,000	925,000	$10,100,000	$15,600,000	$2,420,000	$15,420,000	$23,900,000	0	0	1.69 Some Liked due to flooding on old road, ease of construction and getting trucks off "local road"	0	0	2	0	0	0				X

REMAINING ALTS (ORIGINAL STUDY AREA)

ALTS	Length	Design	Right of Way			Utilities	Environmental		Construction		Construction Cost per Mile	Maintenance Cost for Existing Road When on New Alignment	Total Cost	Total Cost per Mile	Horiz & Vert. Deficiencies	Crash Spots	Public Sentiment (ALTs 1-3 scale) Spots (1-6 scale) Arithmetic Mean	Structurally Deficient Bridges or Culverts	Functionally Obsolete Bridges or Culverts	# Farms	DBNF Property	KYTC Mitigation Site	Historic Properties Affected	Flooding	KYTC Recurring Maintenance Locations	Shoulder or Slope Instability or Failures	Brought up at First Public Meeting
			Approx Relocations	Approx. R/W Acquired	R/W Cost	Utility Costs	Blue Line Stream Impacts	Environmental In-Lieu Fees	Earthwork	Estimated Construction Cost																	
	Miles	$	#	Acres	$	$	Lin Feet	$	CY	$	$	$	$	$	#	#		#	#	#	acres	ft	#				
ALT 1A	4.45	$4,400,000	21	50	$3,800,000	$300,000	3,478	$2,100,000	321,641	$13,900,000	$3,100,000	$0	$24,500,000	$5,500,000	0	2	2.33	0	1	0	0	0	0			X	X - CRASHES BETWEEN ELKLICK ROAD AND BROOKSIDE DRIVE
ALT 1B	4.45	$4,400,000	28	50	$4,300,000	$300,000	3,478	$2,100,000	236,899	$13,700,000	$3,100,000	$0	$24,800,000	$5,600,000	0	2	2.43	0	1	0	0	0	0			X	X - CRASHES BETWEEN ELKLICK ROAD AND BROOKSIDE DRIVE
ALT 2A	1.17	$1,200,000	7	23	$1,100,000	$100,000	250	$400,000	53,557	$3,400,000	$2,900,000	$0	$6,200,000	$5,300,000	7	0	2.36	0	1	0	0	0	1			X	
ALT 2B	1.17	$1,200,000	7	23	$1,100,000	$100,000	250	$400,000	43,698	$3,500,000	$3,000,000	$0	$6,300,000	$5,400,000	7	0	2.54	0	0	0	0	0	1			X	
ALT 3A-1a	0.85	$900,000	3	12	$109,000	$100,000	460	$500,000	45,911	$3,100,000	$3,600,000	$0	$4,709,000	$5,500,000	2	0	2.08	0	1	0	0	0	1				X - SPECIFICALLY THE COUNTY LINE
ALT 3A-1b	1.49	$1,500,000	0	84	$191,000	$400,000	5,918	$3,200,000	1,686,037	$20,200,000	$13,600,000	$2,800,000	$28,291,000	$19,000,000	2	0	2.08	0	0	1	0	0	0			X	X - SPECIFICALLY THE COUNTY LINE
ALT 3A-2	6.38	$6,300,000	14	121	$2,700,000	$3,700,000	8,177	$6,100,000	1,591,760	$33,000,000	$5,200,000	$0	$51,800,000	$8,100,000	33	0	2.08	0	1	18	0	0	2	X	X	X	X
ALT 3B-1a	0.85	$900,000	4	16	$700,000	$100,000	1,260	$900,000	44,570	$3,200,000	$3,800,000	$0	$5,800,000	$6,800,000	2	0	2.15	0	1	0	0	0	1				X - SPECIFICALLY THE COUNTY LINE
ALT 3B-1b	0.75	$800,000	2	36	$500,000	$200,000	1,709	$1,200,000	911,165	$9,600,000	$12,800,000	$400,000	$12,700,000	$16,900,000	3	0	2.15	0	0	0	6	0	7			X	X - SPECIFICALLY THE COUNTY LINE
ALT 3B-2	7.22	$7,100,000	5	52	$1,000,000	$10,000,000	15,155	$11,500,000	3,892,488	$49,200,000	$6,800,000	$14,420,000	$93,220,000	$12,900,000	10	0	2.15	0	0	15	1	0	5		X	X	
ALT 4A	3.55	$3,600,000	2	114	$700,000	$600,000	4,150	$3,700,000	2,611,344	$25,600,000	$7,200,000	$2,300,000	$36,500,000	$10,300,000	21	1	2.00	0	0	10	0	180	0	X	X	X	
ALT 4B	3.52	$3,500,000	1	105	$600,000	$600,000	4,046	$3,600,000	2,439,765	$27,200,000	$7,700,000	$5,800,000	$41,300,000	$11,700,000	8	1	1.83	0	0	7	0	180	0	X	X	X	X
ALT 5A	2.18	$2,300,000	0	63	$300,000	$500,000	1,866	$2,000,000	2,203,000	$21,000,000	$9,600,000	$4,200,000	$30,300,000	$13,900,000	3	0		0	0	8	0	0	0				
ALT 5B1	1.82	$1,800,000	1	69	$800,000	$400,000	8,387	$2,400,000	2,222,962	$15,500,000	$8,500,000	$4,200,000	$25,100,000	$13,800,000	3	0	2.00	0	0	3	0	0	2				
ALT 5B2	1.40	$1,500,000	3	46	$600,000	$200,000	3,889	$3,500,000	580,000	$9,600,000	$6,900,000	$2,140,000	$17,540,000	$12,500,000	2	2	2.00	0	0	0	0	0	0				
ALT 5B1-1	0.81	$900,000	0	28	$100,000	$200,000	1,354	$1,000,000	1,386,572	$12,300,000	$15,200,000	$1,800,000	$16,300,000	$20,100,000	0	0	1.87	0	0	2	0	0	0				
ALT 5B1-2	2.17	$2,300,000	3	108	$900,000	$400,000	10,472	$7,300,000	3,052,393	$20,000,000	$9,200,000	$2,780,000	$33,680,000	$15,500,000	0	0	1.87	0	0	1	0	0	0				
ALT 5C-1	1.15	$1,200,000	5	43	$1,000,000	$200,000	2,338	$2,300,000	746,865	$9,300,000	$8,100,000	$0	$14,000,000	$12,200,000	9	0	2.36	0	0	4	0	0	1		X	X	X - INTERSECTION OF ROCK RUN ROAD & KY 59 AT TIRE STORE
ALT 5C-2	2.07	$2,100,000	8	66	$1,600,000	$1,300,000	3,898	$3,800,000	1,765,557	$16,200,000	$7,800,000	$400,000	$25,400,000	$12,200,000	31	2	2.36	0	0	3	0	0	2		X	X	X - KY 9 INTERSECTION
North Connector	0.73	$800,000	0	24	$200,000	$100,000	2,970	$1,500,000	358,351	$4,500,000	$6,200,000	$0	$7,100,000	$9,700,000	0	0	2.00	0	0	2	0	0	0				

Table 27: Remaining Alternative Combinations

REMAINING ALTS (OUTSIDE OF STUDY AREA)

	Length	Design	Right of Way			Utilities	Environmental		Construction		Construction Cost per Mile	Cost for Existing Road When on New Alignment	Total Cost o	Total Cost per Mile	Horiz & Vert. Deficiencies	Crash Spots	Public Sentiment (ALTs 1-3 scale) Spots (1-6 scale) Arithmetic Mean	Structurally Deficient Bridges or Culverts	Functionally Obsolete Bridges or Culverts	# of Farms	DBNF Property	KYTC Mitigation Site	Historic Properties Affected	Flooding	KYTC Recurring Maintenace Locations	Shoulder/ Slope Instability/ Failures	Brought up at First Public Meeting
			Approx Relocations	Approx. R/W Acquired	R/W Cost	Utility Costs	Blue Line Stream Impacts	Environmental In-Lieu Fees	Earthwork	Estimated Construction Cost																	
	Miles	$	#	Acres	$	$	Lin Feet	$	CY	$	$	$	$	$	#	#					acres	ft	#				
ALT 3D-1 +3D-2 + 3D-3 + 3D-4	8.19	$8,400,000	3	229	$1,200,000	$11,400,000	$9,435	$10,800,000	8,275,000	$66,400,000	$8,100,000	$21,480,000	$119,680,000	$14,600,000	0	0	1.69	0	0	6	38	0	Not available		X	0	X-RECOMMENDED BY LOCAL OFFICIALS AND SOME MEMBERS OF THE PUBLIC, AND MENTIONED ON SURVEY

REMAINING ALTS (ORIGINAL STUDY AREA)

ALTS	Length	Design	Right of Way			Utilities	Environmental		Construction		Construction Cost per Mile	Maintenance Cost for Existing Road When on New	Total Cost	Total Cost per Mile	Horiz & Vert. Deficiencies	Crash Spots	Public Sentiment (ALTs 1-3 scale) Spots (1-6 scale) Arithmetic Mean	Structurally Deficient Bridges or Culverts	Functionally Obsolete Bridges or Culverts	# of Farms	DBNF Property	KYTC Mitigation Site	Historic Properties Affected	Flooding	KYTC Recurring Maintenace Locations	Shoulder/ Slope Instability/ Failures	Brought up at First Public Meeting
			Approx Relocations	Approx. R/W Acquired	R/W Cost	Utility Costs	Blue Line Stream Impacts	Environmental In-Lieu Fees	Earthwork	Estimated Construction Cost																	
	Miles	$	#	Acres	$	$	Lin Feet	$	CY	$	$	$	$	$	#	#					acres	ft	#				
ALT 1A	4.45	$4,400,000	21	50	$3,800,000	$300,000	3,478	$2,100,000	321,641	$13,900,000	$3,100,000	$0	$24,500,000	$5,500,000	0	2	2.33	0	1	0	0	0	0			X	X - CRASHES BETWEEN ELKLICK ROAD AND BROOKSIDE DRIVE
ALT 1B	4.45	$4,400,000	28	50	$4,300,000	$300,000	3,478	$2,100,000	236,899	$13,700,000	$3,100,000	$0	$24,800,000	$5,600,000	0	2	2.43	0	1	0	0	0	0			X	X - CRASHES BETWEEN ELKLICK ROAD AND BROOKSIDE DRIVE
ALT 2A	1.17	$1,200,000	7	23	$1,100,000	$100,000	250	$400,000	53,557	$3,400,000	$2,900,000	$0	$6,200,000	$5,300,000	7	0	2.36	0	1	0	0	0	1			X	
ALT 2B	1.17	$1,200,000	7	23	$1,100,000	$100,000	250	$400,000	43,698	$3,500,000	$3,000,000	$0	$6,300,000	$5,400,000	7	0	2.54	0	0	0	0	0	1			X	
ALT 3A	8.72	$8,700,000	17	217	$3,000,000	$4,200,000	14,555	$9,800,000	3,323,708	$56,300,000	$6,500,000	$2,800,000	$84,800,000	$9,700,000	37	0	2.08	0	2	19	0	0	3	X	X	X	X - SPECIFICALLY THE COUNTY LINE
ALT 3B	8.82	$8,800,000	11	104	$2,200,000	$10,300,000	18,124	$13,600,000	4,848,223	$62,000,000	$7,000,000	$14,820,000	$111,720,000	$12,700,000	15	0	Some opposition - 2.05	0	1	15	7	0	13	X	X	X	X - SPECIFICALLY THE COUNTY LINE
ALT 4A	3.55	$3,600,000	2	114	$700,000	$600,000	4,150	$3,700,000	2,611,344	$25,600,000	$7,200,000	$2,300,000	$36,500,000	$10,300,000	21	1	2.00	0	0	10	0	180	0	X	X	X	X - SPECIFICALLY THE CURVE NORTHEAST OF KY 377/KY 344 INTERSECTION AND THE INTERSECTION ITSELF
ALT 4B	3.52	$3,500,000	1	105	$600,000	$600,000	4,046	$3,600,000	2,439,765	$27,200,000	$7,700,000	$5,800,000	$41,300,000	$11,700,000	8	1	1.83	0	0	7	0	180	0	X	X	X	X - SPECIFICALLY THE CURVE NORTHEAST OF KY 377/KY 344 INTERSECTION AND THE INTERSECTION ITSELF
Alternative 5B	5.90	$6,200,000	5	191	$2,000,000	$1,200,000	15,446	$9,300,000	5,213,662	$48,800,000	$8,300,000	$10,540,000	$78,040,000	$13,200,000	8	2	2.17	0	0	14	0	0	2		X		
Alternative 5B with North Connector	6.63	$7,000,000	5	215	$2,200,000	$1,300,000	18,416	$10,800,000	5,572,013	$53,300,000	$8,000,000	$10,540,000	$85,140,000	$12,800,000	8	2	2.00	0	0	16	0	0	2		X		
Alternative 5B-1	6.81	$7,300,000	9	255	$2,600,000	$1,400,000	17,334	14,000,000	7,596,530	$65,300,000	$9,600,000	$8,780,000	$99,380,000	$14,600,000	12	0	1.87	0	0	18	0	0	1		X		
Alternative 5C Rural/Urban with 10-foot Clear Zone and Truck Climbing Lane for Vanceburg Hill	5.90	$6,200,000	14	185	$3,200,000	$2,100,000	9,406	$9,500,000	4,923,122	$49,200,000	$8,300,000	$4,600,000	$74,800,000	$12,700,000	43	2	2.36	0	0	18	0	0	3		X	X	X - INTERSECTION OF ROCK RUN ROAD & KY 59 AT TIRE STORE
Alternative 5B + 5B1-1 (ALTS 5A + 5A-2 + 5C-1 + 5B1-1 + 5B2)	6.04	$6,500,000	9	193	$2,300,000	$1,200,000	10,751	$10,200,000	5124137.00	$54,900,000	$9,100,000	$8,140,000	$83,240,000	$13,800,000	14	2	2.00	0	0	17	0	0	1		X	X	X - INTERSECTION OF ROCK RUN ROAD & KY 59 AT TIRE STORE
Alternative 5B1 + 5B1-2 (ALTS 5A + 5A-2 + 5C-1 + 5B1 + 5B1-2)	6.67	$7,000,000	5	253	$2,300,000	$1,400,000	22,029	$13,100,000	7,686,055	$59,200,000	$8,900,000	$11,180,000	94180000	$14,100,000	6	0	Not gauged	0	0	15	0	0	2		X	X	
KY 59 FROM APPROXIMATELY MP 19.5 TO MP 23.0																										
5C-1 + 5B1-1 + 5B1-2	4.13	$4,400,000	8	179	$2,000,000	$800,000	14,164	$10,600,000	5,185,830	$41,600,000	$10,100,000	$4,580,000	$63,980,000	$15,500,000	9	0		0	0	7	0	0	1		X	X	
ALTS 5C-1 + 5C-2	3.22	$3,300,000	13	109	$2,600,000	$1,500,000	6,236	$6,100,000	2,512,422	$25,500,000	$7,900,000	$400,000	$39,400,000	$12,200,000	40	2		0	0	7	0	0	3		X	X	X - INTERSECTION OF ROCK RUN ROAD & KY 59 AT TIRE STORE
ALT 5B1 and 5B2 + North Connector	3.95	$4,100,000	4	139	$1,600,000	$700,000	15,246	$7,400,000	3,161,313	$29,600,000	$7,500,000	$6,340,000	$49,740,000	$12,600,000	5	2		0	0	5	0	0	2		X		
ALTS 5C-1 + 5B1-1 + 5B2	3.36	$3,600,000	8	117	$1,700,000	$600,000	7,581	$6,800,000	2713437.00	$31,200,000	$9,300,000	$3,940,000	$47,840,000	$14,200,000	11	2		0	0	6	0	0	1		X	X	
ALTS 5B1 + 5B2	3.22	$3,300,000	4	115	$1,400,000	$600,000	12,276	$5,900,000	2802962.00	$25,100,000	$7,800,000	$6,340,000	$42,640,000	$13,200,000	5	2		0	0	3	0	0	2		X		
VANCEBURG HILL (KY 59 FROM APPROXIMATELY MP 20.7 TO MP 23.0)																										
5B1-1 + 5B1-2	2.98	$3,200,000	3	136	$1,000,000	$600,000	11,826	$8,300,000	4,438,965	$32,300,000	$10,800,000	$4,580,000	$49,980,000	$16,800,000	0	0		0	0	3	0	0	0				
5C-2	2.07	$2,100,000	8	66	$1,600,000	$1,300,000	3,898	$3,800,000	1,765,557	$16,200,000	$7,800,000	$400,000	$25,400,000	$12,200,000	31	2		0	0	3	0	0	2		X	X	X - INTERSECTION OF ROCK RUN ROAD & KY 59 AT TIRE STORE
ALTS 5B1-1 + 5B2	2.21	$2,400,000	3	74	$700,000	$400,000	5,243	$4,500,000	1,966,572	$21,900,000	$9,900,000	$3,940,000	$33,840,000	$15,300,000	2	2		0	0	2	0	0	0				

B. Intersections

As with the mainline, one build scenario capacity analysis was performed for intersections. All other build alternatives should operate the same or better. The 2040 Build Intersection data is shown in **Table 28.**

At the northern terminus, both KY 59 approaches to KY 9 have a low LOS in the PM peak hour due to northbound left turns. However, the 95% queue for that movement is only 4 cars. If right-turn lanes are added to the KY 59 approaches, the LOS for the northbound left-turn movement would remain LOS F. Using projected turning volumes, the KY 9/Alternative 5C/KY 59 intersection would not meet signal warrants. Volumes, delays, and queues should be monitored for changes in traffic patterns or longer queues.

It should be noted that traffic counts were not conducted at other intersections along KY 9. If Alternative 5B-1 is advanced to design, this intersection should be analyzed for any intersection improvements that may be necessary. The remaining major intersections operate at LOS A or B.

Table 28: 2040 Build Intersection Traffic Operations

Intersection	Direction of Travel	2040 LOS AM		2040 LOS PM	
KY 377/KY 799	KY 377 SB	LT (To KY 799 East)	THRU (To KY 799 SB)	LT (To KY 799 East)	THRU (To KY 799 SB)
		A	A	A	A
	KY 799 WB	LT (To KY 377 S)	RT (To KY 377 N)	LT (To KY 377 S)	RT (To KY 377 N)
		B	B	A	A
KY 377/KY 344 and KY 344/KY 59	Both	A	A	A	A
KY 59/KY 9	KY 59 NB	LT (To KY 9W)	THRU/RT (To KY 59N/KY9E)	LT (To KY 9W)	THRU/RT (To KY 59N/KY 9E)
		C	C	F	D/B*
	KY 9	EB RT (To KY59S)	WB LT (To KY 59S)	EB RT (To KY59S)	WB LT (To KY 59S)
		A	A	A	A

XVIII. Project Team Meeting #1

Project Team Meeting #1 was held on May 5, 2015, to present existing conditions and review preliminary alternatives for the KY 59 priority section. At this meeting, four alternatives were presented (Alternatives 5A, 5B, 5C, and 5C EAST), three of which were off-alignment corridors leaving KY 59 substandard existing issues in place, with one along the existing corridor (Alternative 5C).

If an alternative on new alignment is advanced, KYTC would likely maintain both existing KY 59 and the new alignment. KYTC requested a more intense review of Alternative 5C (rebuilding KY 59 within the existing corridor), as following existing KY 59 would allow better access to businesses and residents while reducing, if not eliminating, the additional maintenance mileage. To minimize impacts, KYTC asked that the review utilize a lower design speed, guardrail, and spot slope stability improvements.

For alternatives on new alignment, a connection to existing KY 59 for local access was also requested. The Project Team also desired fixing areas of high maintenance; which included spot improvements along existing KY 59 as a separate project. These spot improvements could be implemented even if a new corridor was chosen for KY 59. Connectivity to existing KY 59 from Alternative 5B was also requested at this meeting.

Additional topics for consideration in future design phases were discussed:

- Consider a hybrid typical section (curb and gutter on one side and a shoulder on the other) through town.
- If needed, lane widths could be reduced to 11 feet.

Minutes of this initial Project Team meeting are located in **Appendix Q**.

XIX. Second Public Involvement Meetings

The second Local Officials/Stakeholders Meeting (including representatives from both counties) and Lewis County Public Meeting were held in November 2015. These meetings were held to present the Do-Nothing and Total Reconstruction alternatives, and Spot Improvements; and to gauge public input. There were 102 survey responses with three letters received following the meeting. Approximately 100 people attended the public meeting. Three options were available to select on the survey: Do-Nothing, Total Reconstruction, or Spot Improvements. The responses indicated 50% preferred Do-Nothing, followed by 34% Total Reconstruction, and 16% Spot Improvements. Of those that preferred Do-Nothing, 30% indicated an out-of-state residence, 37% indicated they were out of the study area, 23% indicated they lived in Lewis County, and 10% skipped the question regarding residence. Reasons given for selection of the Do-Nothing Alternative included property concerns, loss of flora and fauna and other habitat, the project was not worth the investment, and the current road is fine.

A specific question asked for additional comments related to the Reconstruction Alternatives and/or Spot Improvements in the continued development of the planning study. Preferences for improvement to the existing corridor, widening, the addition of passing lanes, and the reduction of steepness and curves were noted in 11 responses. There was not enough variance among comments about alternatives and spot improvements to give a clear indication of preference to move forward or eliminate from further consideration. The three letters received contained comments including one favoring the project, one opposing Alternative 3B and preferring Alternative 3D, and one opposing the project as not being financially feasible. Other comments noted expressed concern for wildlife and the environment, landslides, and Vanceburg's lack of development and growth. Minutes of the Local Officials/Stakeholders meetings and public meeting summaries are located in **Appendix M.**

XX. Alternatives Analysis: Build vs. No-Build/Do-Nothing

At Project Team Meeting #4, key issues were summarized; notable concerns such as recurring maintenance issues, flooding, horizontal and vertical deficiencies, shoulder failures, high-crash locations, and public input were reviewed; and alternatives (including ALT segments) advanced for additional consideration were identified and explained—all toward the purpose of determining recommendations, if any, to advance to the next project development phase.

Following discussion, it was determined alternatives development and screening were complete for this planning study, and all build alternatives remaining in each section would be viable improvements to move to the next project development phase along with the No-Build Alternative.

The purpose of this project is to improve safety, travel time, and regional connectivity from Vanceburg to Morehead, Kentucky, for access to medical, educational, and shopping destinations and to I-64 and KY 9. The No-Build Alternative indicates that no new major roadway improvements would occur and only future maintenance of KY 59, KY 344, and KY 377 would take place. In short, the No-Build Alternative does not meet the Purpose, Need, or Goals of the project.

Traffic Operations

Comparing the 2040 No-Build versus 2040 Build traffic operations **(Table 29)**, corridor travel time, average travel speeds, and percent time spent following (KY 59 and Vanceburg Hill only) improves with selection of the a Build Alternative. Although according to the travel demand model, future traffic is not expected to increase in the corridor, several public meeting attendees' commented that, if the corridor were to be improved, more people might choose to attend Morehead State University, and travel to Morehead to shop.

Table 29: No-Build (Do-Nothing) vs. Build Alternatives

Alternative	2040 Improved Average Travel Speed (mph)	2040 Improved Percent Time Spent Following	2040 Improved LOS No-Build vs. Build	2040 Improved Total Corridor Travel Time (minutes/vehicle)
Entire Corridor	4–10	KY 377/KY 344–0% KY 59–11.1%	E vs. C–KY 377 C vs. B–KY 344 C vs. C–KY 59	6
Vanceburg Hill Only	7–10	4.7%	E vs. C–Vanceburg Hill	1.6

Safety

Safety is also a major component of the Purpose and Need for the project. **Table 2 (p. 8)**, illustrates the number of horizontal and vertical deficiencies in the project corridor if it is signed for 55 mph and built to today's design criteria. By providing wider lanes, wider shoulders, improved ditches, and improved geometry whether 45 or 55 mph, safety for the traveling public will also be improved. According to the Highway Safety Manual, a significant crash reduction can be expected for the following two-lane improvements:

- Improving shoulder widths from 2 to 8 feet–range from 14% to 30% reduction in crashes for single vehicle run-off-the road and multiple-vehicle head-on, opposite-direction sideswipe, and same-direction sideswipe crashes.
- Improving lane widths from 9 feet to 12 feet–range from 50% reduction in crashes for single vehicle run-off-the road and multiple-vehicle head-on, opposite-direction sideswipe, and same-direction sideswipe crashes.

In addition, the following crash reduction is expected for KY 59 over Vanceburg Hill.

- For KY 59, the crash reduction expected for a truck climbing lane on Vanceburg Hill is estimated to be 45% for total crashes over the length of the short four-lane section.

Public Input

As shown in **Figure 38**, in response to the survey question (Public Meeting #2), "What would you like improved in the study corridor?" there were 100 responses that answered the question and 2 skipped the question. The responder had to choose between the Do-Nothing Alternative, Total Reconstruction Alternatives, or Spot Improvements. If Spot Improvements were

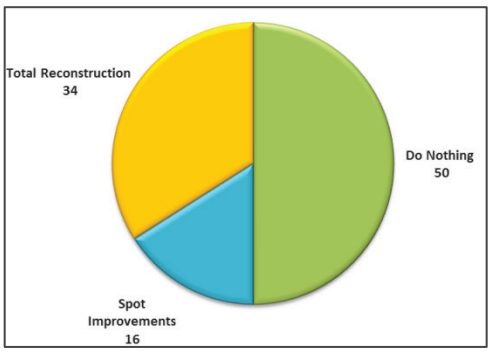


Figure 38: Public/Local Officials Meeting #2 Survey Responses

chosen, they were requested to specify their importance. From the 100 responses, 50 responded with Do-Nothing (50%), 34 responses indicated Total Reconstruction (34%) and 16 responses indicated Spot Improvements (16%).

Accessibility and Connectivity

Because this is the shortest route between Vanceburg and Morehead, an improved and safer route from KY 799 (Big Perry Road) north to KY 9, coupled with the improved corridor from KY 32 to KY 799 (Big Perry Road) will provide improved connectivity from Vanceburg to I-64 and to destinations in Morehead.

Cost

Due to terrain and existing deficiencies, total reconstruction of the corridor is likely to cost between $200 million and $300 million and does not come without impacts. The spot improvements range from $2.5 million to $21.6 million, all with varying degrees of benefits/impacts. These improvements are competing with many needs and diminishing funds to address those needs across Kentucky. Therefore, the No-Build Alternative should move forward to the next project development phase.

XXI. Recommendations

If Build Alternatives advance to the next project development phase, the Project Team agreed on priorities at Project Team Meeting #4 **(Appendix Q)**. It is assumed with each Build alternative that advances, cost savings modifications such as narrower lane widths, reduced slopes, or other practical solutions may be studied at that time. Priorities would be based on funding and design considerations. Each priority has options within each with at least one total reconstruction alternative and one spot improvement for consideration in the next phase of project development. The No-Build Alternative will be a consideration with each priority through to the next project development phase.

The benefits for total reconstruction are improved safety due to the number of horizontal and vertical deficiencies, wider lanes and shoulders, improved slopes, improved high-crash locations, improved KYTC maintenance costs, improved travel time, a truck climbing lane in both directions to help with speed differential and it was supported through public and local officials' input. The impacts are: cost, potential for residential and property impacts, and maintenance of traffic, and some public opposition (Public Meeting #2).

Spot improvements are less expensive and provide wider lanes and shoulders, 45 mph design speed, a narrower footprint, improved slopes, improved high-crash locations, improved KYTC maintenance costs, and were also supported by the public. The disadvantages of spot improvements are lack of an improved, consistent route from Morehead to Vanceburg due to 45 mph speeds and driver expectation.

A. Priority 1–Vanceburg Hill (near MP 19.50 to KY 9 AA Highway)–Section 5

As a section of independent utility, with logical termini, conduct Phase I design and NEPA documentation from KY 344 to KY 9 (AA Highway). The benefits for total reconstruction are improved safety due to the number of horizontal and vertical deficiencies, wider lanes and shoulders, improved slopes, improved high-crash locations, improved KYTC maintenance costs, improved travel time, a truck climbing lane in both directions to help with speed differential, and public and local officials' input. The impacts are: cost, potential for residential and property impacts, and maintenance of traffic, and some public opposition (Public Meeting #2).

At this time there is not enough information to make a recommendation for a preferred alternative, as each has benefits and impacts that should be studied in more detail. Given the project's rough

terrain, it is expected geotechnical findings will significantly impact all alternatives. The estimated costs of improvement alternatives/spots for Priority 1 range from $6.3 million to $64.0 million.

1) From MP 19.50 to MP 23.00
    - ALTS 5C-1, 5B1-1, and 5B1-2 ($64.0 million)
    - ALTS 5C-1 AND 5C-2 ($39.4 million)
    - ALTS 5B1, 5B2 and North Connector ($49.7 million)
    - ALTS 5C-1, 5B1-1, and 5B2 ($47.8 million)
    - ALTS 5B1 AND 5B2 ($42.6 million)
2) From MP 20.70 to MP 23.00
    - ALTS 5B1-1 and 5B1-2 ($50.0 million)
    - ALT 5C-2 ($25.4 million)
    - ALTS 5B1-1 and 5B2 ($33.8 million)
3) Spot improvements falling within Priority 1
    - Spot Improvement 1–Vanceburg Hill ($21.6 million)
    - Spot Improvement 2–Leslie Street/Chestnut Street ($6.3 million)

B. Priority 2–KY 59/KY 344 Intersection–Section 5

This priority replaces a structurally deficient bridge and realigns the intersection of KY 344 and KY 59 to meet one of the project goals for a continuous corridor between Vanceburg and Morehead. There are considerable slope/shoulder stability issues on KY 344 between MP 18.10 and MP 18.20. This section of roadway is adjacent to Kinniconick Creek and fronts the Kinniconick Hotel. There are also numerous horizontal and vertical deficiencies that each improvement would correct. The estimated costs for Priority 2 range from $2.5 million to $30.3 million:

- ALT 5A ($30.3 million)
- Spot improvements within Priority 2
    - Spot Improvement 3–Fuller Branch ($2.5 million)
    - Spot Improvement 4–KY 59/KY 344 intersection ($17.7 million)

C. Priority 3–5A-2–Section 5

ALT 5A-2 would complete Section 5 from south of KY 344 (approximately MP 16.50 to KY 9/AA Highway). ALT 5A-2 is a 0.50-mile section along existing KY 59 just north of the KY 344/KY 59intersection. It has 11-foot-wide lanes, generally 2-foot-wide shoulders, and one sag vertical curve that does not meet sight distance for 55 mph design criteria. The estimated cost for Priority 3 is $5.1 million, and the length is 0.50 mile.

- ALT 5A-2 ($5.1 million)

D. Priority 4–KY 344–Section 4

This section was chosen due to recurring slope/shoulder stability recurring maintenance issues (between MPs 14.30-14.40 and MPs 15.70-15.90), a high-crash spot location (MP 15.10-15.20), a flooding issue causing the route to be closed several times throughout the year, and horizontal and vertical deficiencies. The estimated cost of alternatives/spot improvements for Priority 4 range from $2.6 million to $41.3 million.

1) ALT 4A ($36.5 million)

2) ALT 4B ($41.3 million)
3) Spot improvements within Priority 4
    - Spot Improvement 5–Holly Branch ($11.0 million)
    - Spot Improvement 6–Area from south of Lewis County Park to the old Jack Esham Place ($2.6 million)
    - Spot Improvement 7–Thurman Curve ($7.7 million)
    - Spot Improvement 10–Briery Curve (could be in Section 3 or 4) ($4.6 million)

Tables 30–32 (p. 92–93) provide the estimated phase costs associated with the ALT (segments), spot improvements, and alternative combinations advanced for detailed study. The total costs include Maintenance and Environmental Fees In Lieu Of (FILO).

Sections 1, 2, and 3 are beyond foreseeable funding and are considered long-term projects outside potentially the design year. Section 3 has three alternatives and two spot improvements. Sections 1 and 2 each have two alternatives. Each alternative and spot improvement would be viable to move into the next phase of project development if funding were to become available.

Table 30: Priority Alternative Phase Cost Estimates

ALTS	Length (Miles)	Design	Right of Way	Utilities	Construction	Total Cost
Alt 4A	3.55	$3,600,000	$700,000	$600,000	$25,600,000	**$36,500,000**
Alt 4B	3.52	$3,500,000	$600,000	$600,000	$27,200,000	**$41,300,000**
Alt 5A	2.18	$2,300,000	$300,000	$500,000	$21,000,000	**$30,300,000**
Alt 5A-2	0.50	$600,000	$300,000	$100,000	$2,700,000	**$5,100,000**
Alt 5B1	1.82	$1,800,000	$800,000	$400,000	$15,500,000	**$25,100,000**
Alt 5B2	1.40	$1,500,000	$600,000	$200,000	$9,600,000	**$17,540,000**
Alt 5B1-1	0.81	$900,000	$100,000	$200,000	$12,300,000	**$16,300,000**
Alt 5B1-2	2.17	$2,300,000	$900,000	$400,000	$20,000,000	**$33,680,000**
Alt 5C-1	1.15	$1,200,000	$1,000,000	$200,000	$9,300,000	**$14,000,000**
Alt 5C-2	2.07	$2,100,000	$1,600,000	$1,300,000	$16,200,000	**$25,400,000**
North Connector	0.73	$800,000	$200,000	$100,000	$4,500,000	**$7,100,000**

NOTE: The Total Cost includes Environmental Fees In Lieu Of (FILO) and Maintenance Cost

Table 31: Priority Spot Improvements Phase Cost Estimates

Spots	Length (Miles)	Design	Right of Way	Utilities	Construction	Total Cost
Spot 1-Vanceburg Hill	1.54	$1,700,000	$500,000	$1,300,000	$16,200,000	**$21,600,000**
Spot 2-Leslie Street/Chestnut Street	0.55	$600,000	$1,100,000	$300,000	$3,400,000	**$6,300,000**
Spot 3-Fuller Branch	0.37	$500,000	$200,000	$100,000	$1,000,000	**$2,500,000**
Spot 4-KY 59/KY 344 Intersection	0.56	$600,000	$250,000	$300,000	$14,500,000	**$17,710,000**
Spot 5-Holly Branch	0.81	$900,000	$350,000	$200,000	$7,600,000	**$10,950,000**
Spot 6-Area from South of Lewis County park to the Old Jack Esham Place	0.43	$500,000	$50,000	$100,000	$1,300,000	**$2,550,000**
Spot 7-Thurman Curve	0.54	$600,000	$250,000	$200,000	$5,400,000	**$7,690,000**
Spot 10-Briery Curve	0.65	$800,000	$100,000	$100,000	$2,500,000	**$4,600,000**

NOTE: The Total Cost includes Environmental Fees In Lieu Of (FILO) and Maintenance Cost

Table 32: Build Alternatives Phase Cost Estimates

Build Alternatives Phase Cost Estimates

ALTERNATIVES	Length	Design	Right of Way	Utilities	Construction	Total Cost
	Miles	$	$	$	$	$
ALT 4A	3.55	$3,600,000	$700,000	$600,000	$25,600,000	**$36,500,000**
ALT 4B	3.52	$3,500,000	$600,000	$600,000	$27,200,000	**$41,300,000**
Alternative 5B	5.90	$6,200,000	$2,000,000	$1,200,000	$48,800,000	**$78,040,000**
Alternative 5B with North Connector	6.63	$7,000,000	$2,200,000	$1,300,000	$53,300,000	**$85,140,000**
Alternative 5B-1	6.81	$7,300,000	$2,600,000	$1,400,000	$65,300,000	**$99,380,000**
Alternative 5C Rural/Urban with10-foot Clear Zone and Truck Climbing Lane for Vanceburg Hill	5.90	$6,200,000	$3,200,000	$2,100,000	$49,200,000	**$74,800,000**
Alternative 5B + 5B1-1 (ALTS 5A + 5A-2 + 5C-1 + 5B1-1 + 5B2)	6.04	$6,500,000	$2,300,000	$1,200,000	$54,900,000	**$83,240,000**
Alternative 5B1 + 5B1-2 (ALTS 5A + 5A-2 + 5C-1 + 5B1 + 5B1-2)	6.67	$7,000,000	$2,300,000	$1,400,000	$59,200,000	**$94,180,000**
KY 59 FROM APPROXIMATELY MP 19.5 TO MP 23.0						
ALTS 5C-1 + 5B1-1 + 5B1-2	4.13	$4,400,000	$2,000,000	$800,000	$41,600,000	**$63,980,000**
ALTS 5C-1 + 5C-2	3.22	$3,300,000	$2,600,000	$1,500,000	$25,500,000	**$39,400,000**
ALT 5B1 + 5B2 + North Connector	3.95	$4,100,000	$1,600,000	$700,000	$29,600,000	**$49,740,000**
ALTS 5C-1 + 5B1-1 + 5B2	3.36	$3,600,000	$1,700,000	$600,000	$31,200,000	**$47,840,000**
ALTS 5B1 + 5B2	3.22	$3,300,000	$1,400,000	$600,000	$25,100,000	**$42,640,000**
VANCEBURG HILL (KY 59 FROM APPROXIMATELY MP 20.7 TO MP 23.0)						
5B1-1 + 5B1-2	2.98	$3,200,000	$1,000,000	$600,000	$32,300,000	**$49,980,000**
5C-2	2.07	$2,100,000	$1,600,000	$1,300,000	$16,200,000	**$25,400,000**
ALTS 5B1-1 AND 5B2	2.21	$2,400,000	$700,000	$400,000	$21,900,000	**$33,840,000**

NOTE: The Total Cost includes Environmental Fees In Lieu Of (FILO) and Maintenance Costs