KY 194 / KY 632
Corridor Planning Study

Pike County | November 2014

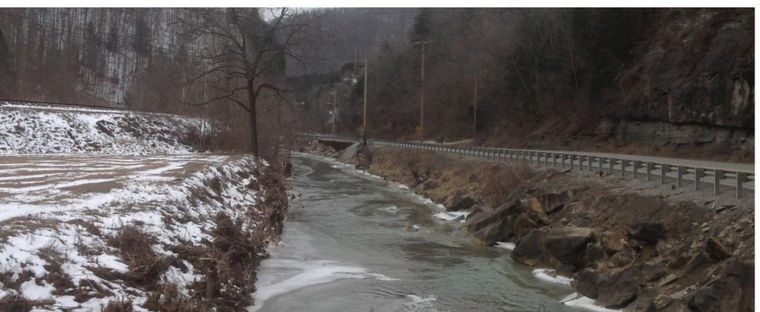
KENTUCKY TRANSPORTATION CABINET

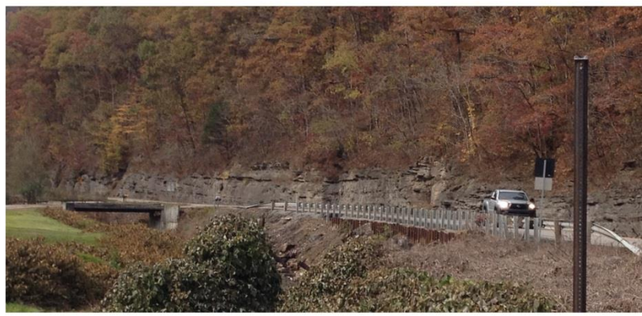
prepared for

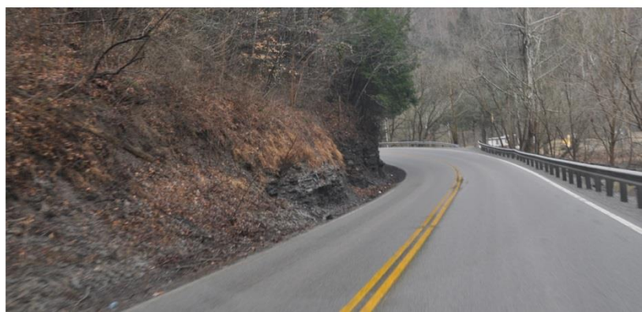
QK4 Engineering Planning

Groundbreaking by Design.

prepared by







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EXECUTIVE SUMMARY

The purpose of this corridor planning study is to identify and evaluate improvements within the existing corridor on KY 194 from US 119 southeast to KY 632 in Kimper, and on KY 632 from KY 194 in Kimper east to KY 194 in Phelps, in Pike County, Kentucky (see Figure ES1, p. ES4). This study includes an inventory of existing conditions, establishes a preliminary project purpose and need, proposes and analyzes alternative improvement options, develops practical solutions and cost estimates for viable construction sections, includes public involvement activities throughout the study process, prioritizes improvements, and includes a technical report that documents the study process and overall results of the study.

US 119 in Pike County provides major interregional connections to Letcher, Harlan, and Bell counties to the southwest and to West Virginia to the northeast. Near Blackburn Bottom northeast of Pikeville, US 119 provides access to Kimper via KY 194 and to Phelps via KY 632. Several agencies of Pike County government have branch offices in Phelps and it provides access to its 1,000 residents. Nearly half of the traffic volume on US119 enters from or exits to KY194 at their junction.

Study Goals

The overall study goal is to investigate a complete reconstruction with passing opportunities every 5 miles for the proposed project's 22.7-mile-long corridor and identify associated impacts and costs. In addition, the study would identify smaller spot improvements that would fit into an overall reconstruction of the corridor. The ultimate typical section would match the typical section for Item Number 12-281.00, is two 12-foot-wide lanes and 6-foot-wide paved shoulders (adding another lane for passing in sections 1, 3, 4, and 5). For cost estimating purposes, the cut slope will be 1.2H:1V and fill slopes 2H:1V for both the full reconstruction and for the spot improvements development. The desired design speed is 55 miles per hour (mph) for a complete reconstruction alternative and 40 mph for the spot improvements. Due to the overall length of the study corridor, it was divided into five sections, each approximately 5 miles in length, with an initial focus from US 119 to just beyond the Kellogg Pikeville Plant. These sections are identified are illustrated in Figure ES2 (p. ES5).

Existing Conditions

KY 194 carries 5,800 vehicles per day (vpd) at the western end of the corridor at Bevins Branch Road and decreases to 4,900 vpd approaching Kimper. KY 632 from Kimper to KY 3419 has a low volume of 3,000 vpd. The eastern segment of KY 632 from KY 3419 to KY 194 in Phelps the traffic volume increases to 4,600 vpd. The lane widths range from 10 to 11 feet wide with a varying average shoulder width of one to four feet. In some instances, the shoulder has completely broken away and has required stabilization. The speed limit for the majority of the corridor is 55 mph; the exception is the section on KY 194 from MP 12.611 to MP 14.019, which is 35 mph. The majority of the corridor does not meet 55-mph design speed criteria. The entire corridor has approximately 15 locations that do not meet the current minimum radius criteria for 40 mph and 57 locations that do not meet the current minimum radius criteria for 55 mph. The area for which existing plans were not available had an additional 11 horizontal curves that do not meet 40-mph design speed criteria and 26 that do not meet 55-mph design speed criteria. According to KYTC's Adequacy Ratings (measure of roadway condition, safety and capacity) 91% of the length of the corridor ranks lower than 93 to 96% of similar roadways in Kentucky. There are also 3 bridges along the corridor that are considered functionally obsolete by KYTC with one posted for load restrictions that District 12 staff recommends for replacement.

Crashes

There are 8 0.3 mile spot locations (some overlap) with Critical Crash Rate Factors (CCRF) greater than or equal to 0.95. A CCRF greater than or equal to 1.0 indicates that crashes may not be occurring randomly (see Figure ES3, p.ES6). The cause of those crashes can be summarized by the following:

- Lost control in a curve
- Lost control
- Majority were on wet pavement.

Traffic

The 2013 Average Daily Traffic (ADT) volumes ranged from 5,800 vehicles per day (vpd) on the western end of the corridor decreasing to 3,000 vpd in the middle, and then increasing from KY 3419 to KY 194 in Phelps to 4,600 vpd. The current and future Level of Service (LOS) for the corridor is D due to the high percentage of time spent following by vehicles, although the v/c ratio is well under 0.5 indicating a facility operating well under capacity. Due to the high percent time following, passing lanes were analyzed in each section to provide for motorists to maneuver around slow moving or large vehicles. Although, the Highway Capacity Software does not show improvement in the levels of service or percent time spent following, limited passing results in driver frustration and unnecessary risks taken by impatient drivers. No additional traffic is expected over normal growth because of any proposed improvements. Eight intersection locations were counted to determine necessary improvements. Each intersection operates at LOS B or C in both the current and design year with the exception of the intersection of KY 632 and KY 194 in Phelps which will operate at LOS F in the design year 2040. However, the intersection delay is only 63.3 seconds. Turn lane warrant analyses were conducted for the current (2013) and design year (2040) for 8 intersections. A left turn lane at the Kellogg Plant employee entrance (easternmost entrance) and the entrance at Kimper Elementary were warranted in the current year due to the AM peak design hour. In 2040, the following turn lanes were warranted:

- KY 194/KY 632 intersection at MP 26.70 / MP 0.00 (very close left and right turns)
- KY 632/Phelps Elementary School (right and left)
- KY 632/KY 194 in Phelps (left)

The existing (2013) and 2040 No Build traffic is shown in Figure ES4 (p.ES7).

Environmental Concerns

A literature search of known environmental features and several windshield surveys revealed the following areas of concern:

- For much of its length, KY 194/KY 632 is located parallel to John's Creek and Peter Creek

- Endangered Species
  - Indiana bat (*Myotis sodalis*; federally endangered)
  - Gray bat (*Myotis grisescens*; federally endangered)
- 10 mine portals within or immediately adjacent to the study area providing potential winter roosting habitat for the Indiana and Gray bats.
- Available geologic mapping indicates that the project is underlain by bedrock of the Breathitt Formation. The Breathitt Formation consists of shale, limestone, siltstone, sandstone, coal and clay. The sandstones can be friable and shales highly weatherable. Detailed study of potential structure locations would need to include an evaluation of past mining activities.
- Deep mines encountered during construction likely will contain water. Measures to mitigate project-related impacts to mining areas would likely be required, depending on the nature of the impacts. It is also likely that areas of uncompacted or loosely compacted mine spoil exist in the area. These areas can be problematic for road construction.
- Existing slopes have shown movement in the past and it is likely that many of the existing soil slopes range from marginally stable to unstable. Wet areas could require undercutting and the replacement of soils.
- Several locations were identified through windshield surveys that appeared to have potential Environmental Justice concerns.
- There are old abandoned gas stations, along with new gas stations that would be a concern for underground storage tanks (UST) leakage. However, no leaking of USTs was observed during a field review. There are also many businesses that appear to be truck, tire and/or car repair shops that could possibly use or store contaminated materials.
- Five cemeteries and at least 44 buildings were identified during the survey. Some of the buildings identified as residences may also have associated outbuildings.

Purpose and Need

The purpose of this project is to improve safety, mobility, and connectivity for travelers along the 22.7-mile KY 194/KY 632 corridor from US 119 to Phelps in Pike County. Both KY 194 and KY 632 are classified as rural minor arterials. This corridor provides a connection for those travelers from Phelps and areas further east to US 119, which leads to Pikeville.

The need for reconstruction and / or spot improvements for KY 194 and KY 632 is characterized by 10-11 foot driving lanes, narrow or no shoulders in locations, numerous deficient horizontal (approximately 83) and vertical curves (over 36) not designed for 55 mph, and issues with breaks or slides in the pavement along the route. Due to the coal mining operations in the area and on KY 194 and KY 632, large trucks carrying equipment travel the corridor. Drivers of these large trucks often must swerve out of their lane to negotiate a curve, thereby crowding the drivers in the opposite oncoming lane. There are three schools located within the study area and, therefore, full-size buses are frequently on the corridor and the narrow roadways give the drivers little room for error. Within a three-year period between 2010-2012, there were 31 0.3 mile spots (8 critical locations with overlapping 0.3 mile high crash spots) with CCRFs > 0.95, indicating the potential that the crashes may not be occurring at random. Some of these spots had as many as 10 crashes in a single location. Over 70% of the crashes occurred in horizontal curves and 55% in wet pavement conditions.

Early Stakeholders' Meetings

Three early Stakeholders' Meetings with industry along the corridor were conducted as part of this study. Each supported improvements along the corridor and identified their areas of concern. All noted wet pavement was an issue and recent high friction pavement used by KYTC seemed to help to reduce crash occurrences. At each meeting, the westbound segment on KY 632 from MP 2.70 to MP 3.20 was consistently identified as a concern. At this location, a westbound passing lane transitions back to one lane at a sharp horizontal curve.

Improvement Options

Utilizing the existing corridor (see Figure ES5, p. ES8), each of the five sections has one Total Reconstruction alternative with passing lanes in Sections 1, 3, 4, and 5. Section 2 has long tangent opportunities for passing without the addition of lanes. The Total Corridor Reconstruction alternative from MP 18.6 on KY 194 to Phelps is estimated to cost $256M (see Table ES1, p. ES9). In today's economy rarely are major corridors of this length slated for overall improvement. Therefore, spot improvements totaling $48.5M were identified that could be implemented as funding becomes available or designated for the corridor. The spot improvements are shown on Figure ES6 (p. ES10). Additionally, safety improvements totaling approximately $3,051,000 were identified. These include guardrail ($380,000), high friction pavement at 7 locations ($1,130,000), and replacement of 3 bridges ($1,541,000).

LOS calculations show even with the proposed improvements, the LOS for the corridor is still D; however, there is an improvement of the average travel speed (ATS) that ranges from 1 mph to 5 mph (see Figure ES7, p. ES11). Using general Crash Modification Factors for Rural, 2-Lane Roads in the Highway Safety Manual and from the Crash Modification Factor Clearinghouse, increasing roadway width from an average of 10.5 feet to 12 feet can be expected to reduce single vehicle run-off-the-road and multiple vehicle head-on, and same and opposite direction sideswipe crashes by 17%. Increasing shoulder width from an average of 3 feet to 6 feet is expected to reduce all crashes by 25%. Thus, overall crashes could be expected to be reduced by at least 25%.

Additional Stakeholders' Meetings

Two Local Officials/Stakeholders' Meetings were held as a part of this project. The first meeting consisted of representatives from Kellogg, KYTC, the Pike County Government, Fiscal Court, Emergency Management, KY Berwind Land, the Ross Harris Group, and BSADD. The meeting was held to solicit concerns along the project corridor, and to present the existing conditions inventory to the group. The items of discussion or concerns are listed below:

- Advocated the use of "coal to roads to fund construction"
- Entrances
- Blind curves
- Deep ditches

- Flooding
- Lack of shoulders
- Slow moving trucks causing congestion
- Issues with trucks entering and exiting the roadway
- The need for three-lane passing opportunities, turn lanes at Kellogg's
- Possible high friction surface
- The potential to utilize coal seams and leave the existing road in place
- The need for jobs
- The "community is due" because of the large amount of coal that has been removed from this area, and issues with utilities
- Location of water lines is critical
- Bypass existing KY 194 beginning at US 119, and then proceed along a new alignment either north or south of the existing roadway, connecting back to existing KY 194 near the Kellogg's Plant. This option was previously discussed with the District 12 staff, and it was dismissed from consideration due to the impacts on the operation of the existing interchange, the potential for a new interchange construction, impacts to mining operations, and increased project costs due to additional excavation required.

The second meeting, presented improvement options and cost estimates. Again, proceeding with new alignment and working with coal companies to use part of their roads was voiced since improving the existing road only improved the speeds up to 5 mph and did not improve the LOS.

Project Team Meetings

Two project meetings were held on the same day prior to the aforementioned stakeholders' meetings. The following were significant discussion items.

For Section 1

- Increase the estimated bridge cost/square foot from $80 to $120.
- Increase the earthwork cost/cubic yard from $5 to $6 on the Total Reconstruction alternative due to the manner that material must be handled, and the proximity of the work to the existing road.
- Increase the Maintenance of Traffic cost from $43,000 to $150,000.
- Add a line in the estimate specifically for in-lieu fees.

For the remaining corridor

- District 12 staff requested to add the bridge replacement in Kimper to the spot improvements. This bridge continually presents issues for District 12.
- Document the number of miles of road that would be abandoned by the reconstruction of each section.
- In-lieu fee rates were recently raised to $600–$650 per linear foot; therefore, it was suggested using a placeholder for in-lieu fees for waste areas (perhaps $500,000–$750,000); or a cost/lineal foot for a small, medium, and large project in District 12, and perhaps for each Section 1 through 5 use a ratio for the in-lieu fees based on the cubic yards of excavation and add that cost as a footnote in the cost estimate summaries.
- In future phases, a lesser typical section for the spot improvements would potentially save at least 15%.

Prioritization and Recommendations

Various factors were considered in developing recommendations for the priority of the Total Reconstruction alternatives, including: current and future traffic volumes (including truck percentages), horizontal and vertical curve deficiencies, cost, and the estimated increase in average travel speed resulting from improvements, environmental concerns, utility issues, and the number of right-of-way parcels affected. The top priority is Section 1. During this study, Section 1 was included in the approved Final April 2014 Highway Plan (FY 2014-2020) as Item Number 12- 198.00. Because the Highway Plan is only funded for the first two years, it is recommended that this project continue funding through to construction before other Reconstruction alternatives commence.

Due to the overall economy and other transportation needs across the Commonwealth, Section 1 is the only Total Reconstruction alternative recommended at this time.

However, several spot improvements are recommended for implementation as funding becomes available. Spots considered for geometric improvements were identified based on crash history and stakeholder input. The following priorities were recommended:

- Installing high friction pavement at high crash locations
- Upgrading existing guardrail (locations provided to District 12 staff) end treatments
- Replacement of functionally obsolete structures
- Spot 8 in Section 3 identified by all stakeholders as a problem area

These recommendations were developed in concert with the project team and District 12 maintenance staff. However, as the projects move forward, that coordination should continue.

If funding became available for the entire corridor, improvements should continue from west to east (Section 2, 3, 4, and 5).

The recommended corridor priorities are shown in Figure ES8 (p. ES12).

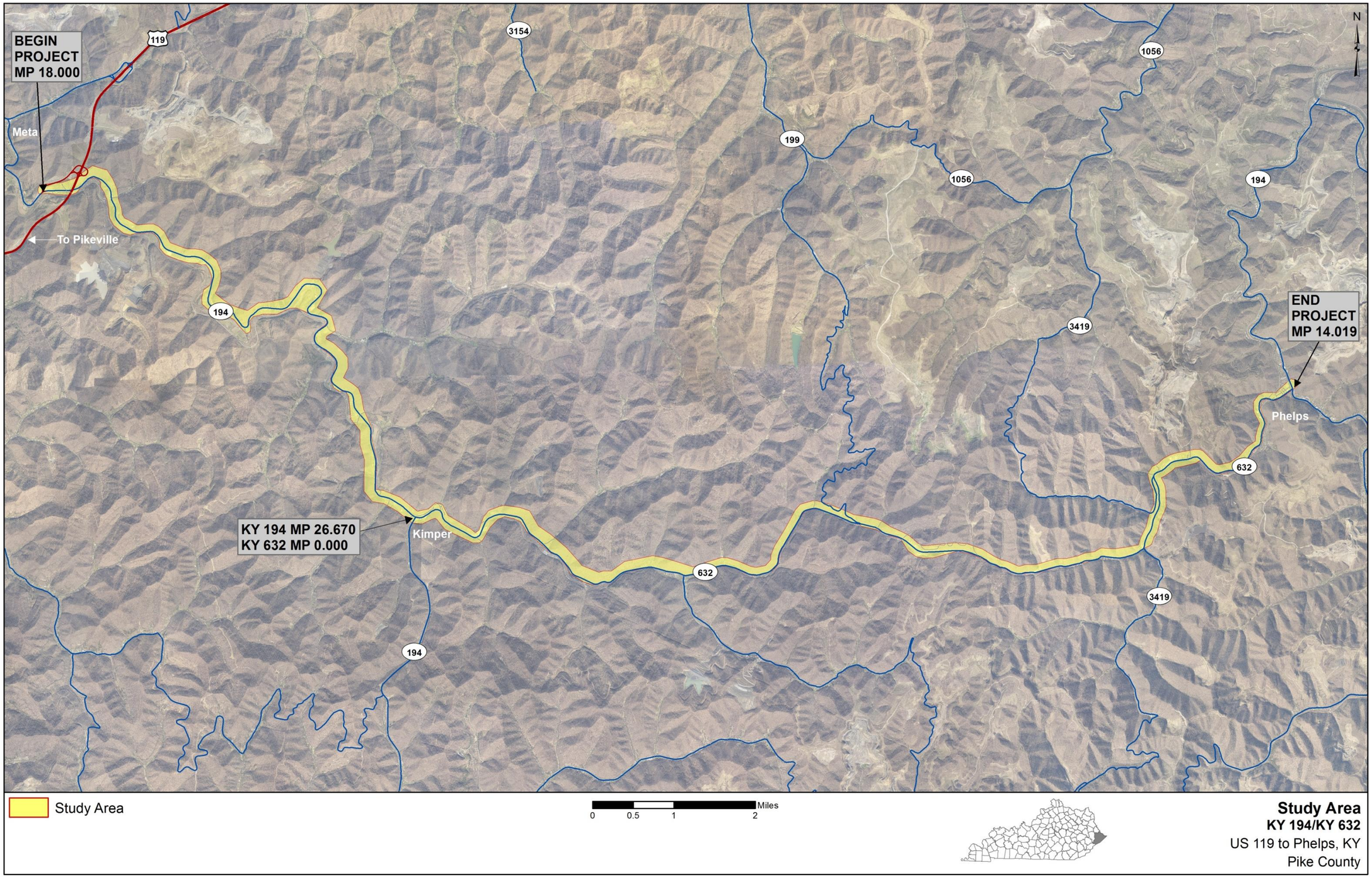


Figure ES 1: Study Area

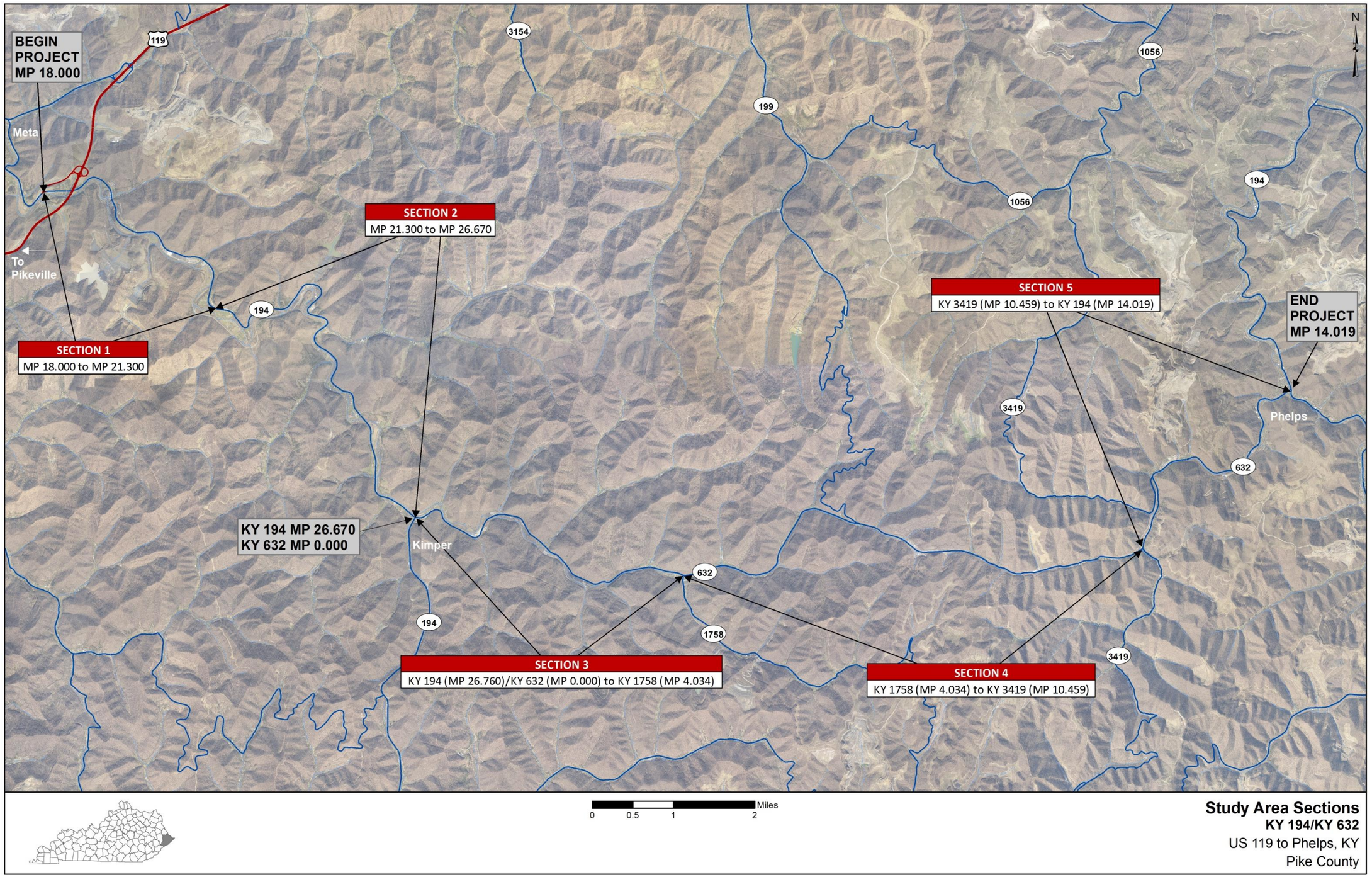


Figure ES 2: Study Area Sections

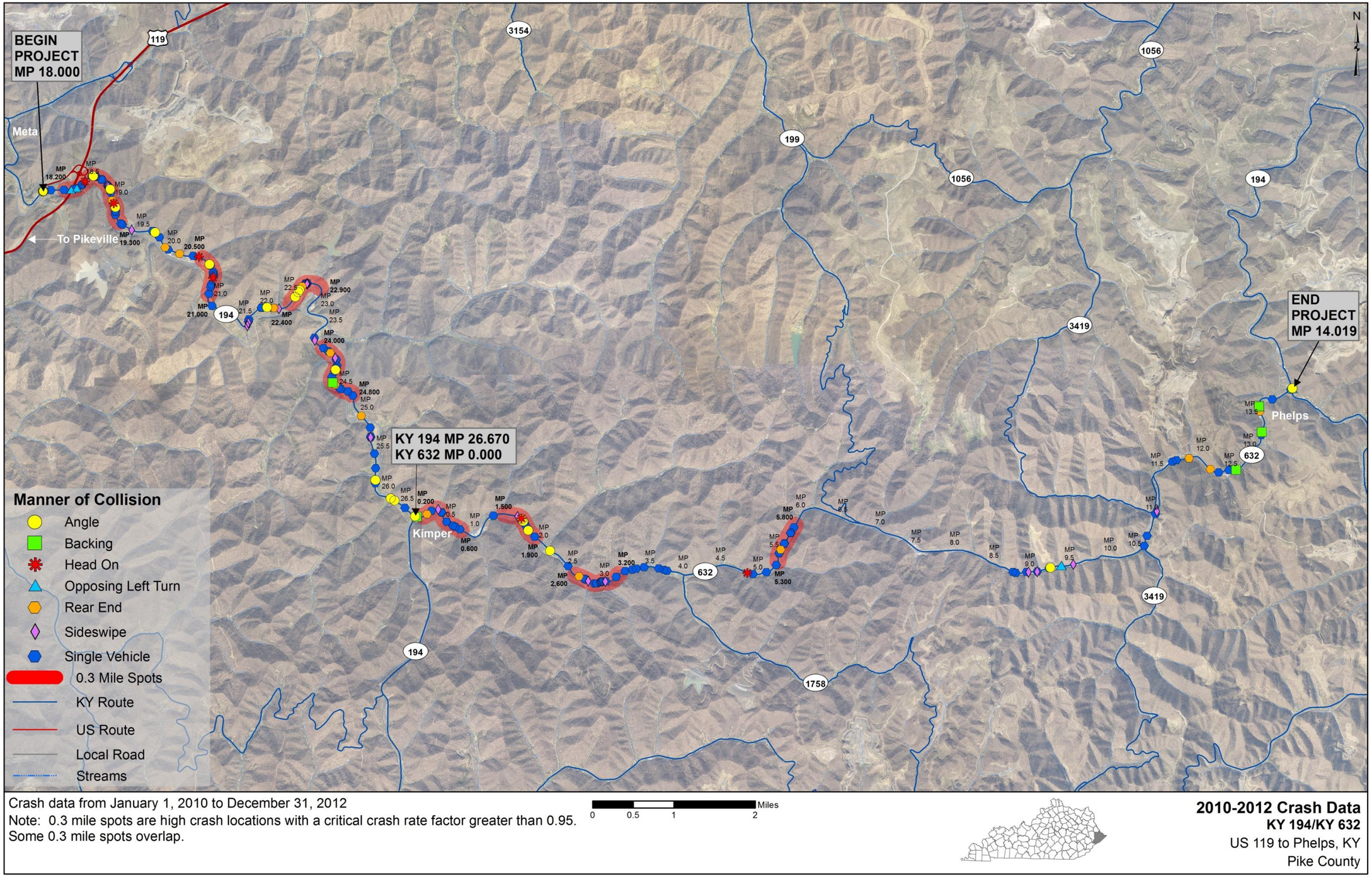


Figure ES 3: 2010-2012 Crash Data

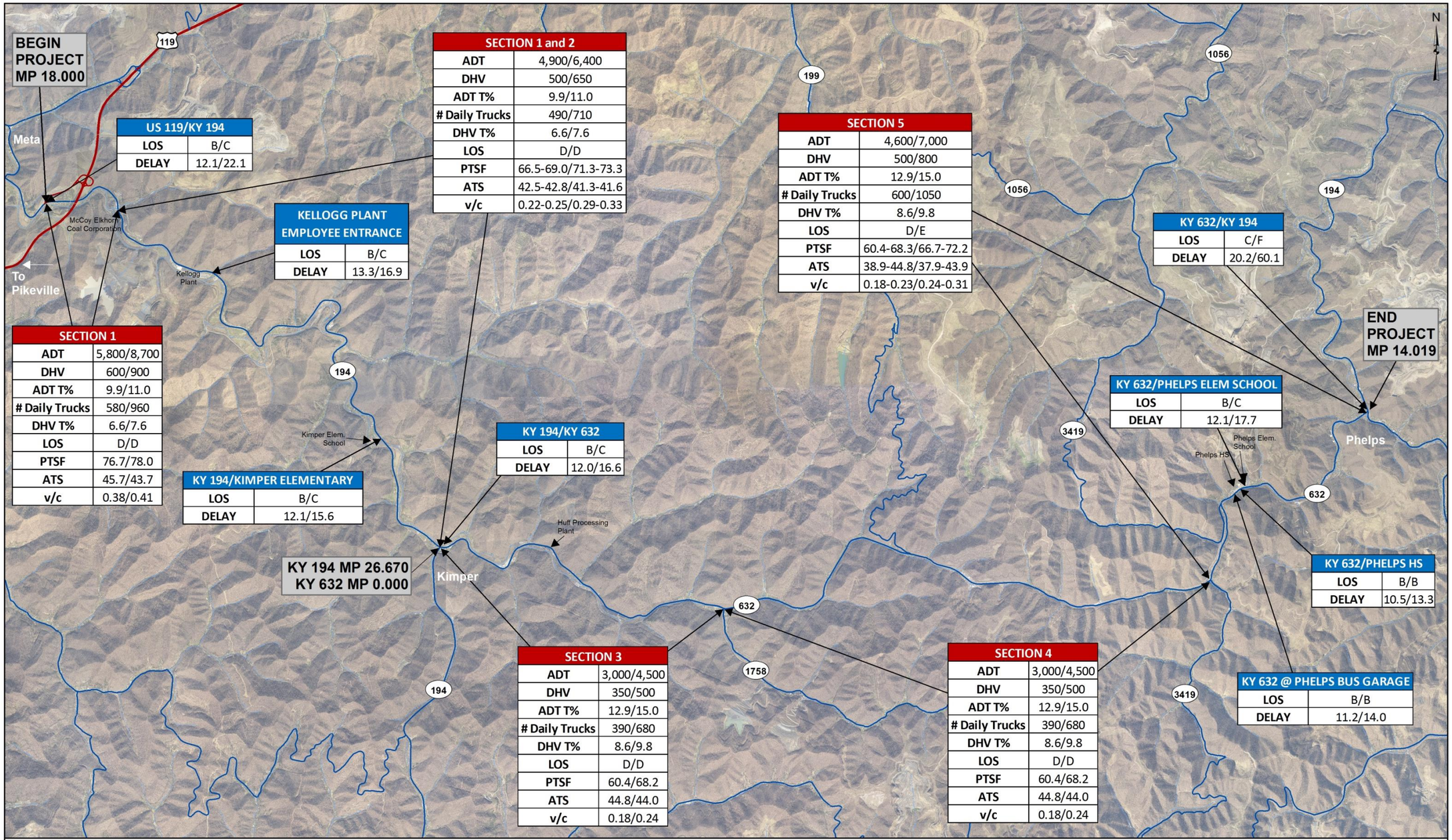


Figure ES 4: 2013 (Existing) and 2040 No Build Traffic Characteristics

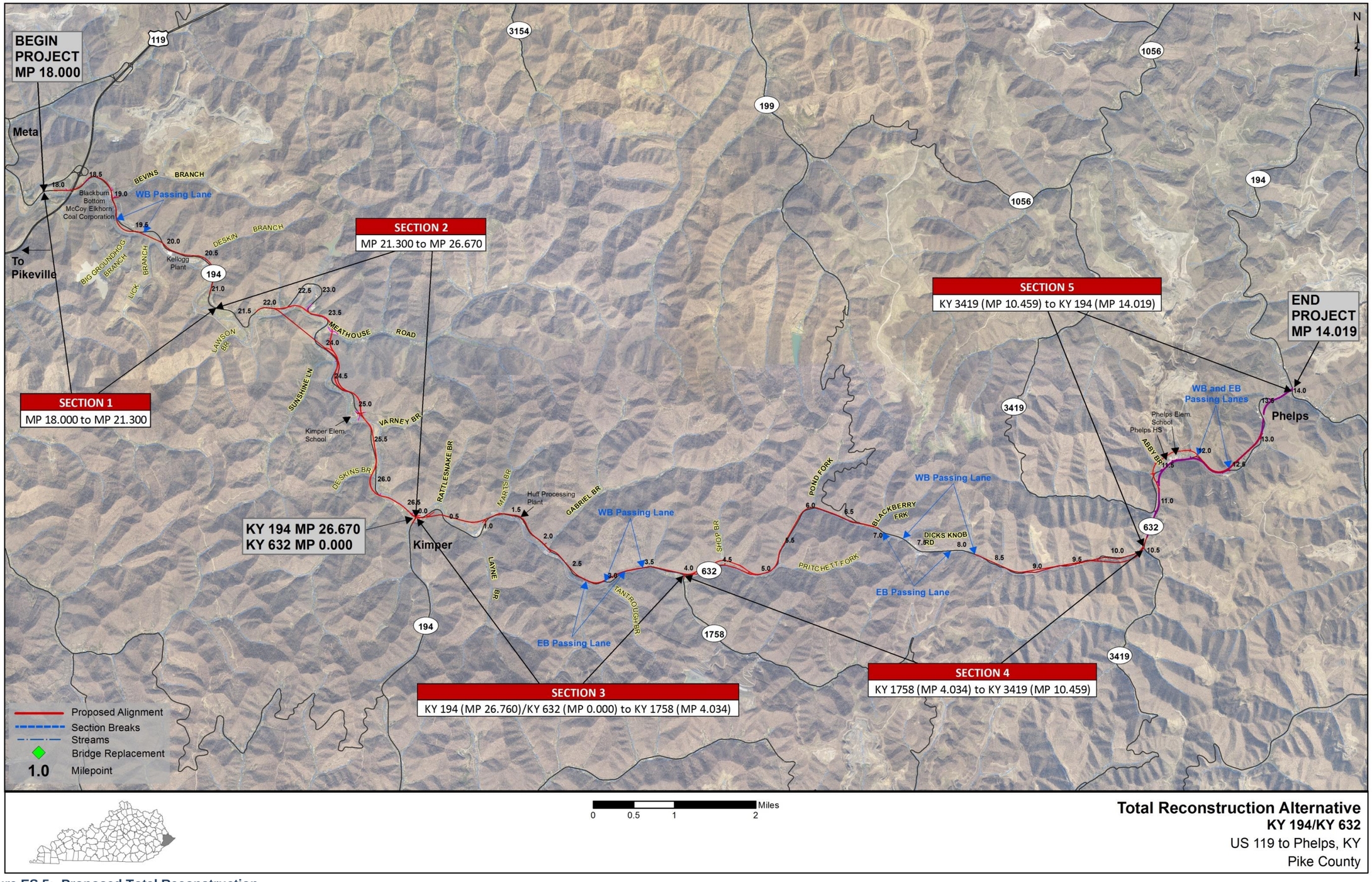


Figure ES 5: Proposed Total Reconstruction

Table ES 1: Total Reconstruction Sections Cost Estimate Summary

		Total Reconstruction Sections Cost Estimate Summary				
Phases	No-Build Alternative	1	2	3	4*	5
Length (miles)**		2.30	3.99	3.79	5.22	3.11
Milepoints *(approximate project limits)**		MP 18.68 to MP 20.98	MP 22.00 to MP 27.00	MP 0.21 to MP 4.00	MP 4.20 to MP 10.50*	MP 10.50 to MP 14.00
Design	$0	$2,000,000	$5,700,000	$3,200,000	$2,300,000	$3,000,000
Right-of-Way	$0	$2,000,000	$3,500,000	$3,300,000	$4,500,000	$2,700,000
Utilities	$0	$1,500,000	$2,600,000	$2,500,000	$3,400,000	$2,100,000
Construction	$0	$14,139,000	$78,720,000	$44,300,000	$32,100,000	$42,100,000
Total	$0	$19,639,000	$90,520,000	$53,300,000	$42,300,000	$49,900,000
Waste Area In Lieu Fee****	$0	$910,000	$910,000	$4,095,000	$1,040,000	$1,560,000

Note:

*Section 4 ties into an existing WB and EB passing lane that is approximately 1.2 miles in length.
**The length represents the length of the improvement.
***Milepoints represent the approximate termini of each reconstructed section given today's MPs. They will not match the project length.
**** Waste Area in lieu fees are not included in the total above and are estimated at $650.00/LF.

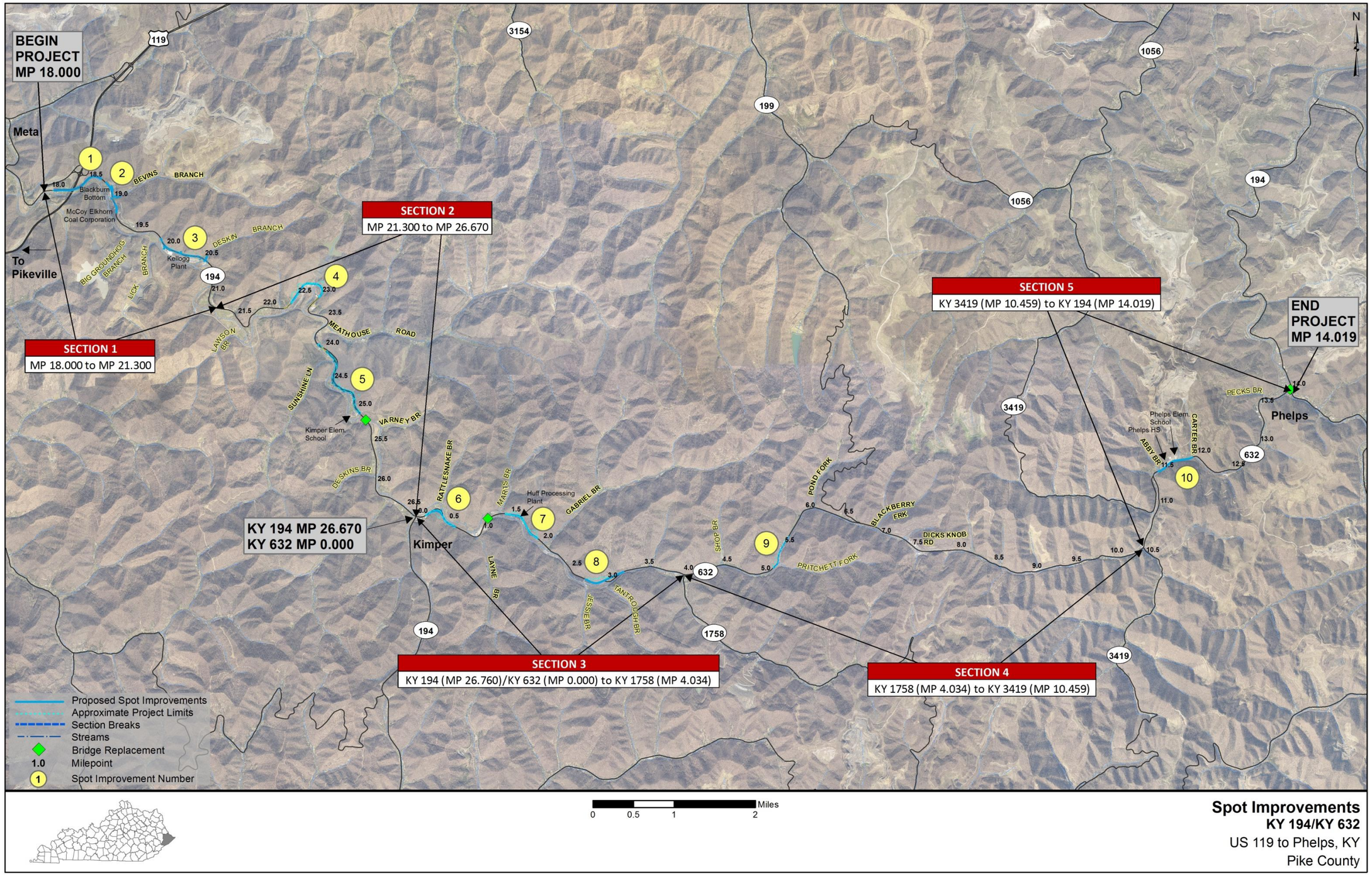


Figure ES 6: Proposed Spot Improvements

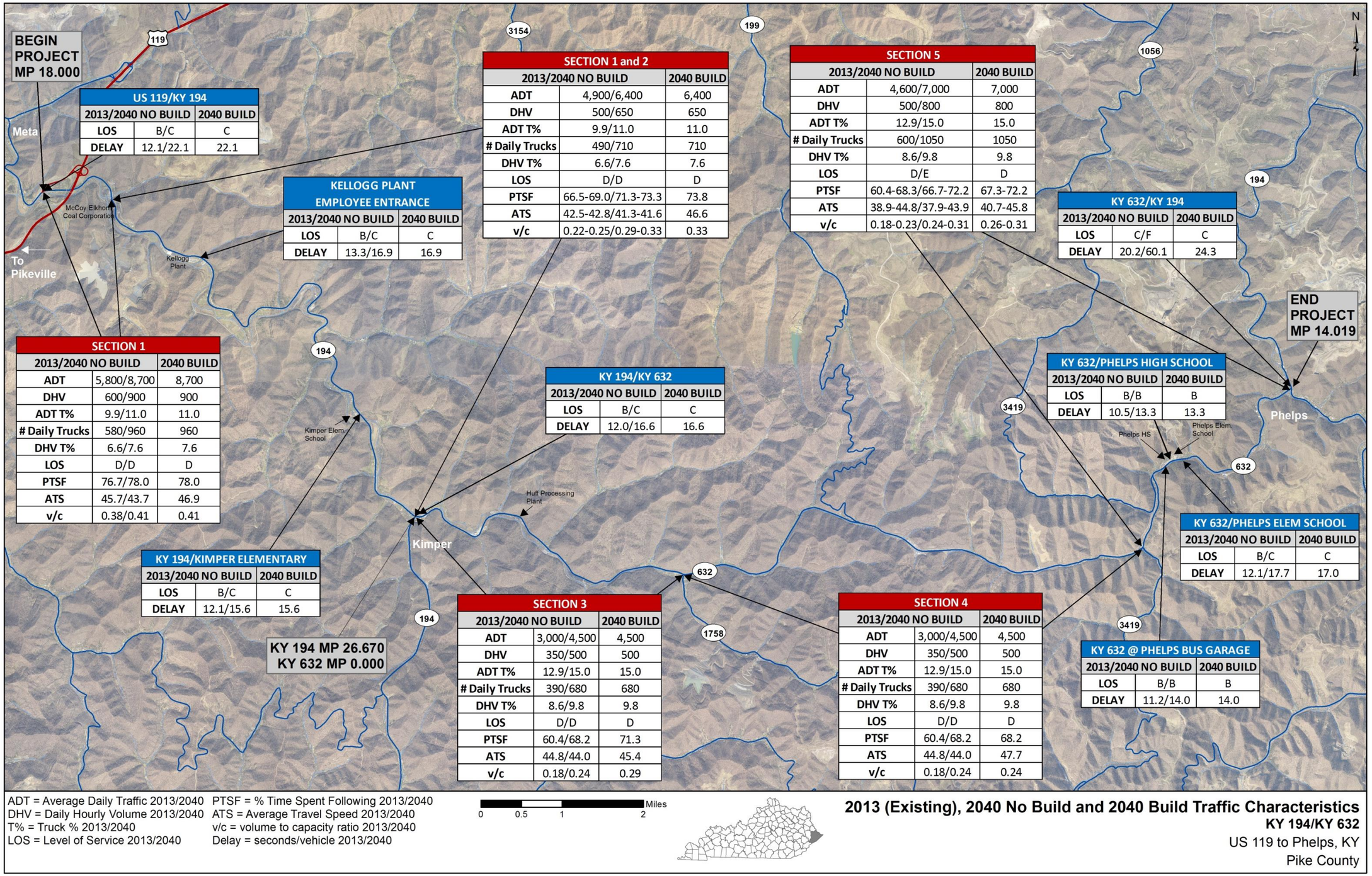


Figure ES 7: 2013 (Existing), 2040 No Build and 2040 Build Traffic Characteristics for Total Reconstruction

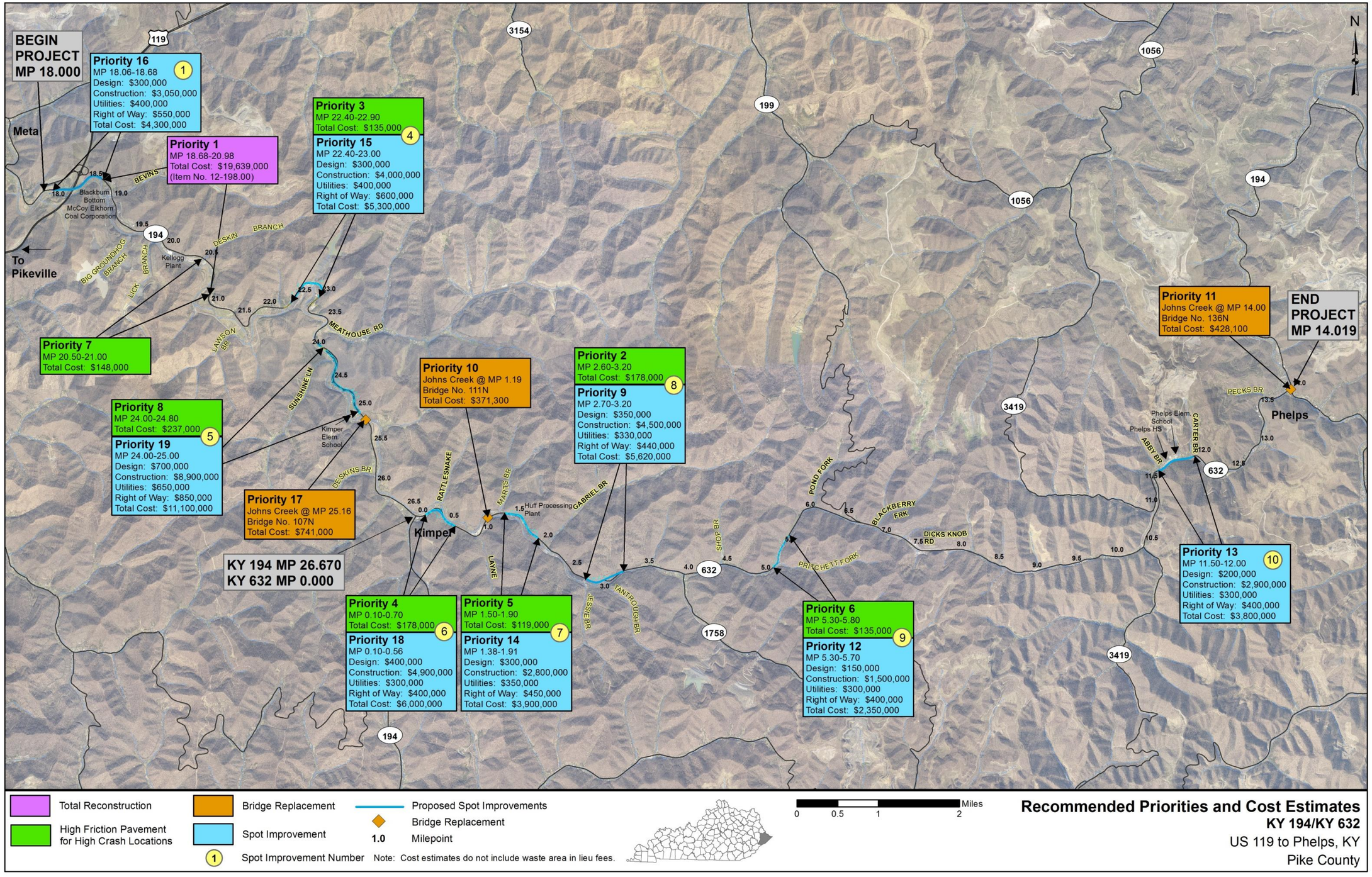


Figure ES 8: Recommended Priorities and Cost Estimates

I. KY 194/KY 632 Corridor Overview

The purpose of this corridor planning study is to identify and evaluate improvements within the existing corridor on KY 194 from US 119 southeast to KY 632 in Kimper and on KY 632 from KY 194 in Kimper, east to KY 194 in Phelps, in Pike County, Kentucky (see Figure 1, p. 2). This study includes an inventory of existing conditions, establishes a preliminary project purpose and need, proposes and analyzes alternative improvement options, develops practical solutions and cost estimates for viable construction sections, includes public involvement activities throughout the study process, prioritizes improvements, and includes a technical report that documents the process and overall results of the study.

A. Project History and Setting

Pikeville, the Pike County seat, has an estimated 2013 population of 6,905 making Pikeville the largest community in Kentucky east of London and Corbin and south of Ashland. Home to the University of Pikeville and its 2,300 students, Pikeville is connected to I-64 to the north by US 23, to I-75 to the west by KY 80 and the Hal Rogers Parkway, and to the Mountain Parkway by US 460 and KY 114.

US 119 in Pike County also provides major interregional connections to Letcher, Harlan, and Bell counties to the southwest and to West Virginia to the northeast. Near Blackburn Bottom northeast of Pikeville, US 119 provides access to Kimper via KY 194 and to Phelps via KY 632. Several agencies of Pike County government have branch offices in Phelps and it provides access to its 1,000 residents. Nearly half of the traffic volume on US119 enters from or exits to KY194 at their junction.

The KY 194/KY 632 corridor has been a topic of discussion for the area and also within the Kentucky Transportation Cabinet (KYTC) for years. There is currently one active reconstruction project (Item Number 12-281.00) on KY 194 from just east of the Kellogg Pikeville Plant, beginning near Deskins Branch Road from MP 21.3 to just beyond MP 22.0. Item Number 12-940.00 added high friction surface pavement to KY 194 from MP 18.4 to MP 19.0. There have also been five Project Identification Forms (PIFs) completed along the corridor to address various deficiencies and safety issues—four along KY 194 and one on KY 632 from Kimper to Phelps. In the early 1980s, passing opportunities were constructed at three locations along KY 632.

B. Project Goals

The overall study goal is to investigate a complete reconstruction with passing opportunities every five miles for the proposed project's 22.7-mile-long corridor and provide associated impacts and costs. In addition, the study would identify smaller spot improvements that would fit into an overall reconstruction of the corridor. Due to the overall length of the study corridor, it was divided into five sections, each approximately 5 miles in length, with an initial focus from US 119 to just beyond the Kellogg Pikeville Plant. These sections are identified in Table 1 and illustrated in Figure 2 (p. 3).

The ultimate typical section would match the typical section for Item Number 12-281.00, with 12-foot-wide lanes and 6-foot-wide paved shoulders (see Figure 3, p. 5). For cost estimating purposes, the cut slope will be 1.2H:1V and fill slopes 2H:1V for both the full reconstruction and for the spot improvements development. The desired design speed is 55 miles per hour (mph) for a complete reconstruction alternative and 40 mph for any spot improvements.

Table 1: Typical Roadway Sections

Section	Beginning MP Description	Beginning MP	Ending MP	Ending MP Description
1	US 119	18.000	21.300	Beginning of Item No. 12-281.00
2	End of Item No. 12-281.00	22.000	26.670	KY 194/KY 632
3	KY 194/KY 632	0.000	4.034	KY 1758
4	KY 1758	4.034	10.459	KY 3419
5	KY 3419	10.459	14.019	KY 194

II. Review and Summarization of Previous Work

A. Project Identification Forms (PIFs)

During the planning process, KYTC has developed five PIFs - four along KY 194 and one on KY 632. Each has a recurring theme of substandard geometrics; i.e., a narrow, two-lane roadway with virtually no shoulders, sharp curves, and steep grades. There are numerous heavy coal trucks from various mines that travel these roads, a major employer with the Kellogg Pikeville Plant and both roads exhibit high crash rates. Table 2 provides a summary and location of the PIFs, with a description of the proposed improvements and a 2008 cost estimate for each. These PIFs have been on record since 2000. The five PIFs are located in **Appendix A.**

Table 2: Project Identification Forms (PIFs)

PIF #	Beginning MP	Ending MP	Length	Description	Last Revision	Total Cost (Millions $)
12098 D0194 65.10	17.08	19.99	2.9	Improve from KY 194 from KY 2169 to Mountain Top Bakery	9-June-08	12.5
12098 D0194 65.30	21.5	22.2	0.7	Safety improvements for curve 2.5 miles south of Bevins Branch	5-June-08	17.6
12098 D0194 65.40	24.2	25.1	0.9	Improvements for curve at Stinking Branch near Deskins Branch	5-June-08	9.5
412098 D0194 65.40	26.1	27.1	1.0	Address safety concerns and substandard geometrics from the RR Xing 0.15 mile before Hurricane Creek to 0.5 mile beyond the junction of KY 194 and KY 632	5-June-08	4.4
12098 D0632 1.00	0	14.0	14.0	Address service, condition, and safety issues on KY 632 from KY 194 to Phelps	9-June-08	100.0

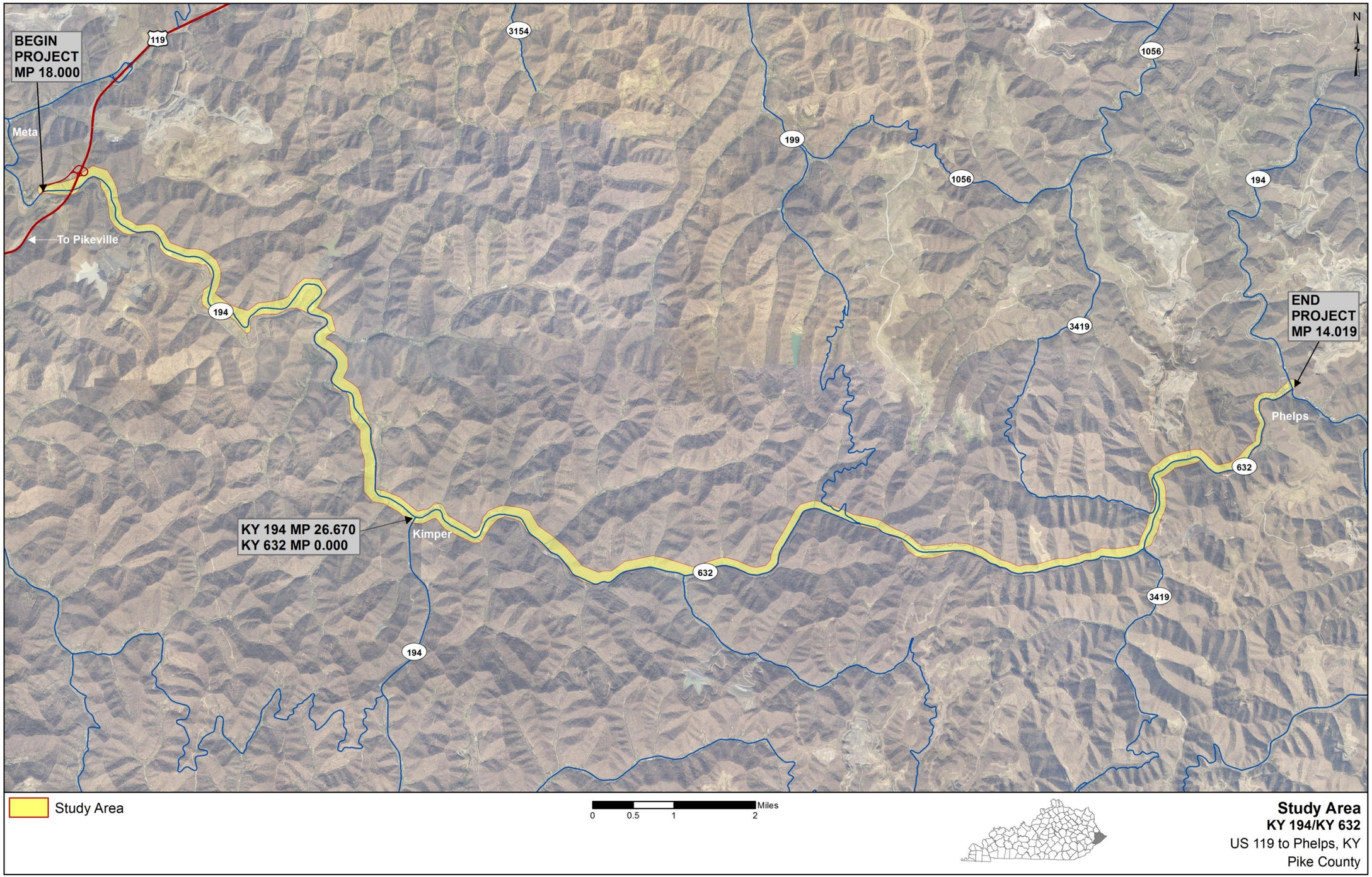


Figure 1: Study Area

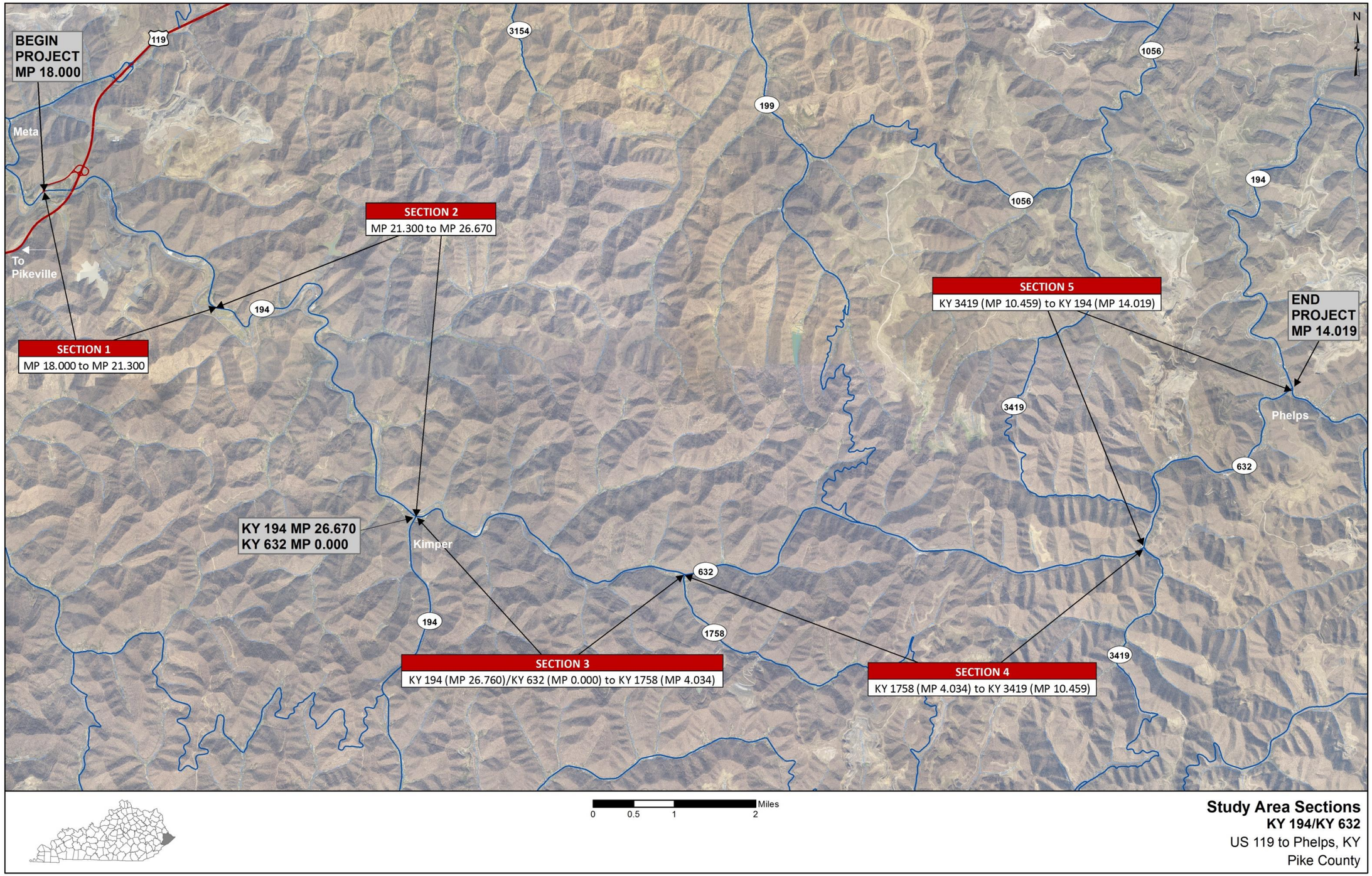


Figure 2: Study Area Sections

B. Opportunities for Passing

In the mid-1980s, opportunities for passing were added to KY 632 at three locations. Those locations are listed in Table 3.

Table 3: Current Opportunities for Passing

Route	Beginning MP	Ending MP
KY 632	3.050	3.500
	7.020	8.182
	11.932	12.230

C. Spot Improvement KYTC Item Number 12-281.00

Currently, KYTC has one active spot improvement project identified as Item Number 12-281.00 on KY 194 from just east of the Kellogg Pikeville Plant beginning near Deskins Branch Road from MP 21.3 to just beyond MP 22.0. This project is a 40-mph design speed spot improvement project with an eastbound passing lane and a normal typical section as shown in Figures 3 and 4 (pp. 5 and 6).

D. High Friction Pavement

To improve safety along KY 194, KYTC Item Number 12-940.00 added high friction surface pavement at the following locations: MP 18.40–MP 19.00, MP 21.95–MP 22.00, MP 23.18–MP 23.32, and MP 23.47–MP 23.62.

III. Existing Conditions Inventory

A. Roadway Characteristics

This southeastern Kentucky corridor is on the State Primary Road System and classified as a Rural Minor Arterial connecting Meta to Phelps. It also appears on the State System as a State Secondary system. KY 194 in the study corridor carries between 4,900 and 5,800 vehicles per day (vpd) with higher volumes toward Meta. KY 632 along the study corridor carries between 3,000 and 4,600 vpd with higher volumes towards Phelps. As shown in Table 5, (p. 7) the lane widths range from 10 to 11 feet wide with a varying average shoulder width of one to four feet. In some instances, the shoulder has completely broken away and has required stabilization. The speed limit for the majority of the corridor is 55 mph; the exception is the section from MP 12.611 to MP 14.019, which is 35 mph. All characteristics are shown in Table 5 (pp.7and 8)

B. Horizontal and Vertical Geometry

If existing plans were available, they were reviewed and compared to current design criteria. Utilizing as-built plans and KYTC's Highway Information System (HIS), horizontal and vertical geometrics were assessed for both 40 mph and 55 mph design speeds and deficiencies are summarized in **Appendix B**. The 22.7-mile corridor offers safe opportunities to pass along only 11.4% of its length. The criteria used for identifying deficiencies are shown in Table 4.

Given the criteria in Table 4, there are many instances along the corridor where the horizontal geometry does not meet 40-mph design speed criteria (considering current 8% maximum superelevation tables ($e_{max)}$ tables). The majority of the corridor does not meet 55-mph design speed criteria. The entire corridor has approximately 15 locations that do not meet the current minimum radius criteria for 40 mph and 57 locations that do not meet the current minimum radius criteria for 55 mph. The area for which existing plans were not available had an additional 11 horizontal curves that did not meet 40-mph design speed criteria and 26 that do not meet 55-mph design speed criteria.

Table 4: Design Criteria

Category	Criteria	
Design Speed	40 mph	55 mph
Minimum Horizontal Radius	465 feet	965 feet
Maximum Grade	8.0	6.0
e_{max}	8%	8%
Stopping Sight Distance (SSD)	405 feet	495 feet

Grades do not appear to be an issue for most of the route, with the exception of KY 632 between Pond Fork (MP 6.6) and Blackberry Fork (MP 8.1), where three vertical grades do not meet both 55-mph and 40-mph design speed criteria (9.0%, 7.0% and 6.7%). Stopping sight distance (SSD) criteria are not met for much of the route given current design standards. Sixteen areas were identified that do not meet the minimum SSD for 40 mph and 36 locations do not meet the SSD for 55 mph.

C. Adequacy Ratings

As shown in Table 5 (p. 8), KYTC uses roadway adequacy ratings as a tool in its efforts to prioritize proposed highway improvements. These ratings have three components:

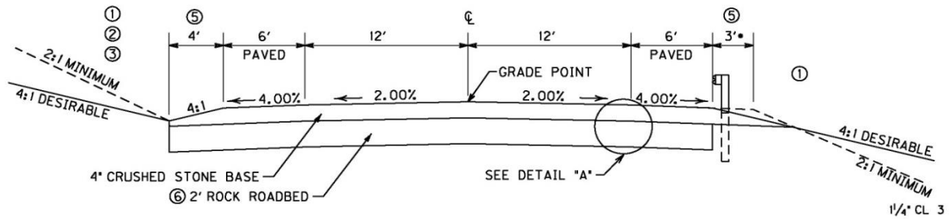
1) A measure of the roadway condition.
2) A measure of safety.
3) A measure of service.

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 Minor Arterial, there are 30 points for pavement condition, 45 points for safety (lane width, shoulder width, median type, alignment, and critical rate factor), and 25 points for service (volume-to-capacity [v/c] Ratio and access control) to equal 100.

COUNTY OF	ITEM NO.	SHEET NO.
PIKE	12-281.00	R2

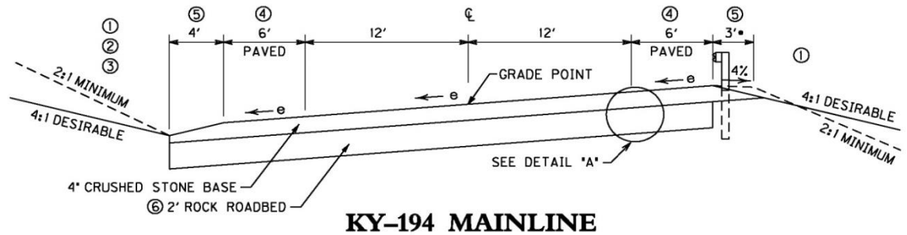
TYPICAL SECTIONS

(NOT TO SCALE)



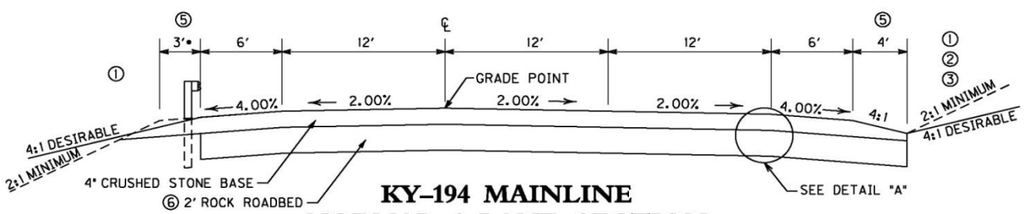
KY-194 MAINLINE
NORMAL 2-LANE SECTION
STA. 39+50.00 TO 75+55.00

*** – Shoulder is widened 3' when guardrail is necessary.**



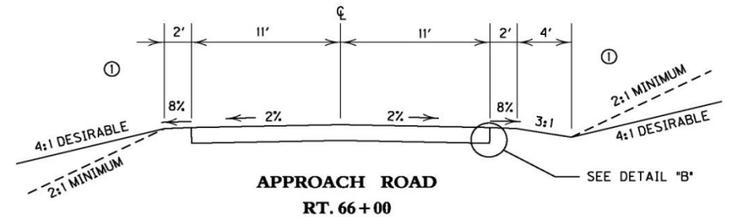
KY-194 MAINLINE
SUPERELEVATED 2-LANE SECTION
STA. 39+50.00 TO 75+55.00

*** – Shoulder is widened 3' when guardrail is necessary.**

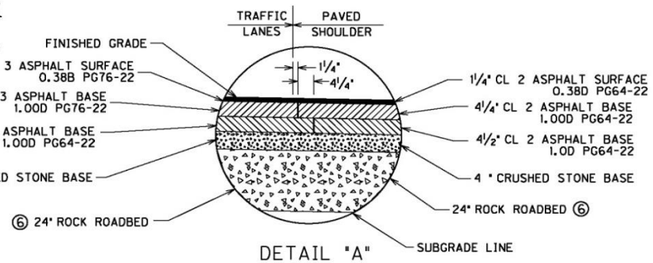


KY-194 MAINLINE
NORMAL 3-LANE SECTION
STA. 43+30.00 TO 59+20.00

*** – Shoulder is widened 3' when guardrail is necessary.**

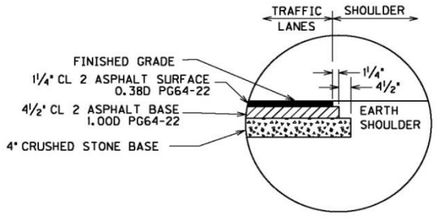


APPROACH ROAD
RT. 66+00



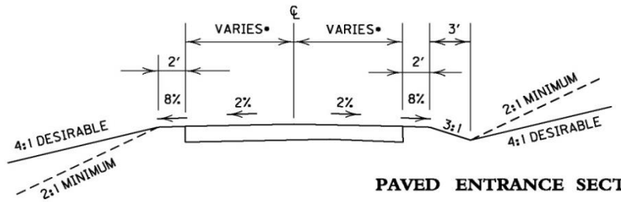
DETAIL "A"
N.T.S.

MAINLINE
TRAFFIC LANE / SHOULDER
ASPHALT PAVEMENT



DETAIL "B"
N.T.S.

APPROACH ROAD
TRAFFIC LANE PAVEMENT



PAVED ENTRANCE SECTION

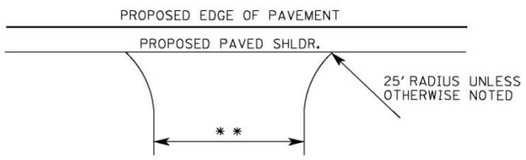
• WIDTH VARIES SEE PLAN SHEETS

BITUMINOUS PAVEMENT

BIT. SURFACE – – 1 ¼" CL 2 ASPHALT SURFACE 0.38D PG64-22
BASE – – – – – – 2" CL 2 ASPHALT BASE CLASS 1.00D PG64-22
D.G.A. – – – – – – 4" CRUSHED STONE BASE (RESIDENTIAL)
D.G.A. – – – – – – 6" CRUSHED STONE BASE (COMMERCIAL)

SHOULDERS

EARTH SHOULDERS



TYPICAL ASPHALT ENTRANCE

• • WIDTH VARIES SEE PLAN SHEETS

NOTES

① SEE CROSS SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDERS.

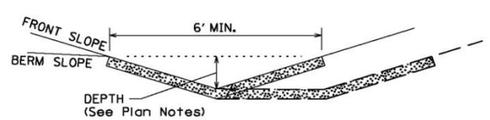
② FOR ROCK SLOPES, SEE CROSS SECTIONS.

③ SEE CROSS SECTIONS FOR PRE-SPLIT SLOPES FROM RDZ TO GRADE FOR ROCK CUTS.

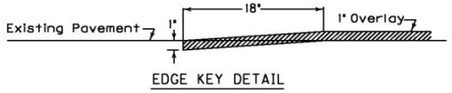
④ SUPERELEVATED SHOULDER TO BE CONSTRUCTED TO SUPERELEVATION RATE. AT NO TIME WILL THE SLOPE BE FLATTER THAN THE SLOPE INDICATED FOR NORMAL SECTION.

⑤ ASPHALT SEAL REQUIRED FROM OUTSIDE EDGE OF PAVED SHOULDER TO A POINT 2' DOWN THE DITCH OR FILL SLOPE.

⑥ ROCK ROADBED SHALL CONSIST OF DURABLE SANDSTONE FROM ROADWAY EXCAVATION.



INSTALL EROSION CONTROL BLANKET IN ALL SURFACE DITCHES AND ALL ROADWAY DITCHES ABOVE THE ROCK DISINTEGRATION ZONE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER ON CONSTRUCTION.



EDGE KEY DETAIL

Work under this item shall include cutting out the existing asphalt surface to a minimum depth and width as shown, so the new surface may heel into the existing surface. The contract unit price bid per linear foot for "EDGE KEY" shall include all necessary materials, labor, equipment, etc. to perform the work and dispose of the asphalt material removed.

TYPICAL SECTIONS

MicroStation v8.11.7.180 | E-SHEET NAME: | USER: Alexi.Smith DATE PLOTTED: January 1, 0001 | FILE NAME: G:\PW\WORK\ALEXI.SMITH\D0144511\KYTC_SHEET.CEL

Figure 3: Normal Typical Section for Item Number 12-281.00

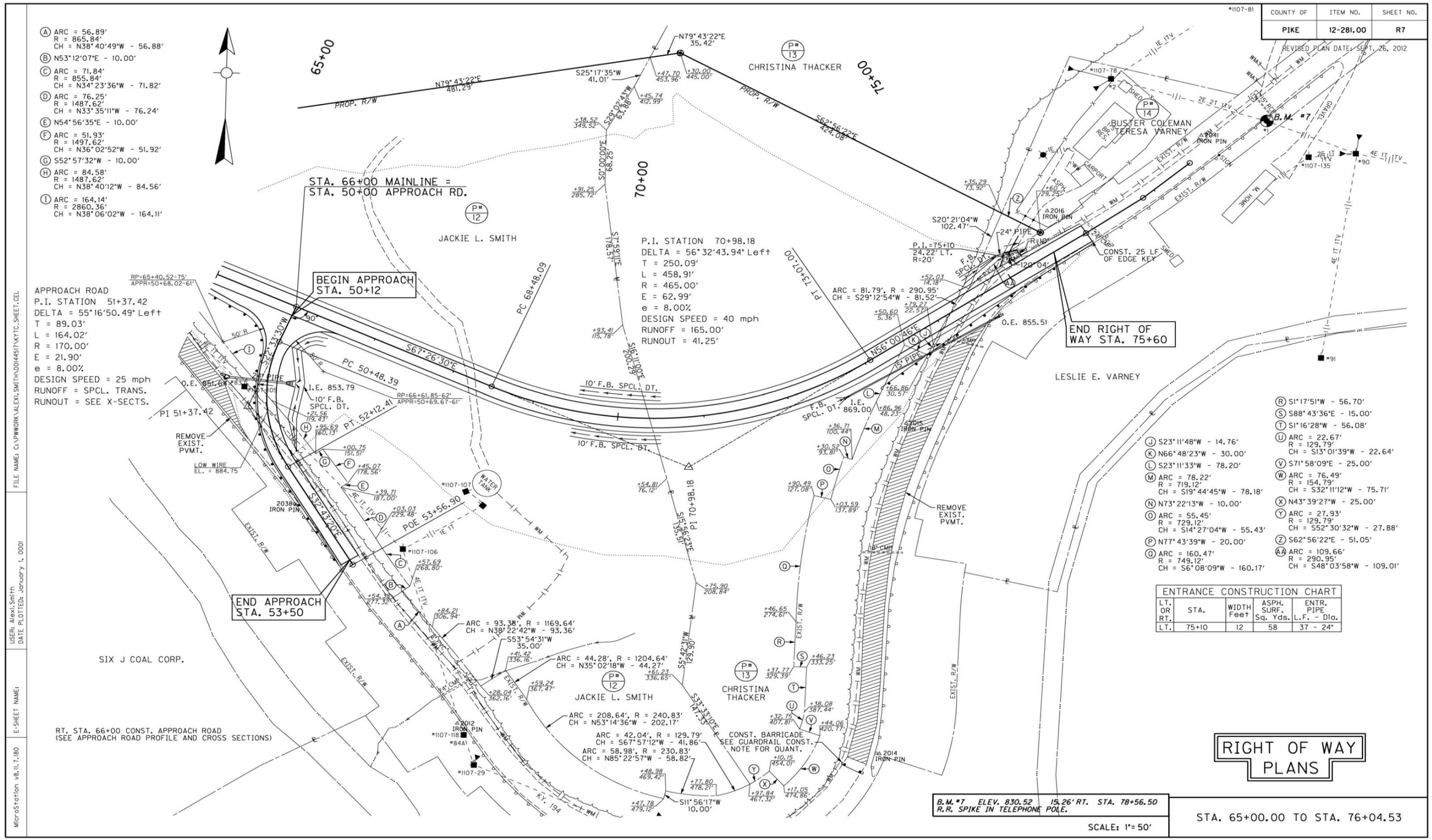


Figure 4: Item Number 12-281.00 Alignment at MP 21.3 to Just Beyond MP 22.0

Table 5: Existing Conditions Inventory

EXISTING CONDITIONS INVENTORY

Description						Systems					Roadway Typical Section								Traffic						
Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length	Functional Class	State System	NHS	NTN	Truck Weight Class	# of Lanes	Lane Width	Passing Lane/EB or WB	Shoulder Type	Shoulder Width	Deteriorated Shoulder	Speed Limit	Pavement Type	KYTC Provided 2013 ADT	KYTC 2013 Truck %	KYTC Provided 2040 ADT	KYTC 2040 Truck %	Current (HIS) ADT	Annual Tons of Coal (Cardinal)	Annual Tons of Coal (Non-Cardinal)
KY 194 Section 1	18.000	Near end of US 119 Ramp	18.207	Hillcrest Drive	0.207	Minor Arterial	State Secondary	Yes	No	A	2	12/11	No*	Paved with Bituminous Material	11-4/2	No	55	Mixed Bituminous	5,800	9.9	9,000	11.0	4,390	2,041,272	188,390
	18.207	Hillcrest Drive	18.510	North Blackburn Btm	0.303							11			2										
	18.510	North Blackburn Btm	18.979	Bevins Br	0.469																				
	18.979	Bevins Br	21.678	Lawson Br	2.699			No				10			2/1				4,900		7,300			21,347	188,390
KY 194 Section 2	21.678	Lawson Br	23.581	Meathouse Rd	1.903	Minor Arterial	State Secondary	No	No	A	2	10	No*	Paved with Bituminous Material	1	No	55	Mixed Bituminous	4,900	9.9	7,300	11.0	4,390	21,347	188,390
	23.581	Meathouse Rd	24.222	Sunshine Ln	0.641											Yes									
	24.222	Sunshine Ln	25.077	Merritt Williams Rd	0.855							10/11													
	25.077	Merritt Williams Rd	25.197	RR Crossing	0.120							11													
	25.197	RR Crossing	26.140	RR Crossing	0.943							11/10													
	26.140	RR Crossing	26.146	Spears Rd	0.006											No									
	26.146	Spears Rd	26.285	Hurricane Crk	0.139							10													
	26.285	Hurricane Crk	26.616	Ratliff Rd	0.331																				
	26.616	Ratliff Rd	26.653	Fire Station Rd	0.037																				
	26.653	Fire Station Rd	26.667	RR Crossing	0.014																				
	26.667	RR Crossing	26.670	KY 632	0.003																				
KY 632 Section 3	0.000	KY 194	0.333	Rattlesnake Br	0.333	Minor Arterial	State Secondary	No	No	AAA	2	11	No	Combination	3	Yes	55	Mixed Bituminou					2,904	21,347	230,063
	0.333	Rattlesnake Br	0.916	Layne Br	0.583											No									
	0.916	Layne Br	1.133	Coleman Rd	0.217																				
	1.133	Coleman Rd	1.158	RR Crossing	0.025																				
	1.158	RR Crossing	2.044	Gabriel Br	0.886																				
	2.044	Gabriel Br	4.034	KY 1758	1.990							11/10	Yes/WB						3,000	12.9	4,500	15.0	2,837		187,379
KY 632 Section 4	4.034	KY 1758	6.138	Pond Fork	2.104	Minor Arterial	State Secondary	No	No	AAA	2	10	No	Combination	3	No	55	Mixed Bituminou					2,837	94,001	436,080
	6.138	Pond Fork	6.737	KY 199	0.599																				
	6.737	KY 199	6.963	Blackberry Frk	0.226							11			4								2,592		
	6.963	Blackberry Frk	10.459	KY 3419	3.496					AAA/A			Yes /EB & WB		4/2				3,000	12.9	4,500	15.0			
KY 632 Section 5	10.459	KY 3419	11.389	KY 3419	0.930	Minor Arterial	State Secondary	No	No	A	2	11	No	Combination	2	No	55	Mixed Bituminou	4,600	12.9	7,000	15.0	2,592	94,001	436,080
	11.389	KY 3419	11.404	Mill Branch Rd	0.015																		3,820	0	958,897
	11.404	Mill Branch Rd	11.492	Abby Br	0.088											Yes									
	11.492	Abby Br	11.892	Birch Ct	0.400																				
	11.892	Birch Ct	11.932	Carter Br	0.040																				
	11.932	Carter Br	12.831	Maple St	0.899								Yes/WB				55/35								
	12.831	Maple St	13.029	Elm Br	0.198																				
	13.029	Elm Br	13.686	Pecks Br	0.657											No									
	13.686	Pecks Br	13.721	Bamboo Ln	0.035								No		4		35								
	13.721	Bamboo Ln	13.804	5th St-Phelps	0.083																				
	13.804	5th St-Phelps	13.892	Sycamore St	0.088																				
	13.892	Sycamore St	13.913	Ash St	0.021																				
	13.913	Ash St	13.945	Gregory St	0.032																				
	13.945	Gregory St	13.990	Locust St	0.045																				
	13.990	Locust St	14.019	KY 194	0.029																		4,370		

Also includes shoulder failure

	Includes an auxiliary lane for passing	Side of the KY 632:
KY 632	MP 3.053 to MP 3.495	North
KY 632	MP 7.022 to MP 8.182	South/North (staggered)
KY 632	MP 11.932 to MP 12.230	North

Note: *An eastbound passing lane will be added as a part of 12-281.00 as an overall curve improvement from MP 21.3 to MP 22.0
Neither route is on the National Truck Network

Abbreviations
NHS - National Highway System
NTN - National Truck Network
HIS - Highway
EB - Eastbound
WB - Westbound

Existing Conditions Inventory (Continued)

EXISTING CONDITIONS INVENTORY continued

Description						Adequacy Rating						Crashes							
Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length	Pavement Condition	Safety	Service	IRI	Composite	Percentile	Number of Crashes	Number of Fatal Crashes	Number of Injury Crashes	Number of PDO Crashes	ADT (For CCRF Calculation)	Actual Crash Rate	Critical Crash Rate	CCRF
KY 194 Section 1*	18.000	Near end of US 119 Ramp	18.207	Hillcrest Drive	0.207	30	32	20	101	82	56.8	66	1	21	44	4,390	373.300	307.660	1.213
	18.207	Hillcrest Drive	18.510	North Blackburn Btm	0.303														
	18.510	North Blackburn Btm	18.979	Bevins Br	0.469														
	18.979	Bevins Br	21.678	Lawson Br	2.699														
KY 194 Section 2	21.678	Lawson Br	23.581	Meathouse Rd	1.903	30	5.5	20	105	56	3.5	75	1	23	51	4,390	312.540	294.190	1.062
	23.581	Meathouse Rd	24.222	Sunshine Ln	0.641														
	24.222	Sunshine Ln	25.077	Merritt Williams Rd	0.855														
	25.077	Merritt Williams Rd	25.197	RR Crossing	0.120														
	25.197	RR Crossing	26.140	RR Crossing	0.943														
	26.140	RR Crossing	26.146	Spears Rd	0.006														
	26.146	Spears Rd	26.285	Hurricane Crk	0.139														
	26.285	Hurricane Crk	26.616	Ratliff Rd	0.331														
	26.616	Ratliff Rd	26.653	Fire Station Rd	0.037														
	26.653	Fire Station Rd	26.667	RR Crossing	0.014														
	26.667	RR Crossing	26.670	KY 632	0.003														
KY 632 Section 3	0.000	KY 194	0.333	Rattlesnake Br	0.333	30	14.5	19	114	64	7.1	44	1	20	23	2,870	346.950	325.010	1.068
	0.333	Rattlesnake Br	0.916	Layne Br	0.583														
	0.916	Layne Br	1.133	Coleman Rd	0.217														
	1.133	Coleman Rd	1.158	RR Crossing	0.025														
	1.158	RR Crossing	2.044	Gabriel Br	0.886														
	2.044	Gabriel Br	4.034	KY 1758	1.990														
KY 632 Section 4	4.034	KY 1758	6.138	Pond Fork	2.104							22	0	10	12	2,695	116.030	304.380	0.381
	6.138	Pond Fork	6.737	KY 199	0.599														
	6.737	KY 199	6.963	Blackberry Frk	0.226														
	6.963	Blackberry Frk	10.459	KY 3419	3.496														
KY 632 Section 5	10.459	KY 3419	11.389	KY 3419	0.930	30	14.5	19	114	64	7.1	23	0	8	15	3,504	168.380	320.860	0.525
	11.389	KY 3419	11.404	Mill Branch Rd	0.015														
	11.404	Mill Branch Rd	11.492	Abby Br	0.088														
	11.492	Abby Br	11.892	Birch Ct	0.400														
	11.892	Birch Ct	11.932	Carter Br	0.040														
	11.932	Carter Br	12.831	Maple St	0.899														
	12.831	Maple St	13.029	Elm Br	0.198														
	13.029	Elm Br	13.686	Pecks Br	0.657														
	13.686	Pecks Br	13.721	Bamboo Ln	0.035	23	38	20	135	80	50								
	13.721	Bamboo Ln	13.804	5th St-Phelps	0.083														
	13.804	5th St-Phelps	13.892	Sycamore St	0.088														
	13.892	Sycamore St	13.913	Ash St	0.021														
	13.913	Ash St	13.945	Gregory St	0.032														
	13.945	Gregory St	13.990	Locust St	0.045														
	13.990	Locust St	14.019	KY 194	0.029														

	Also includes shoulder failure

	Includes an auxiliary lane for passing	Side of the KY 632:
KY 632	MP 3.053 to MP 3.495	North
KY 632	MP 7.022 to MP 8.182	South/North (staggered)
KY 632	MP 11.932 to MP 12.230	North

*An eastbound passing lane will be added as a part of 12-281.00 as an overall curve improvement from MP 21.3 to MP 22.0
Note: Neither route is on the National Truck Network

Abbreviations
CCRF - Critical Crash Rate Factor
IRI -

Abbreviations
HIS - Highway Inventory System
EB - Eastbound
WB - Westbound

Deteriorated Shoulder along south side of KY 194/KY 632					
KY 194			KY 632		
BEG MP	EMP	DIRECTION	BEG MP	EMP	DIRECTION
18.102	18.121	EB	3.188	3.289	EB
18.150	18.207	EB	3.671	3.996	EB
18.405	18.415	EB	4.500	4.550	EB
18.415	18.456	WB	5.780	5.800	EB
18.516	18.526	EB	5.900	5.925	EB
18.949	18.979	EB	6.291	6.409	EB
19.560	19.670	EB	6.671	6.686	EB
19.923	19.982	EB	6.220	9.723	WB
20.380	20.353	EB	9.723	10.100	WB
20.835	20.845	EB	10.129	10.264	EB
21.300	21.335	EB	10.410	10.439	EB
21.375	21.395	EB	10.500	10.563	EB
21.500	21.541	EB	11.532	11.602	EB
22.279	23.304	EB	11.627	11.914	EB
23.561	23.571	WB	12.284	12.309	EB
23.581	23.591	WB	12.700	12.722	EB
23.810	23.935	EB	12.877	12.912	EB
24.019	24.044	EB	13.066	13.140	EB
24.099	24.129	EB			
24.690	24.710	EB			
26.136	26.146	EB			

Each roadway is then ranked with others in Kentucky. The highest percentile rating along the corridor is 56.8. Even more revealing is the percentile ranking of 3.5 and 7.1, respectively, for KY 194 from MP 18.98 to MP 26.67 at KY 632 and for KY 632 from MP 0.00 to MP 13.69. These low ratings are mainly due to the low service (lack of access control) and safety ratings (high Critical Crash Rate Factors, narrow lanes, shoulders, and geometry) which will become more apparent in the crashes discussion. This indicates 93-96% of the roadways in Kentucky rank higher than these sections of KY 194 and KY 632. An adequacy rating summary is located in **Appendix C**.

D. Existing Structures

An inventory of existing structures along the route is provided in Table 6 (p. 10). As shown, three structures are considered functionally obsolete (FO). A FO bridge is one that does not meet current design standards. They are bridges that do not have adequate lane widths, shoulder widths or vertical clearances to serve current traffic demand or may occasionally flood. No structures were considered structurally deficient, and three bridges did not have the sufficiency ratings calculated.

E. Right-of-Way Widths

From the existing plans, the right-of-way widths along the corridor are between 60 and 100 feet. (See **Appendix D)**.

F. Crashes

As shown in Table 5, from January 1, 2010, to December 31, 2012, the Kentucky State Police's (KSP) Kentucky Collision Analysis for the Public[1] reported a total of 212 crashes within the corridor, including fatality crashes at three locations: MPs 18.40 (KY 194), 20.61 (KY 194) and 3.82 (KY 632). The charts in Figure 5 (p. 11) reveal the following regarding those crashes:

- 64% involved two or more vehicles
- 39% involved injuries
- 55% involved wet pavement
- 63% occurred in daylight
- 40% "ran off the roadway"
- 6 involved head-on crashes
- Over 73% involved curves

A rolling crash analysis was performed for the corridor from January 1, 2008, to January 31, 2012, to correspond with the Kentucky Transportation Center's Research Report for Years 2008–2012[2]. This analysis moves along the corridor in 0.3-mile increments in a manner e.g. from MP 0.0 to MP 0.3, then 0.1 to 0.4 and so on which ensures that every 0.3-mile spot is identified. The actual crash rate was calculated using the number of crashes correctly located in KSP's database. The Critical Crash Rates (CCRs) were calculated for both segments and 0.3-mile spots using the methodology in KTC's Research Report, and the Statewide Rural Crash Rate for two-lane roadways of 215 crashes per 100 million vehicle miles (MVM) for segments and 0.60 crashes per million vehicles (MV) per spot for 0.3-mile spots. The methodology in KTC's Research Report was used to calculate Critical Crash Rate Factors (CCRF) for 1.0 mile segments and 0.3-mile spots by dividing the total CCR per MVM divided by the calculated CCR per MVM. CCRFs greater than 1.0 are an indication that crashes may not be occurring randomly. The KSP's database was used to identify patterns.

The crash segments are illustrated in Table 5 continued (p. 8). To hone in on more specific locations, 0.3 mile spots were the focus of the crash analysis. The crash analysis revealed 31 0.3-mile spots with a CCRF of at least 0.95, (see **Appendix E**). Many of those spots overlapped, therefore 8 segments of crash concern along the corridor were identified are shown in Figure 6 (p. 12).

A review of the crash reports for those spots revealed the following three themes:

- Lost control in a curve
- Lost control
- Majority of crashes on wet pavement

Each crash spot was analyzed to determine potential issues beyond the norm when determining priorities. The analysis summary is located in **Appendix E**.

G. No-Build Traffic Characteristics and Level of Service (LOS)

The 2013 Average Daily Traffic (ADT) volumes provided by KYTC (see **Appendix F** for KYTC Traffic Forecast) were based on historical counts on KY 194 and special turn movement counts (performed for this study) on KY 632. The Kentucky State Data Center estimates the population of Pike County to decline 0.65% annually for the next twenty years. Trend line analysis of the traffic stations on KY 194 from MP 15.0 to MP 57.0 and KY 632 from MP 0.0 to MP 14.0, as well as the traffic stations on US 119 from MP 2.0 to MP 14.0 projected a growth rate of 1.0 % to 1.9 %. The presence of the Kellogg Plant and several other businesses along this corridor was also considered in developing a growth rate. The result, a future year 2040, a growth rate of 1.0% was used for Bevins Branch (MP 19.0) to KY 632 (MP 26.7), whereas a growth rate of 1.5% was used from US119 (MP 18.0) to Bevins Branch (MP 19.0) and then from KY 632 (MP 0.0) to Phelps (MP 14.0). The mainline 2013 and 2040 No-Build ADTs are shown in Figure 7 (p. 13), and on the Compact Disk (CD) at the back of this report.

For the capacity analysis, Class I two-lane highways are those where motorists expect to travel at relatively high speeds. KY 194 and KY 632 are classified as a Class I two-lane highways. Two-lane highways that are major intercity routes, primary connectors of major traffic generators, daily commuter routes, or major links in state or national highway networks are generally assigned to Class I. These facilities serve mostly long-distance trips or provide the connections between facilities that serve long-distance trips. Most arterials or truck roads are considered to be Class I highways. A major intercity route passing through a rugged mountainous area might be described as Class II if drivers recognize that high-speed operation is not feasible due to the terrain, but the route could still be considered to be Class I. Level of Service (LOS) is a performance measure used to determine a roadway or intersection performance.

[1] Kentucky Collision Analysis for the Public, http://crashinformationky.org/KCAP/Public/Home.aspx
[2] University of Kentucky, Kentucky Transportation Center Research Report KTC – 13-13/KSP2-11-1F Analysis of Traffic Crash Data in Kentucky (2008-2012).

Table 6: Structure Inventory

Route	Structure Number	MP	Intersecting Feature	Location	Length	Type	Approach Roadway Width (feet)	Curb to Curb Width (feet)	Skew (degrees)	Sufficiency Rating	Condition	Design Load	Posting Status	Bridge Posting
KY 194	098B00105N	18.97	BEVINS BRANCH	2.5 MI SOUTH OF JCT US 119	27.89	2-Span Concrete Culvert			0	78.90	Not Deficient	H 20	No Restriction	5 At/Above Legal Loads
	098B00106N	23.57	MEATHOUSE BRANCH	2.7 MI N OF W-JCT KY 632	42.98	2-Span Concrete Culvert			45	73.60	Not Deficient	H15	No Restriction	5 At/Above Legal Loads
	098B00107N	25.16	JOHN'S CREEK	1.5 MI N OF W-JCT KY 632	131.89	4 Span Concrete Tee Beam	22.0	22	45	62.30	**Functionally Obsolete**	H 15	No Restriction	5 At/Above Legal Loads
	098B00108N	26.29	HURRICANE BRANCH	.3 MI N OF W-JCT KY 632	26.90	2-Span Concrete Culvert			0	75.70	Not Deficient	H 15	No Restriction	5 At/Above Legal Loads
	098B00109N	26.62	ELKHORN CREEK	.1 MI N OF W-JCT KY 632	26.90	2-Span Concrete Culvert			0	79.20	Not Deficient	H 15	No Restriction	5 At/Above Legal Loads
KY 632	098B00110N	0.90	LANE BRANCH	1 MI SE OF W-JCT KY 194	25.92	2-Span Concrete Culvert	23.0		45	82.40	Not Deficient	H 15	No Restriction	5 At/Above Legal Loads
	098B00111N	1.19	JOHN'S CREEK	1.3 MI SE OF W-JCT KY 194	65.94	2-Span Concrete Tee Beam	22.0	24	0	67.40	**Functionally Obsolete**	H 15	Posted for Load	P Posted for load
	098B00112N	2.04	GABRIEL BRANCH	1.7 MI SE OF W-JCT KY 194	30.84	2-Span Concrete Culvert	22.0		0	70.10	Not Deficient	H 15	No Restriction	10.0-19.9%below
	098R00609N	11.37	KY 632 & RT FK PETER CRK	2.75 MI W OF JCT KY 194	167.98	1-Span Steel Girder and Floorbeam System					Not Calculated		No Restriction	0 >39.9% below
	098R00608N	13.69	KY 632 & RT FK PETER CRK	.35 MI-JCT KY 194	191.93						Not Calculated		No Restriction	0 >39.9% below
	098R00607N	13.90	NS (N&W) SYSTEM	.2 MI W OF JCT KY 194	188.98	1-Span Steel Girder and Floorbeam System	24.0	24	0		Not Calculated		No Restriction	0 >39.9% below
	098B00136N	14.00	PETER CREEK	W @E-JCT KY 194 @PHELPS	76.12	2-Span Concrete Tee Beam	28.9	25.9	30	67.90	**Functionally Obsolete**	H 20	No Restriction	5 At/Above Legal Loads
US 119	098B00258L	7.88	JOHN'S CK,CSXRR,KY194	US 119 OVER KY 194	1391	6-Span Steel Continuous Stringer/Multi-Beam or Girder	54	54	0	99.80	Not Deficient	HS 25	No Restriction	5 At/Above Legal Loads
	098B00258R	7.89	JOHN'S CK,CSXRR,KY194	US 119 OVER KY 194	1361	6-Span Steel Continuous Stringer/Multi-Beam or Girder	42	42		100.00	Not Deficient	HS 25	No Restriction	5 At/Above Legal Loads

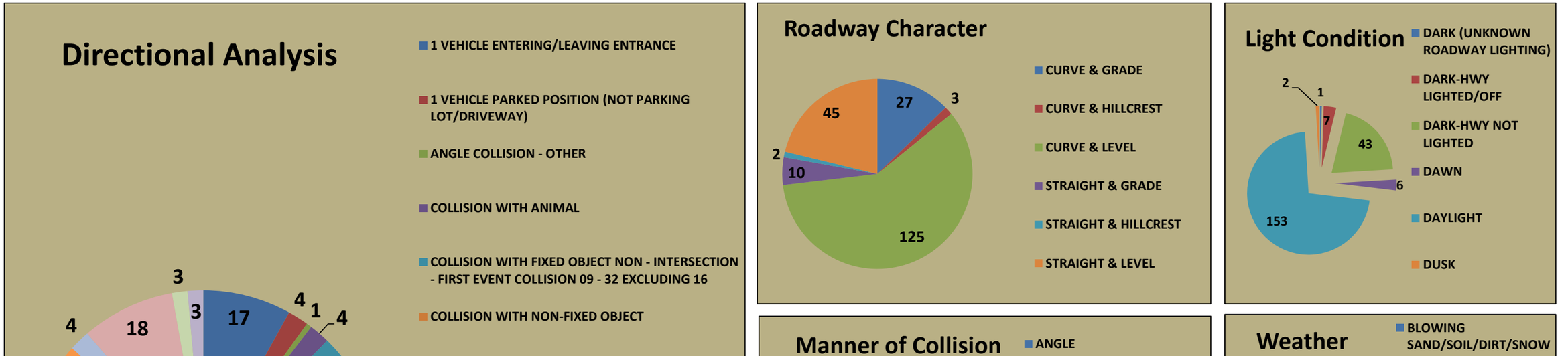


Figure 5: Overall Corridor Crash Data Analysis

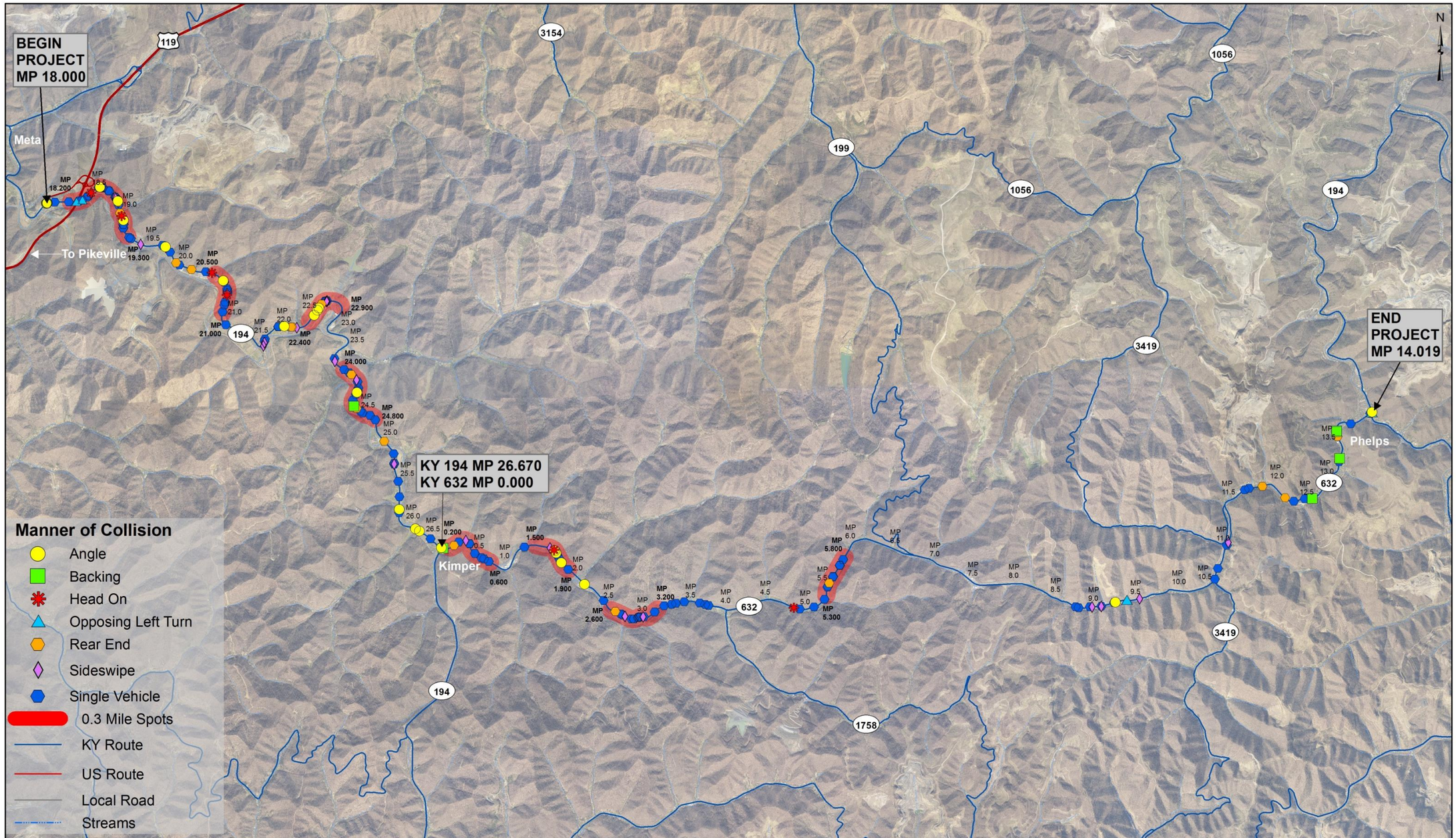


Figure 6: Overall Corridor Crashes and High Crash Locations

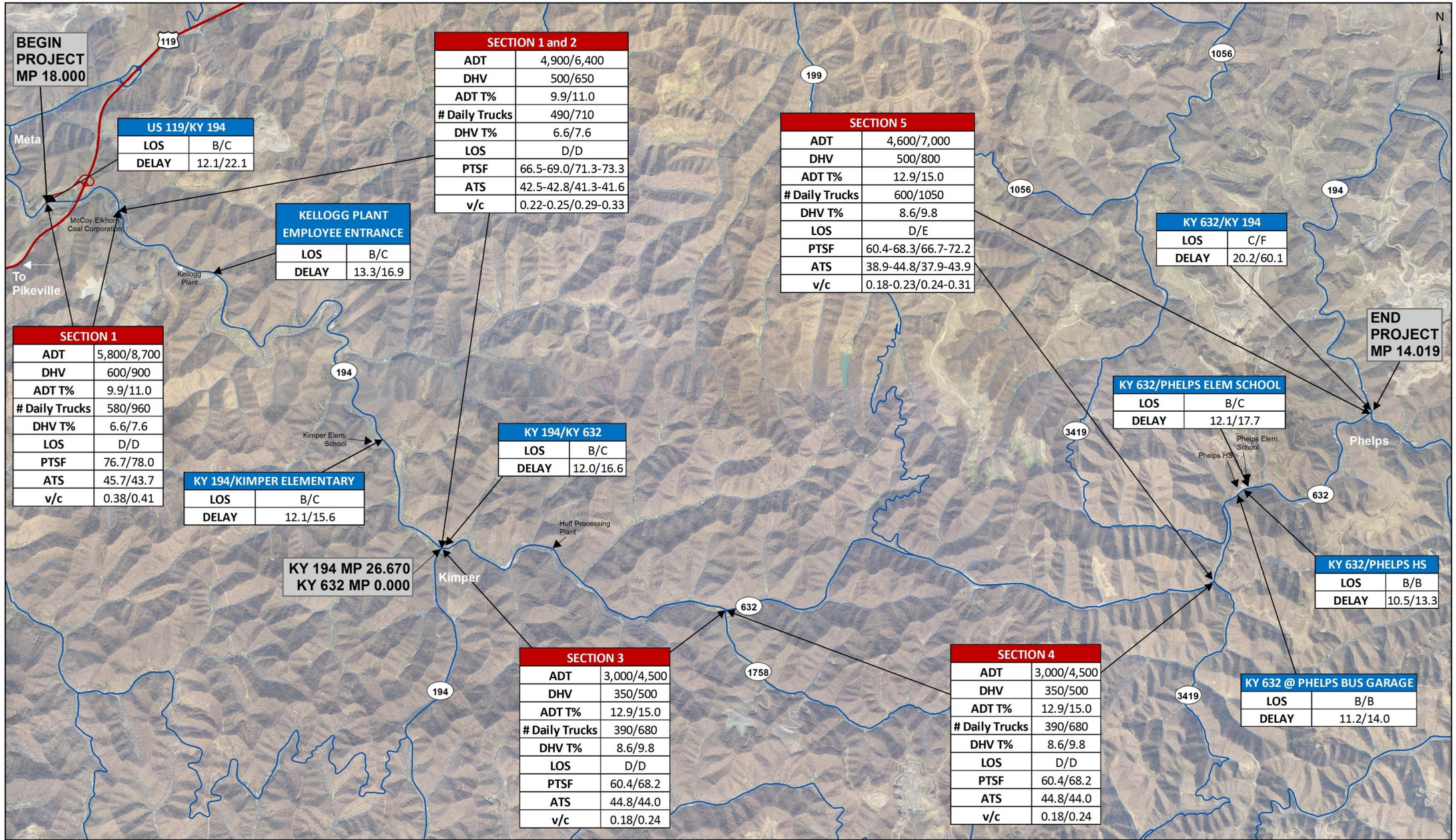


Figure 7: 2013 (Exisiting) and 2040 No-Build Traffic Characteristics

a. Mainline

The LOS criteria for Class I highways are measured by Average Travel Speed (ATS) and Percent Time Spent Following (PTSF), as shown in Table 7. The mainline current (2013) ADT ranges from 3,000 vpd to 5,800 vpd. The lowest ADT is along KY 632 from KY 194 to KY 3419. Given these traffic volumes, capacity is not an issue (see Table 9, p.15). The current year mainline LOS is D due to following-time percents that range from 59.5% to 76.7% and travel speeds from 38.9 mph to 45.7 mph.

Table 7: LOS Criteria for Two-Lane Roads

LOS	Class I Highways	
	ATS (mph)	PTSF (%)
A	>55	≤35
B	>50-55	>35-50
C	>45-50	>50-65
D	>40-45	>65-80
E	≤40	>80

b. Intersections

The levels of service for stop control and signalized intersections are measured in delay (Table 8).

In November 2013, KYTC performed traffic counts at the following intersections for this project. These counts were factored to determine current year ADT volumes and design hourly volume (DHV) turn movements.

- US 119/KY 194
- Kellogg Plant Employee Entrance (easternmost)
- KY 194/Kimper Elementary School
- KY 194/KY 632
- KY 632/Phelps Bus Garage
- KY 632/Phelps High School
- KY 632/Phelps Elementary School
- KY 632/KY 194

Table 8: LOS Intersection Criteria

LOS	Two Way Stop Control Delay (sec/vehicle)	Signalized Intersection (sec/vehicle)
A	0-10	≤10
B	>10-15	>10-20
C	>15-20	>20-35
D	>25-35	>35-55
E	>35-50	>55-80
F	>50	>80

Table 10 (p. 15) illustrates delay in seconds (sec)/vehicle for the intersections for both current year (2013) and the design year (2040). Each intersection operates at LOS B or C for the current year 2013. However, in the future design year (2040), the KY 194/KY 632 intersection drops to LOS F with an intersection delay of 63.3 seconds/vehicle due to the KY 194 eastbound left/through movement.

Turn-lane warrants were conducted for each intersection for AM and PM peak hours for the current and design years. Left turn lane warrants consider the left turn, advancing, and opposing volumes along with the speed limit, the percent heavy vehicles, and number of through lanes. Right turn lane warrants consider the speed limit, right turn and advancing volumes. As shown in Table 11 (p. 16), the following locations warrant left-turn lanes at present due to the AM peak-hour volume:

- Kellogg Plant Employee Entrance
- KY 194/Kimper Elementary School

In 2040, these additional locations warrant a turn lane:

- KY 632/Phelps Elementary School (left and right)
- KY 632/KY 194 (left, near KY 632 MP 14.019)
- The KY 194/KY 632 intersection at KY 194 MP 26.670 is very close to warranting left-turn (AM) and right-turn (PM) lanes.
- In addition, the KY 632/Phelps High School is close to warranting a right-turn lane due to the AM peak hour traffic.

IV. Environmental Overview

The purpose of the environmental overview is to assess potential key environmental resources, impacts, and issues that would be important during the future environmental documentation stage of this project. Abbreviated summaries are located in **Appendix G**. Following is a brief overview of anticipated key environmental areas of concern. The existing environmental conditions associated with each of the five project sections are described, by section, in greater detail in Chapter VII (p. 21).

A. Air Quality

In accordance with the U.S. Environmental Protection Agency (EPA) Green Book Nonattainment Areas for Criteria Pollutants, as of December 5, 2013, Pike County is in attainment for all of 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 the KYTC July 2008 Air Quality Guidance, a reconstruction project for this corridor would not warrant a quantitative air quality analyses for any pollutant.

The purpose of this study is to identify and evaluate potential improvements on KY 194 from US 119 southeast to KY 632 in Kimper and on KY 632 from KY 194 east to KY 194 in Phelps, Kentucky. The proposed improvement alternatives have been determined to generate minimal air quality impacts for CAAA criteria pollutants and have not been linked with any special MSAT concerns. The proposed alternatives would not result in 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 even minor MSAT emissions from this project.

Table 9: Existing and 2040 AM and PM Peak No-Build Mainline Operations

Section Descriptions					2013								2040							
					No Build AM				No Build PM				No Build AM				No Build PM			
Section	Beg MP Description	Beg MP	End MP	End MP Description	LOS	PTSF	ATS	v/c Ratio	LOS	PTSF	ATS	v/c Ratio	LOS	PTSF	ATS	v/c Ratio	LOS	PTSF	ATS	v/c Ratio
1	US 119	18.00	21.30	Beg. Item No.12-281.00	D	71.2	45.6	0.28	D	76.7	45.7	0.38	D	78.0	43.7	0.41	D	70.2	44.1	0.27
2	End Item No. 12-281.00	22.00	26.67	KY 632	D	66.5 - 69.0	42.5 - 42.8	0.22-0.25	D	60.7-66.4	42.4 -43.7	0.18-0.22	D	71.3 - 73.8	41.3 - 41.6	0.29-0.33	D	69.4 - 69.5	41.4 - 42.6	0.26-0.29
3	KY 194/ KY 632	26.76	4.030	KY 1758	D	59.5-66.5	42.5-45.0	0.17	D	60.4	44.8	0.18	D	68.2	44.0	0.24	D	66.7	43.9	0.24
4	KY 1758	4.030	10.46	KY 3419	D	59.0 - 59.5	45.0	0.17	D	60.4	44.8	0.18	D	68.2	44.0	0.24	D	66.7	43.9	0.24
5	KY 3419	10.46	11.60	Phelps Garage	D	59.0 – 59.5	43.5-45.0	0.17	D	60.4 – 61.9	43.2-44.8	0.18-0.19	D	65.8 - 71.5	42.6-44.0	0.23-0.24	D/E	66.7-67.3	42.2-43.9	0.24-0.26
	Phelps Garage	11.60	11.70	Phelps High School	E	63.1	38.9	0.19	E	61.7	38.9	0.19	E	68.2	37.9	0.26	E	67.3	37.7	0.26
	Phelps High School	11.70	14.02	KY 194 in Phelps	D	68.3	41.6	0.23	D	65.6	41.5	0.23	D	71.5	40.2	0.32	D	72.2	40.1	0.31

Table 10: Existing and 2040 AM and PM Peak No-Build Intersection Operation

Turning Movement Number	Location	AM	PM	2013/2040 LOS AM	Delay 2013/2040 AM	2013/2040 LOS PM	Delay 2013/2040 PM
1	US 119/KY 194	7-9	4-6	B/C	12.1/15.4	B/C	12.1/22.1
2	Kellogg Plant Employee Entrance	6:30-8:30	6:30-8:30	B/C	13.3/21.1	B/B	10.9/14.3
3	KY 194 / Kimper Elem.	7-9	2-4	B/C	12.4/16.1	B/B	11.1/13.9
4	KY 194/KY 632	7-9	2-6	B/C	12.1/16.6	B/B	11.8/14.6
5	KY 632 @ Phelps Bus Garage	7-9	2-4	B/B	10.7/12.8	B/B	11.2/14.0
6	KY 632/ Phelps H.S.	7-9	2-4	A/A	7.9/8.2	B/B	11.0/13.3
7	KY 632/ Phelps Elem.	7-9	2-4	B/C	12.1/17.3	B/C	12.2/17.7
8	KY 632 / KY 194	7-9	2-6	C/F	15.4/63.3	C/F	15.5/54.2

Table 11: Turn-Lane Warrants

Turning Lane	Location	2013				2040			
		AM		PM		AM		PM	
		Left Turn Lane Warranted	Right Turn Lane Warranted	Left Turn Lane Warranted	Right Turn Lane Warranted	Left Turn Lane Warranted	Right Turn Lane Warranted	Left Turn Lane Warranted	Right Turn Lane Warranted
1	US 119/KY 194	NA	NA	NA	NA	NA	NA	NA	NA
2	Kellogg Plant Employee Entrance	YES	NO	NO	NO	YES	NO	NO	NO
3	KY 194 / Kimper Elementary School	YES	NO	NO	NO	YES	NO	NO	NO
4	KY 194/KY 632	NO	NO	NO	NO	CLOSE	NO	NO	CLOSE
5	KY 632 @ Phelps Bus Garage	NO	NO	NO	NO	NO	NO	NO	NO
6	KY 632/ Phelps High School	NO	NO	NO	NO	NO	VERY CLOSE	NO	NO
7	KY 632/ Phelps Elem.	NO	NO	NO	NO	YES	YES	YES	NO
8	KY 632 / KY 194	NO	NO	NO	NO	YES	NO	YES	NO

Each left and right turn lane calculation and supporting graphs are located on the supporting documentation CD within this report

B. Noise

The alternatives under consideration in this corridor study are located in mostly rural areas with the exception of Phelps. There are several clusters of residential dwellings, churches, and schools along the route that would likely require noise readings and impact analysis. However, given existing and projected future traffic volumes, it is not anticipated that the noise levels would be an issue.

C. Natural Resources

The project study area includes approximately 22.7 miles and a total of 255 acres along the current roadway. The study area contains a mix of open/developed land (135 acres), scrub-shrub (wetland) habitat (27 acres), and upland woods habitat (93 acres). Open and developed areas are located on the lower, flat ground and consist of residential and commercial development, industrial development at the Kellogg plant, industrial coal processing and storage facilities, and roadway right-of-way. Flatland in the corridor is at a premium and most flat areas have been heavily modified by past development activities, including stream ditching and culvert placement.

1. Aquatic Resources—Streams, Ponds, and Wetlands

The study area includes the following streams and ponds:

- 2 perennial streams: Bevins Branch and Deskins Branch, totaling 1,820 linear feet
- 1 intermittent stream, 470 linear feet
- 6 ephemeral streams, totaling 2,760 linear feet
- 5 ponds, totaling 0.62 acre

The streams generally flow to the central valley and then are routed through road ditches and culverts to John's Creek, which lies just outside the study boundary. For much of its length, KY 194/KY 632 is located parallel to John's Creek and Peter Creek.

A review of the National Wetland Inventory (NWI) maps illustrates that wetlands will be a concern, as there are many hydric soils in the area and scrub-shrub habitat has been identified in the area.

Impacts to aquatic resources that fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE) could require a Clean Water Act Section 404 permit from USACE and a Section 401 Water Quality Certification from the Kentucky Division of Water. USACE generally makes jurisdictional determinations at the final design/permitting stage of a project. At that time, mitigation for impacts to jurisdictional steams, ponds, and wetlands are identified. Jurisdictional determinations and identifying specific wetlands are beyond the scope of this study.

2. Floodway and Floodplain

According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (in **Appendix H**) and associated data, the 100-year floodplain and floodway may be an issue due to the presence of John's Creek. Conversations with stakeholders revealed that Blackburn Bottom frequently floods on the south side of KY 194 near MP 18.6. There were comments referring to other drainage issues in Chapter VI, Early Stakeholders' Meetings.

Alternatives may have involvement with floodplains and would require mitigation to obtain a No-Rise Certification from FEMA. If filling in a floodplain is necessary, then a KDOW Floodplain Construction Permit would also be required. Both Floodplain Zones A and AE are present in the corridors studied herein, and are both considered "high risk areas" by FEMA.

3. Caves and Rockshelters

No caves or rockshelters were observed within the study area; however, the area has been extensively mined for coal. A review of mine maps, topographic quadrangle maps, and geologic maps identified 10 mine portals within or immediately adjacent to the study area. These features appear to be associated with the McCoy Elkhorn Coal facility in the west-central portion of the study area. The study area is not underlain by karst geology, and no springs or sinkholes were observed during the study. As stated by McCoy Elkhorn, their mines are over 400 feet deep; therefore, subsidence would not be an issue. However, additional mines are identified in the Geotechnical Overview.

4. Threatened and Endangered Species

Based on research from the U.S. Fish and Wildlife Service (USFWS), the Kentucky Department of Fish and Wildlife Resources (KDFWR), the Kentucky State Nature Preserves Commission (KSNPC) and review of available database information, federally-listed species potentially occurring within the study area are limited to the following:

- Indiana bat (*Myotis sodalis*; federally endangered)
- Gray bat (*Myotis grisescens*; federally endangered)

The upland woods habitat (93 acres) is considered to be potential Indiana bat summer habitat. The wooded corridors along the perennial and intermittent streams provide potential foraging habitat for the gray bat. Mine portals are present in the study area and provide potential winter roosting habitat for the Indiana bat and potential roosting habitat for the gray bat. The study area is not located in the vicinity of a known maternity roost or hibernacula for the Indiana bat, as designated by the USFWS 2011 maps. Project impacts to habitat for federally listed species would require coordination with the USFWS.

5. Groundwater

The area is not known to be located within a wellhead protection area; however, coordination with water suppliers would be warranted.

6. Geotechnical Concerns

KYTC provided a preliminary geotechnical assessment for the project corridor. This assessment is located in **Appendix I**. The study area is located in the Eastern Kentucky Coal Field Physiographic Region. Available geologic mapping indicates that the project is underlain by bedrock of the Breathitt

Formation. The Breathitt Formation consists of shale, limestone, siltstone, sandstone, coal and clay. The sandstones can be friable and shales highly weatherable. According to the geotechnical overview provided by KYTC, It is typical to assume from an IV:1H to 1.5V:1H for cut slopes as an estimation of-right-of-way for rock cuts in this area. In this study, 1.2H:1V cut slopes and 2H:1V fill slopes were used.

Previous mine works can have a substantial impact on cut slope design. There are numerous places throughout the area where manmade fills are present. These could be present either from mining operations or previous grading for various projects. Some of these areas cannot be compacted and will require remediation for a roadway project.

There are numerous, active permitted mine boundaries in the project corridor. Strip mining, auger mining and multi-level deep mining have taken place in the project area. It is also likely that there are numerous locations where small scale “house coal” mining operations have occurred.

The Pond Creek Coal Bed has been mined extensively in the area. Bridge foundations in this area would typically occur on shallow foundations (spread footings on bedrock) or deep foundations (steel H-piles driven to bedrock or drilled shafts socketed into bedrock). Culverts and walls are typically supported on shallow (either yielding or non-yielding) foundations either on soil or bedrock. Mined areas can be problematic for structure foundations. Detailed study of potential structure locations would need to include an evaluation of past mining activities.

Numerous mine areas with potential alignment overlays have been identified and are shown in the Preliminary Geotechnical Assessment (**Appendix I**). These overlays indicate deep mining for various seams. Additional mines may be encountered during design and construction. Deep mines encountered during construction likely will contain water. Measures to mitigate project-related impacts to mining areas would likely be required, depending on the nature of the impacts. It is also likely that areas of uncompacted or loosely compacted mine spoil exist in the area. These areas can be problematic for road construction.

Soil strata in this area tend to be relatively thin. The soils encountered in the area are generally suitable for embankment construction. Building embankments with non-durable shales may require special methods to obtain acceptable long term results. Suitable rock for embankment construction and rock roadbed is often available in this area of the state. Soils in the area are considered erodible.

There are likely numerous potentially unstable Talus areas in the study area. Talus areas are problematic in drainage areas and may require extensive excavation to remediate. Numerous places where railroad rails are in use as a landslide abatement measure (holding up the downhill side of the road at the creek) were viewed during the site visit. Some of the existing slopes have shown movement in the past and it is likely that many of the existing soil slopes range from marginally stable to unstable. Wet areas could require undercutting and the replacement of soils.

California Bearing Ratios (CBR) values used in pavement designs range from 2 to 4 for soil upgrades in the area and 9 to 11 for a 2-foot durable rock road bed. Wet areas could require undercutting and replacement soils.

D. Socioeconomic Impacts

Following are key areas that could warrant more detailed analysis during future stages of the project:

1. Environmental Justice

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

Several locations in the project study area identified through a windshield survey conducted at different times by Qk4, Big Sandy Area Development District (BSADD), and KYTC appeared to have potential Environmental Justice concerns. Those are located on the Existing Conditions figures contained in Chapter VII.

The BSADD is the Regional Transportation Planning staff that reviewed U.S. Census data; met with community members, business leaders, and local and county officials; and made field observations to identify the presence of and potential for impacts to EJ populations in the study area. The staff concluded that, while there are low-income and minority populations in the study area, project-related effects on these populations were not likely to be disproportionately high and adverse (see **Appendix G**).

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, the 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.

2. Land Use

Outside of direct conversion of privately held land to publicly held right-of-way, this project is not expected to induce land use change along the corridor. Today, the existing land use consists of mostly mining or rural areas, with rural residential and limited commercial developments.

3. Hazardous Materials

Contaminated and potentially hazardous materials are a concern in the corridor. There are old abandoned gas stations, along with new gas stations that would be a concern for underground storage tanks (UST) leakage. No leaking of USTs was observed during a field review. There are also many businesses that appear to be truck, tire and/or car repair shops that could possibly use or store contaminated materials. A detailed database search and field verification to identify potential hazardous conditions was conducted and is summarized in Chapter VII by section and contained in, due to its size, on the supporting documentation CD in the back of this report.

E. Cultural Historic and Archaeological Resources

For this corridor study, the study area was considered the Area of Potential Effect (APE). This corridor study did not include a buffer. The results of a records check from the Kentucky Heritage Council were received on December 11, 2013. The search revealed that there are no recorded historic resources within the project area. One resource located west of the community of Jamboree, but outside the project area, is listed on the National Register of Historic Places (NRHP). Four buildings are recorded on the state survey: two are located northeast of Kimper and all are outside the project study area and APE.

On December 13, 2013, a drive-through survey of the project corridor was made by Corn Island Archaeology, Inc., staff. The objective was to obtain a sense of the presence and number of buildings over 50 years of age that exist along the corridor. Five cemeteries and at least 44 buildings were identified during the survey. Some of the buildings identified as residences may also have associated outbuildings. As this was a windshield survey only, it is possible that other buildings older than 50 years of age exist along this corridor. No research has yet been done to confirm the ages of other standing structures within the corridor. Rather, the effort was placed on identifying those buildings that appear on mapping between 1950 and 1955 (especially the 1954 topographic maps) that are still standing along the roadway. These buildings and cemeteries are located on maps in Chapter VII by section and in **Appendix G** along with an abbreviated report. No determinations of eligibility have been made for this Planning Study, since that will require more site-specific detailed investigations.

To protect the sites, the locations of archaeological resources are generally not disclosed in public documents. Cemeteries are known to occur throughout the corridor and should be avoided if possible. There is also one known archaeological site, and a cemetery with seven graves in close proximity to the archaeology site, located just outside of the study area. This site has two standing structures, the remains of two structures, and a well. Though outside the APE, it could be affected by the project. The project team has been made aware of the site.

F. Section 4(f)

There are no known Section 4(f) resources located within the study area. Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966 requires that prior to the use of any of the resource types listed below, it must be determined either (1) that there is no prudent and feasible alternative that avoids such use and that the project includes all possible planning to minimize harm resulting from such use, or (2) that 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:

- A publicly owned and officially designated park
- A publicly owned and officially designated recreation area
- A publicly owned and officially designated wildlife or waterfowl refuge
- 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)]

V. Project Purpose and Need

The purpose of this project is to improve safety, mobility, and connectivity for travelers along the 23-mile KY 194/KY 632 corridor from US 119 to Phelps in Pike County. Both KY 194 and KY 632 are classified as rural minor arterials. This corridor provides a connection for those travelers from Phelps and areas further east to US 119 and on into Pikeville.

Photo 1: Illustration of Purpose and Need Issues and Existing Conditions

The need for reconstruction and / or spot improvements for KY 194 and KY 632 is characterized by 10-11’ driving lanes, narrow or no shoulders in locations, numerous deficient horizontal (approximately 83) and vertical curves (over 36) using 55 mph, and issues with breaks or slides in the pavement along the route. Due to the coal mining operations in the area and on KY 194 and KY 632, large trucks carrying equipment travel the corridor. Drivers of these large trucks often must swerve out of their lane to negotiate a curve, thereby crowding the drivers in the opposite oncoming lane see Photo 1). There are three schools located within the study area and, therefore, full-size buses are frequently on the roads and the narrow roadways give the drivers little room for error. Within a three-year period, there are 31 0.3 mile spots with CCRFs > .95, indicating the potential that the crashes may not be occurring at random. Some of these spots had as many as 10 crashes in a single location. Over 70% of the crashes occurred in horizontal curves and 55% on wet pavement conditions.

VI. Early Stakeholders’ Meetings

The focus for the initial phase of this project was to identify existing conditions, an alignment, cost estimate, and spot improvements for Section 1 from MP 18.0 to MP 21.3 (the start of Item Number 12-281.00). Within Section 1, there are two major stakeholders: McCoy Elkhorn and the Kellogg Pikeville Plant. Early meetings were held on November 14, 2013 with these two stakeholders in order to define any concerns and obtain their input as the corridor study moved forward. Both meeting minutes and photographs of the notes taken on maps are found in **Appendix J**.

A. Stakeholder Meeting— Kellogg Pikeville Plant (Kellogg)

Kellogg is located on the south side of KY 194 near MP 20.1. They have 370 employees, and approximately 60 to 70 trucks per week are inbound and outbound. Their truck traffic mainly comes from US 119 and their hours of operation are 24/7 with four shifts. Kellogg representatives expressed the following concerns:

- There are drainage issues in front of their plant proper (see Photo 2), especially in the visitors' parking area. Problems were derived from a combination of roof drainage to the front along with silted roadside ditches and/or cross drains along KY 194.

Photo 2: Kellogg Plant Truck Entrance Facing East

- Exiting the visitors' parking area and turning towards US 119 is a major concern. Their receiving schedule is Monday through Friday. Traffic typically spikes on Thursday because approximately 50 employees who do not receive direct deposits pick up their checks onsite and some additional employees also stop to pick up their paycheck stubs. Kellogg representatives requested a right-turn lane at that entrance.
- Large trucks entering the westernmost entrance do not have a right-turn lane and when two trucks arrive simultaneously, it creates a safety hazard. There have been several crashes into the existing guardrail and an adjacent building in this area. Kellogg representatives requested a right-turn lane at that entrance.
- Kellogg representatives noted interest in adding to their facilities by constructing an off-site warehouse. One of the locations that would be considered is across KY 194 from the factory.
- US 119/KY 194 interchange may not be clearly identifiable by Kellogg's out-of-state suppliers. The Kellogg Plant has had three tractor trailers overturn attempting to make the turn from US 119 to KY 194. Kellogg representatives suggested that a flashing light warning of a sharp turn at this ramp might be helpful.
- Inadequate sight distance where the Kellogg trucks exit the factory at the easternmost access point is a safety concern.
- Kellogg representatives also provided locations of the natural gas wells and supply lines from East Kentucky Energy that provides gas services to the Kellogg Plant.

B. Stakeholder Meeting—McCoy Elkhorn Coal Corporation (McCoy)

McCoy has 300 to 500 trucks daily that travel KY 194 to their facility just east of KY 119. The trucks are loaded entering and empty exiting their facility. Their access both in and out for trucks is located directly across from Bevins Branch. They are mining approximately 430 feet below the surface and, therefore, any improvements to KY 194/KY 632 should not impact the mine. Representatives of McCoy had several concerns (see Photo 3) and noted the following:

- McCoy must have continued access both in and out of their main entrance, which is located directly across from Bevins Branch. Poor sight distance also exists at this location.
- McCoy's stockpile area must remain intact.
- From US 119 headed east, there is a conveyor over KY 194 that is expected to be in use only 3 more years, and is therefore, not a concern for this project. However, another conveyor, also east from US 119, will be in operation another 15 years. McCoy representatives stated that this conveyor is a fixed location and cannot be moved.
- Several buildings cannot be relocated due to the nature of their operations.
- There is an area of mine reclamation that could be used for the road improvements. McCoy representatives requested KYTC coordination early-on to allow McCoy time to find other locations for their reclamation.
- A ventilation building along a service road on the north side of KY 194 is fixed and cannot be moved.
- A building on the north side of KY 194 across from the stockpile area that is fixed and cannot be moved.

Photo 3: Concerns at McCoy Elkhorn Corp

- McCoy requires access be retained to a low water crossing they maintain at the east end of their reclamation area.
- Access to an active mine area just east of the reclamation area must be maintained.
- McCoy representatives advised that cemetery is located on an access road operated by Appalachia approximately 2,800 feet east of Deskins Branch.
- Approximately 2,800 feet east of Deskins Branch, two of their employees were killed.
- McCoy staff noted there were several fatalities near MP 22.9 in an area that also has a drainage problem. This is the area that has since been resurfaced with high friction pavement.
- The following additional corridor concerns were mentioned by McCoy representatives:
    1. There have been a couple of fatalities on KY 194 in the curve encompassing MP 23.0, new pavement has been installed.
    2. There is a blind curve on KY 194 near MP 24.5.
    3. There is a bad curve at approximately MP 2.9 on KY 632.
    4. Wrecks occur near MP 6.0 on KY 632 just west of KY 199.

C. Stakeholder Meeting 3

The purpose of this meeting was to talk with representatives of High Ridge Mining and Revelation Energy regarding the project corridor. Berkley Corporation was invited but did not attend. Both High Ridge Mining and Revelation Energy expressed an interest in partnering with KYTC to mine in such a way that their roadways could be usable by KYTC for road construction. Neither company performs underground mining in the area. Revelation Energy identified locations of constraints such as stacker plants, load outs and belts on Section 5. Both companies' deep mines have 200 feet of cover. In Section 2, High Ridge Mining has a belt line that should not be disturbed. When asked their concerns or issues along the corridor, both companies stated that rain is a factor in crashes. They also conveyed that the high friction pavement recently used in the corridor has helped with crashes. They identified one "bad spot" between MP 3.0 to MP 3.5 -- westbound passing lane that merges back to two lanes immediately before a curve.

VII. Analysis of Conditions and Improvements

The study goals are to investigate a complete reconstruction along or near the existing corridor (55-mph design speed) and identify spot improvements that could be implemented to improve safety (40-mph minimum design speed) as an alternative to or in combination with the reconstruction alternative. As shown in Figure 2 (p. 3), the corridor was divided into segments, each approximately five miles in length, with an initial focus on Section 1 from US 119 to the Kellogg Plant. The first section was given immediate attention, with more detailed work due to the substandard roadway issues and constraints that include: requirements of the Kellogg Plant, local coal industries such as McCoy, and other business stakeholders; the magnitude of the US 119 interchange footprint with KY 194; the location of the CSX Railroad and John's Creek through the area; the residences in Blackburn Bottom; anticipated large rock cuts; and a major gabion drainage area traversing the hillside on the north side of KY 194.

The ultimate typical section matches Item Number 12-281.00 and includes two 12-foot-wide lanes and 6-foot-wide paved shoulders except for where passing lanes are provided. The desired design speed is 55 mph for the complete reconstruction alternative and 40 mph for the spot improvements. The typical section for the improvements is shown in Figure 3 (p. 5).

Before developing alignments, information was collected during the existing conditions inventory including a crash history and environmental issues. Horizontal and vertical deficiencies were mapped. In this chapter, each of the five project sections is discussed individually. There are three figures accompanying each section discussion: Crashes by Manner of Collision with 0.3-mile-spot high-crash locations, Existing Conditions, and Improvement Options.

An estimated total cost is provided in the discussion for each section with detailed cost estimates following in Chapter XII (p. 54). In addition, there is a Preliminary Matrix of Impacts for the Total Reconstruction Alternative, (Table 12, p. 57).

Approximate locations of known utility impacts were provided by the Big Sandy Area Development District (BSADD) and are illustrated in Figure 28 (p. 63). All spot improvements have an oversized exhibit located on the enclosed CD at the back of this report.

A. Section 1

Section 1 begins on KY 194 near MP 18.0 and extends east for approximately 3.3 miles before ending at approximately MP 21.3 (the beginning of KYTC's Item Number 12-281.00). It is illustrated in photos (p. 25) and Figures 8-10 (pp. 26-28).

1. Existing Conditions

As part of the US 119 Pikeville to South Williamson reconstruction project (KYTC Item Number 12-308.5), KY 194 was improved by providing 11.8-foot-wide lanes with 6-foot-wide shoulders in each direction from MP 18.0 to approximately MP 18.1. In addition, right- and left-turn lanes were added on KY 194 at the US 119 exit/entrance ramp. At approximately MP 18.1, the shoulder narrows to approximately 2 feet wide and the roadway narrows to 11-foot-wide lanes to Bevins Branch (MP 19.0). The roadway then further narrows to 10-foot-wide lanes east of Bevins Branch Road, with shoulders that vary from one to two feet in width.

2. Crashes

As shown in Table 5, (p. 8) Section 1 has a segment (>0.3 miles in length) that has a Critical Crash Rate Factor (CCRF) that exceeds 1.0 indicating crashes may not be occurring at random. A review of the crash data indicates the following:

- 65 crashes were recorded
- 1 fatality
- 21 Injury crashes

Within Section 1, using KTC's methodology, there are two locations where there are multiple overlapping 0.3 mile spots that exceed a CCRF of .95, see Figure 8 (p. 26)

1) MP 18.2 and MP 19.3.

2) MP 20.5 to MP 21.0.

Because of the number of multiple overlapping spots from MP 18.2 to MP 19.3 was studied as one location. There were 38 crashes between January 1, 2010, and December 31, 2012: 11 of the 38 were injury crashes, and the remaining crashes were classified as Property Damage Only (PDO); 30 of the 37 crashes involved some type of curve, and 19 of those curve-related crashes occurred on wet pavement. Of the 38 crashes, 16 were coded as "ran off roadway;" and 10 of the 16 were on wet pavement. As-build plans were unreadable for this section of KY 194; therefore, the relation of the crash to curves was taken from the crash reports.

Between MP 20.5 and MP 21.0 there were 12 crashes of which 7 involved wet pavement. Of the 12 crashes, 7 were coded as "ran off roadway;" 11 of the crashes were curve-related according to the crash reports, and appear from latitude/longitude were related to the deficient horizontal curves.

3. Deficiencies

As shown in Figure 9 (p. 27), based on available existing plans from MP 18.0 to MP 21.3, there are vertical curves that do not currently meet Stopping Sight Distance criteria. These curves include:

- 2 that do not meet 40 mph design speed.
- 4 that do not meet 55 mph design speed.

There are 11 horizontal curves that exceed the current minimum horizontal radius criteria and do not meet the 55 mph design speed.

Photo 4: KY194/Bevins Branch Intersection

Field visits and stakeholder involvement identified two locations where sight distance is an issue in Section 1. As shown in Photo 4, a motorist sitting at the stop bar waiting to exit Bevins Branch Road encounters sight distance issues looking east. Also, at the Kellogg Pikeville Plant's easternmost employee parking lot, sight distance to the east is limited (Photo 5).

4. Constraints Affecting Alignment

As stated from the early stakeholder meeting with McCoy representatives, there are several structures and areas that are considered "fixed" and unable to be moved.

- The largest conveyor traversing KY 194 at 300 feet east of MP 19.00
- Entrance to McCoy Elkhorn
- Stockpile of coal
- Ventilation building
- Major transmission line that crosses near the Kellogg Plant

In addition, it was advised large trucks travel KY 194 carrying large equipment and coal (pg. 25); a major gabion area just east of the US 119 overpass; and the maximum radius would be necessary on several horizontal curves to ensure that the fixed areas were not encroached upon by proposed road reconstruction or spot improvements.

Figure 9 (p. 27) illustrates a summary of the environmental overview for Section 1 from US 119 to Deskins Branch. The following were identified as potential issues that may affect the alignment of KY 194/KY 632 in Section 1:

Photo 5: KY 194 Kellogg Employee Entrance (easternmost)

- John's Creek (south side of KY 194).
- Potential floodway and 100-year floodplain impacts.
- Large cuts that will require waste disposal areas.
- Numerous mine areas with potential alignment overlays.
- An archaeological site that may be affected and should be investigated further for NRHP eligibility as this section moves forward into future phases.
- Residences in Blackburn Bottom on the south side of KY 194 near MP 18.5.
- CSX Railroad alongside the south side of KY 194 (south of John's Creek).

5. Traffic Forecasts and LOS

This section of KY 194 currently carries 5,800 vpd and is projected to carry 8,700 vpd in 2040. The average daily truck percentage for 2013 is 9.9% and it is expected to increase to 11.0% by 2040.

Based on capacity analysis, the existing and future LOS is LOS D with an ATS of 45.7 mph and 43.7 mph, respectively. The current PTSF is 76.7% and is expected to be 78.0% in 2040. The existing and design year volume-to-capacity ratios are well under 1.0 indicating that the two-lane roadway is and will be operating well under capacity.

Intersections along KY 194 at US 119 and at the easternmost Kellogg Pikeville Plant entrance were analyzed for traffic operations. The 2010 Highway Capacity Manual and accompanying software (HCS) were used to calculate delay for both the current year (2013) and design year (2040). They both currently operate at LOS B, and are expected to operate at LOS C in 2040.

The easternmost Kellogg Pikeville Plant employee entrance was also analyzed for left- and right-turn lane warrants. For existing conditions and for the design year, this entrance warrants a left-turn lane due to the AM peak hour volumes (see Table 11, p. 16)

Existing (2013) and future design year traffic forecasts (2040) for Section 1 are shown in Figure 9 (p 27).

6. Alternatives

Section 1 was analyzed for a 55-mph Total Reconstruction. Three 40-mph spot improvements were identified based primarily on crash history, stakeholder input, and field visits. Both the Total Reconstruction alternative and spot improvements are depicted in Figure 10 (p.28).

a. Total Reconstruction

The Total Reconstruction alternative follows the existing alignment beginning at MP 18.68 just past the rock wall, (p. 25) and follows the existing alignment (centerline of the new roadway along shoulder of existing roadway) extending under the conveyors, and protecting the stockpile at McCoy. Just past the coal stockpile, (to provide for the minimum radius), two off-alignment curves are necessary, one near McCoy's helipad and the other on a flat area just west of Kellogg. The alignment then pulls north of Kellogg to provide for better drainage, and stays near existing alignment before tying into Item Number 12-281.00. This Total Reconstruction alternative for Section 1 is 2.30 miles in length and provides:

- Right-turn lane at the main McCoy Elkhorn entrance.
- Right-turn lanes at the westernmost and easternmost entrances to the Kellogg Plant.
- Left-turn lane at the easternmost entrance to the Kellogg Plant.
- Westbound passing lane between approximate Stations 149+00 (MP19.2) and the bridge over John's Creek at 167+00 (MP 19.5). This passing lane will complement the eastbound passing lane proposed as a part of Item Number 12-281.00.

Potential Impacts and Environmental Concerns:

Environmental resources and concerns identified in the study area could require detailed environmental assessment through the NEPA process to identify resources potential for impacts as a result of the Total Reconstruction alternative, and mitigation measures should those be warranted. The assessment could include, but not necessarily be limited to, the following:

- McCoy Elkhorn Minerals Lab
- McCoy Elkhorn Helipad
- Possible Oil Well lines impact (#CF-2)
- Waste area site for 773,000 cubic yards.
- Archaeological site located between the McCoy stockpile and the Kellogg Plant; potentially NRHP eligible.
- 7 structures over 50 years old; potentially NRHP eligible.
- Scrub-shrub (wetland) habitat along the corridor.
- Presence of Indiana bat and gray bat habitat (federal endangered species).
- Floodway/floodplain.
- Noise from future roadway in residential and other areas.
- It should be discussed as to whether a passing lane ending right before a major coal operation would encourage higher speeds through a congested area.

Potential impacts for Section 1 are summarized in Table 12 (p. 57).

b. Spot Improvements

As with the Total Reconstruction alternative, environmental resources and concerns identified in the study area could require detailed environmental assessment through the NEPA process to identify resources potential for impacts as a result of the spot improvements, and mitigation measures should those be warranted. Three spot improvements were investigated for Section 1: Spots 1, 2, and 3.

- Spot 1 Because of the magnitude of the US 119 interchange footprint with KY 194, the location of the railroad, the houses in Blackburn Bottom, the rock cut that would be required, John's Creek, and a major gabion drainage area traversing the hillside on the north side of KY 194, only minor shoulder widening was recommended from MP 18.1 to MP 18.6 (see p. 25)

The purpose of this spot improvement is to improve safety and roadway geometrics by providing two 12-foot-wide lanes and 6-foot-wide paved shoulders from MP 18.0 to MP 18.7. The widening will be shifted to the north side due to the location of the floodplain and the Blackburn Bottom at MP 18.5 development (Figure 10, p. 28). Based on the proposed typical section, the disturbed limits (with 1.2H:1V cut slopes from the roadside ditch bench) for this preliminary alignment will cut into the existing US 119 ramp. To minimize this impact, the widths of the shoulders were reduced to 4 feet. Without geotechnical exploration and additional field surveys, it is not possible to determine if this spot improvement with the reduced typical section is feasible due to the proximity of the reduced disturbed limits and constraints noted above. If a retaining wall is allowable, (see Photo 6) it would cost approximately $456,000 (assuming 500 feet long with an average height of 16 feet estimated with $70/square foot cost).

This spot improvement could be coupled with the Section 1 Total Reconstruction Alternative. A suitable place for excess material will need to be located.

Potential Impacts and Environmental Concerns:

- **Spot 1** Spot Improvement 1 must occur on the north side due to John's Creek; the cut slopes are very close to the ramps to and from northbound US 119 to KY 194 (Photo 6).

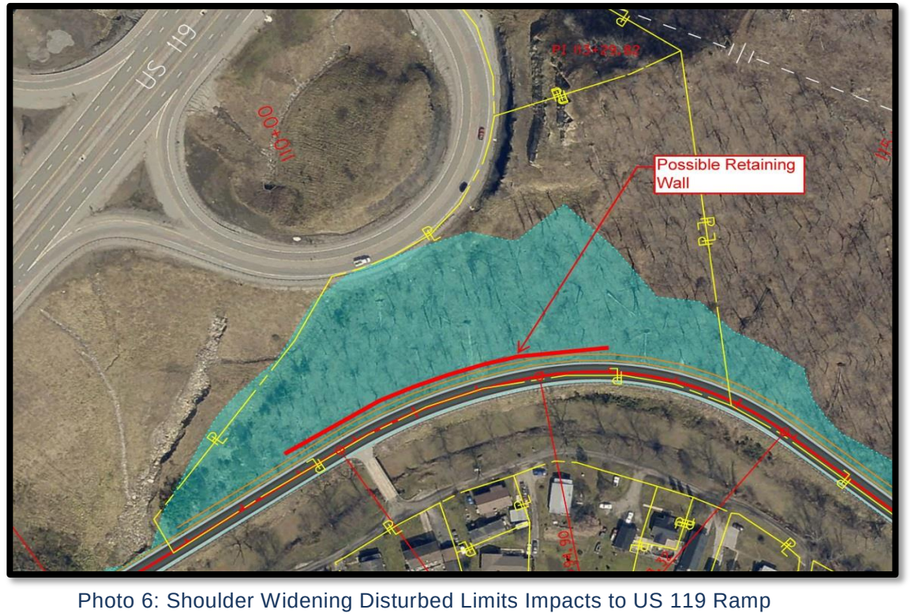


Photo 6: Shoulder Widening Disturbed Limits Impacts to US 119 Ramp

- Presence of floodway/100-year floodplain.
- US 119 Ramp.
- 10 structures older than 50 years located along KY 194; potentially NRHP eligible.
- Presence of Indiana bat and gray bat habitat.

- **Spot 2** The purpose of this spot improvement is to improve safety by improving sight distance at Bevin's Branch Road by realigning KY 194. The spot improvement will include two 12-foot-wide lanes and 6-foot-wide paved shoulders at Bevin's Branch from approximately MP 18.8 to MP 19.2 to improve sight distance (Photo 4, p. 22) This spot improvement is included in the Total Reconstruction alternative for Section 1 (see Figure 10, p. 28).
  - Presence of Indiana and Gray Bat habitat;
  - 1 structure potentially NRHP eligible.
  - Upland woods habitat.
  - 100-year floodplain.
- **Spot 3** The purpose of this spot improvement is to improve safety and roadway geometrics in front of the Kellogg Plant from approximately MP 19.8 to MP 20.5. This spot improvement is included in the Total Reconstruction Alternative for Section 1 (Figure 10, p. 28).

  It includes the following:
  - Shifting KY 194 to the north to provide two 12-foot-wide lanes and 6-foot-wide shoulders, thereby providing better access to Kellogg, and improving drainage at the plant.
  - Replacing the right-turn lane into the westernmost Kellogg Plant entrance.
  - Adding a left-turn lane into the easternmost employee entrance.
  - Presence of Indiana bat and gray bat habitat.
  - Upland woods habitat.
  - Potential jurisdictional wetland.

7. Preliminary Alignment and Cost Estimates

The Total Reconstruction Alternative cost is estimated at $19,639,000.

The following are the total costs (including Design, Right-of-Way, and Utility and Construction phases) associated with Spot Improvements.

- Spot 1 - $4,300,000
- Spot 2 - $1.492,000
- Spot 3 - $4,600,000

Due to the terrain, the excavation required to make improvements in the corridor can become significant. In an effort to improve cost estimates, an attempt to identify waste area sites for the Total Reconstruction Alternative was made and stream impacts at that site(s) were quantified. The Total Reconstruction Alternative has estimated waste area stream impacts of 1,400 linear feet of stream. These stream impacts were estimated using $650/linear foot of stream for a total of $910,000. These fees are not included in the overall total cost estimate. The estimate for waste area stream impacts for Spot 1, 2, and 3 are estimated to be $234,000, $39,000, and $201,500, respectively. These waste area stream impact in-lieu fee cost estimates are not included in the total cost estimate for the spots.

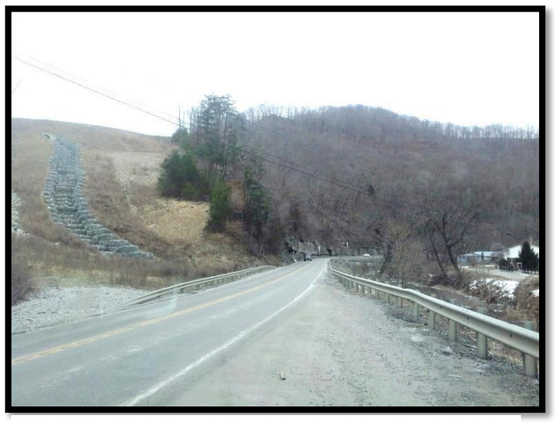
Photo Tour Section 1

McCoy Elkhorn Helipad on Southside of KY 194 near MP 19.5

Substation East of Kellogg

MP 20.0, Kellogg West Entrance Looking East

MP 20.5, High Crash Spot 2 - Looking East



MP 18.5, High Crash Spot 1 - Looking East Gabion Baskets

An Example of Typical Equipment Hauled on KY 194 and KY 632

MP 18.5, High Crash Spot 1 - Looking West at KY 119 Bridge Piers

McCoy Elkhorn Conveyor just East of Bevins Branch Road

MP 18.5, High Crash Spot 1 - Looking East at Rock Wall where Section 1 Begins

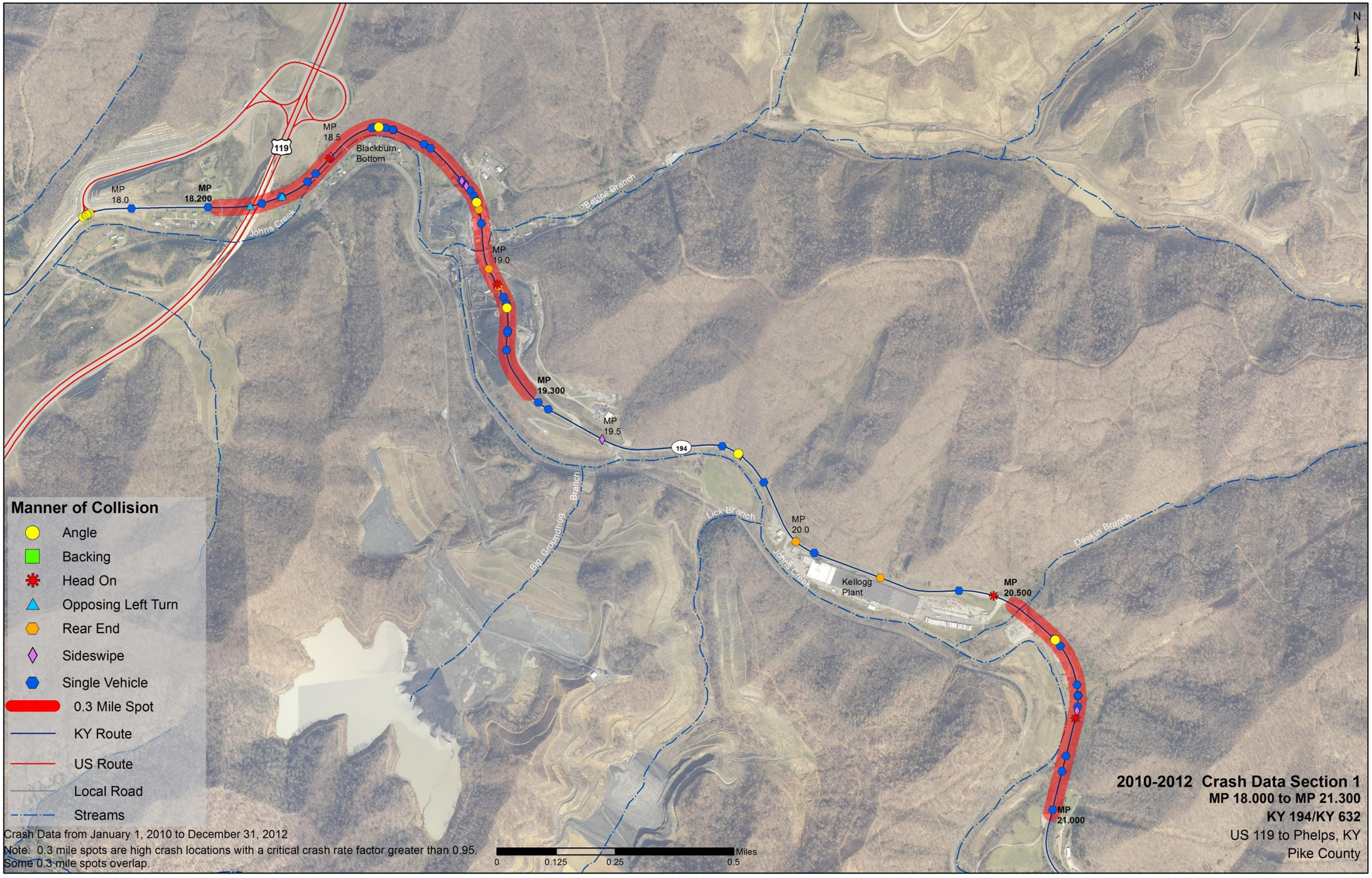


Figure 8: 2010-2012 Crash Data Section 1

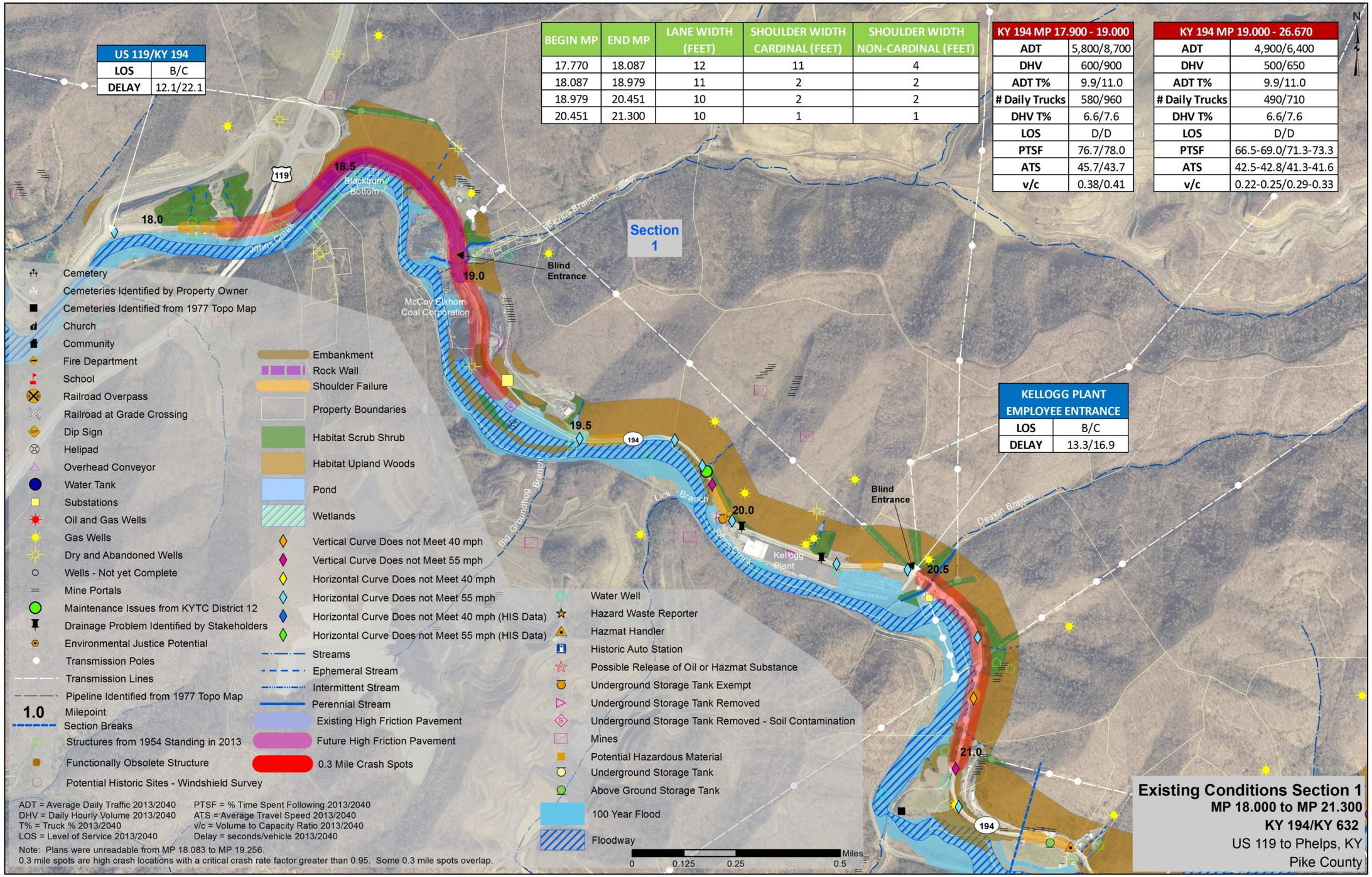


Figure 9: Existing Conditions Section 1

Spot Improvement 1 - Shoulder widening to 4 foot paved shoulders

Spot Improvement 2 - Improve sight distance at Bevins Branch Road

Spot Improvement 3 - Reconstruct from near MP 20.0 to approximately MP 20.6 to improve substandard geometrics, improve sight distance and provide for right turn lanes at both entrances and left turn at eastern most entrance

0 0.125 0.25 0.5 Miles

Improvement Options Section 1
MP 18.000 to MP 21.300
KY 194/KY 632
US 119 to Phelps, KY
Pike County

Figure 10: Improvement Options for Section 1

B. Section 2

Section 2 begins at the end of KYTC Item Number 12-281.00 at approximately MP 22.0 and ends at KY 632 (MP 26.67 for KY 194). Existing conditions are illustrated beginning with photos (p. 32) and Figures 12-13, pp. 33-34.

1. Existing Conditions

Beginning at MP 21.7, KY 194 narrows to 10-foot-wide lanes with 1-foot-wide shoulders to MP 24.2 (Sunshine Lane). Between MP 24.2 and the railroad crossing, the travel lanes vary between 10 and 11 feet wide. There is a large mining operation within a very substandard section of KY 194 between MP 22.0 to MP 23.5. There is a trailer park located near MP 23.7. From the railroad crossing at MP 25.2 and continuing to KY 632 (MP 26.67), the lanes narrow to 10 feet. The shoulder has deteriorated on KY 194 between Meathouse Road (MP 23.6) and the railroad crossing (MP 25.2). There are also three at grade railroad crossings in this section.

2. Crashes

This section has a Critical Crash Rate Factor (CCRF) that is 0.825. A review of the crash data indicates there were 58 crashes, 1 of which was a fatality and 23 of which resulted in injuries (Table 5, continued on p. 8).

In Section 2 there are two locations that have overlapping 0.3-mile high-crash areas: MP 22.4 to MP 22.9 and MP 24.0 to MP 24.8 (see Figure 12, p. 33).

- **MP 22.4 to MP 22.9** had 1 fatality crash, 4 injury crashes, and 10 Property Damage Only (PDO) crashes. Eleven were on wet pavement, 12 lost control (10 of which occurred in a deficient curve) with 13 during daylight hours.

- **MP 24.0 to MP 24.8** had 23 crashes with no fatalities, 12 injury crashes, and 11 PDO crashes. Crash breakdown at this location included 16 single vehicles, 2 with animals, 12 on wet pavement, 10 coded “ran off roadway,” 15 in deficient curves, and 2 rear-ends. A review of crash reports (only 17 available) revealed that only 2 were due to driver inattention while 15 occurred during the daylight hours.

3. Deficiencies

Based on available existing plans for Section 2 from MP 22.0 to MP 26.7, there are a number of deficiencies in addition to lane and shoulder widths. The following curves do not meet current design criteria:

- 1 horizontal curve that does not meet the 40-mph design speed.
- 9 horizontal curves that do not meet 55-mph design speed.
- 5 vertical curves that do not meet 40-mph design speed.
- 11 vertical curves that do not meet 55 mph design speed.

There is one bridge over John’s Creek at MP 25.2 that is considered functionally obsolete (FO) and has a sufficiency rating of 62.3.

4. Constraints Affecting Alignment

Constraints affecting Section 2 are John’s Creek, High Ridge Mining Operation at MP 22.0, development in Kimper, the railroad, and side hill cuts. The minimum radius also played a large role in the realignment.

5. Traffic Forecasts and LOS

Existing (2013) and future design year traffic forecasts (2040) are shown in Figure 13, (p. 34). This section of KY 194 currently carries 4,900 vpd and is projected to carry 6,400 vpd in 2040. The average daily truck percentage for 2013 is 9.9% and is projected to increase to 11.0% by 2040.

Based on capacity analysis the existing and future level of service for Section 2 is LOS D with the ATS ranging from 42.5 to 42.8 mph for existing conditions and from 41.3 to 43.6 mph in 2040. The current PTSF ranges from 66.5% to 69.0%. In 2040, the PTSF is expected to range between 71.3% and 73.3%. As shown in Figure 13 (p.34), the existing and design year v/c ratios are well under 1.0 indicating that the two-lane roadway does and will continue to operate well under capacity. HCS calculations are found on CD in the back of this report.

The KY 194/Kimper Elementary School entrance and KY194/KY 632 intersection were both analyzed for traffic operations. They both currently operate at LOS B and are expected to operate at LOS C in 2040.

Both were analyzed for left- and right-turn lane warrants. Currently, and in the design year, the intersection at Kimper Elementary School warrants a left-turn lane due to the AM peak hour volumes. The intersection of KY 632 does not currently warrant turn lanes; however, in the design year 2040, future volumes will approach warrants for both turn lanes (Table 11, p. 16).

6. Alternatives

Section 2 was analyzed for a 55-mph total reconstruction, and then 40-mph spot improvements were identified for possible improvements based primarily on crash history. Both the Total Reconstruction alternative and the spot improvements are depicted in Figure 14 (p. 35).

a. Total Reconstruction

Section 2 begins at the end of KYTC Item Number 12-281.00 near MP 22.0. Two alternatives were studied near MP 22.0:

1) The first alternative bridged over John's Creek (twice) and the CSX Railroad Spur and under the coal conveyor (tube) through the High Ridge Mining Company property (see photo to right).

2) The second alternative cut through the mountain south of the High Ridge Mining facility to avoid High Ridge Mining Company's assets. This alternative was not advanced because of the excessive additional excavation (7 million cubic yards) and impacts to a major transmission line and tower (see Figure 14, p. 35).

Based on these potential impacts, the alternative that was advanced stays closer to the existing corridor, and crosses John's Creek twice, passing under a coal conveyer (tube) - (see Photo 7 and Figure 11, right). Continuing eastward, efforts were made to minimize relocations and stream impacts. The alignment includes two at-grade crossings of the railroad and would be slightly north of Kimper Elementary School. This section rejoins the existing alignment near MP 26.0 and ends at KY 632. (See Figure 14, p. 35).

The potential impacts for Section 2 include over 11 million cubic yards of excavation; therefore, it will most likely be necessary to divide it into two sections for construction purposes. Passing lanes were not added in Section 2 due to the long tangent sections that allow for normal passing. Efforts were made to minimize the amount of relocations and stream impacts (second highest potential of any of the sections) with presence of the 100-year floodplain. However, this reconstruction alignment will have 1,400 linear feet of stream impacts, could affect as many as 60 parcels, and two structures and four parcels that are at least 50 years old and will require assessment for NRHP eligibility. There are also potentially 70 acres of Upland Woods Habitat that may be impacted, which would limit tree cutting. There are the potential for three gas well impacts and four mine portals within the disturbed limits. Waste areas and stream impacts will also be an issue

Potential impacts for Section 2 are summarized in Table 12 (p.57).

Additional Section 2 features include (oversized exhibits have stations and are located on CD):

- Approximately 3.99 miles in mountainous terrain.

Below milepoints are approximate existing milepoints.

- Left-turn lanes to Varney Branch and Kimper Elementary School (MP 25.0) at Sta. 300+70.
- Bridge over Johns Creek at just east of Varney Branch.

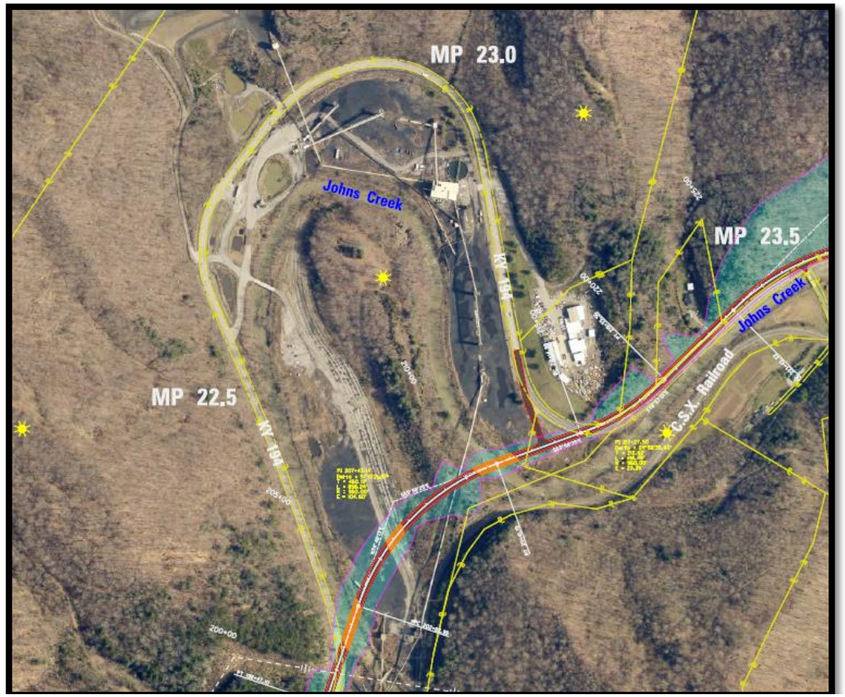


Photo 7: Plan view of Section 2 Alternative 1 at High Ridge Mining MP 22.5

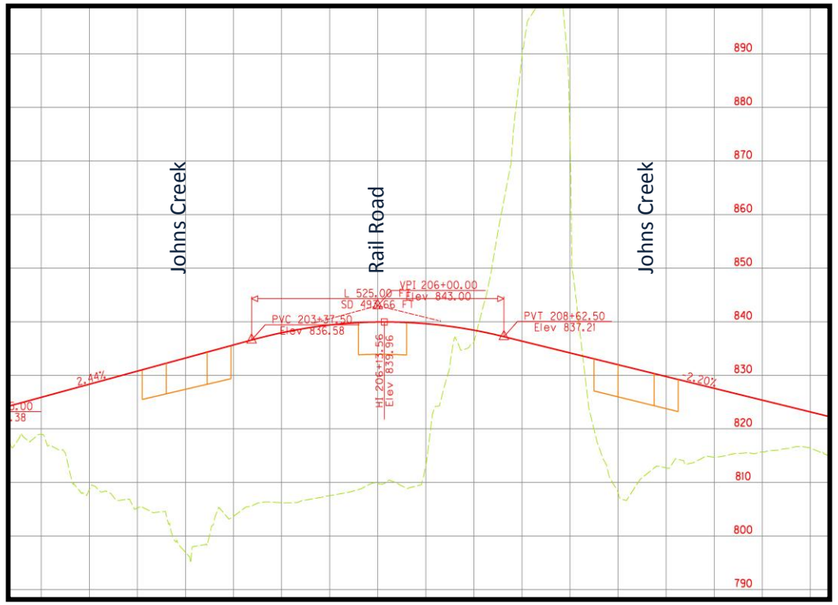


Figure 11: Proposed Profile of Section 2 Alternative 1 at High Ridge Mining Near MP 22.5

- At-grade railroad crossings near MP 25.2 (Sta. 307+50) and MP 26.1 (Sta. 360+00).
- A long tangent MP 25.0 and MP 26.0 (between Sta. 314+00 and Sta. 331+00) that provides eastbound and westbound passing opportunity.
- An alignment that stays on existing alignment from near Spears Road at MP 26.1 (Sta. 360+00) to MP 26.7 (Sta. 390+00) to the end of Section 2.
- Right- and left-turn lane approaches to KY 194.
- Steepest grade is 4% from mountain cut east to Deskins Branch near MP 26.0 (348+50) eastward.
- 11,346,000 CY Excavation, 27,900 SF Bridges

b. Spot Improvements

To address high crash locations at deficient curve locations, two spot improvements were developed. As with the Total Reconstruction alternative, environmental resources and concerns identified in the study area could require detailed environmental assessment through the NEPA process to identify resources potential for impacts as a result of the spot improvements, and mitigation measures should those be warranted. Spots 4 and 5 are illustrated in Figure 14 (p. 35)

- **Spot 4—**(MP 22.4 to MP 23.0). This improvement is to widen the horseshoe curve in place. It is approximately 0.63 mile in length with an estimated construction cost of $5 million (37% is earthwork). This is a high crash location and an area with shoulder failure. Crashes may be minimized with high friction pavement. Most of the crashes were due to losing control in the curve and many occurred during wet weather conditions.

- **Spot 5—**(MP 24.0 to MP 25.0). This spot improvement is approximately 0.97 mile in length and is also a high crash location (many in wet weather) with shoulder failure. Rock walls and mine portals are located in the corridor. This improvement requires a long bridge over John's Creek and a culvert to transition back to the existing roadway. This would eliminate the shoulder failure in this section. The spot improvement was extended east to improve sight distance approaching Kimper Elementary School from the west. When a driver is sitting at the Kimper Elementary School entrance and looks west to travel KY 194, there is a rise that makes it difficult to see an oncoming vehicle. The cost estimate for the Spot 5 improvement is $10.3 million (26% earthwork and 21% bridge).

7. Preliminary Alignment and Cost Estimates

The Total Reconstruction alternative cost is estimated at $90,520,000. This section would likely have to be divided into two construction sections due to the estimated construction costs and large amount of excavation material (11M cubic yards). Two locations may be suitable for such a break and are at MP 24.7 (280+00) or MP 25.3 (310+00).The total cost estimates for spot improvements are as follows:

- Spot 4 - $5,300,000
- Spot 5 - $11,100,000

Due to the terrain, the excavation required to make improvements in the corridor can become significant. In an effort to improve cost estimates, an attempt to identify waste area sites for the Total Reconstruction Alternative was made and stream impacts at that site(s) were quantified. The Total Reconstruction Alternative has estimated waste area stream impacts of 1,400 linear feet of stream. These stream impacts were estimated using $650/linear foot of stream for a total of $910,000. These fees are not included in the overall total cost estimate. The estimate for waste area stream impacts for Spot 4 and 5 are estimated to be $97,500, $136,500, respectively. These waste area stream impact in-lieu fee cost estimates are not included in the total cost estimate for these spots.

Photo Tour Section 2

MP 25.0, Kimper Elementary School from Hill across KY 194

MP 24.3, High Crash Spot 4 - Stream

MP 22.0, Watertown Hill - Skid Resistant Pavement Looking West

MP 22.5, High Crash Spot 3 - Looking West

MP 23.0, High Crash Spot 3 - Looking West

MP 22.4 to MP 22.9 High Crash Location

MP 25.0, Kimper Elementary Sight Distance Looking West

MP 24.8. High Crash Spot 4 - Looking West into Curve

Looking West at Row of Houses

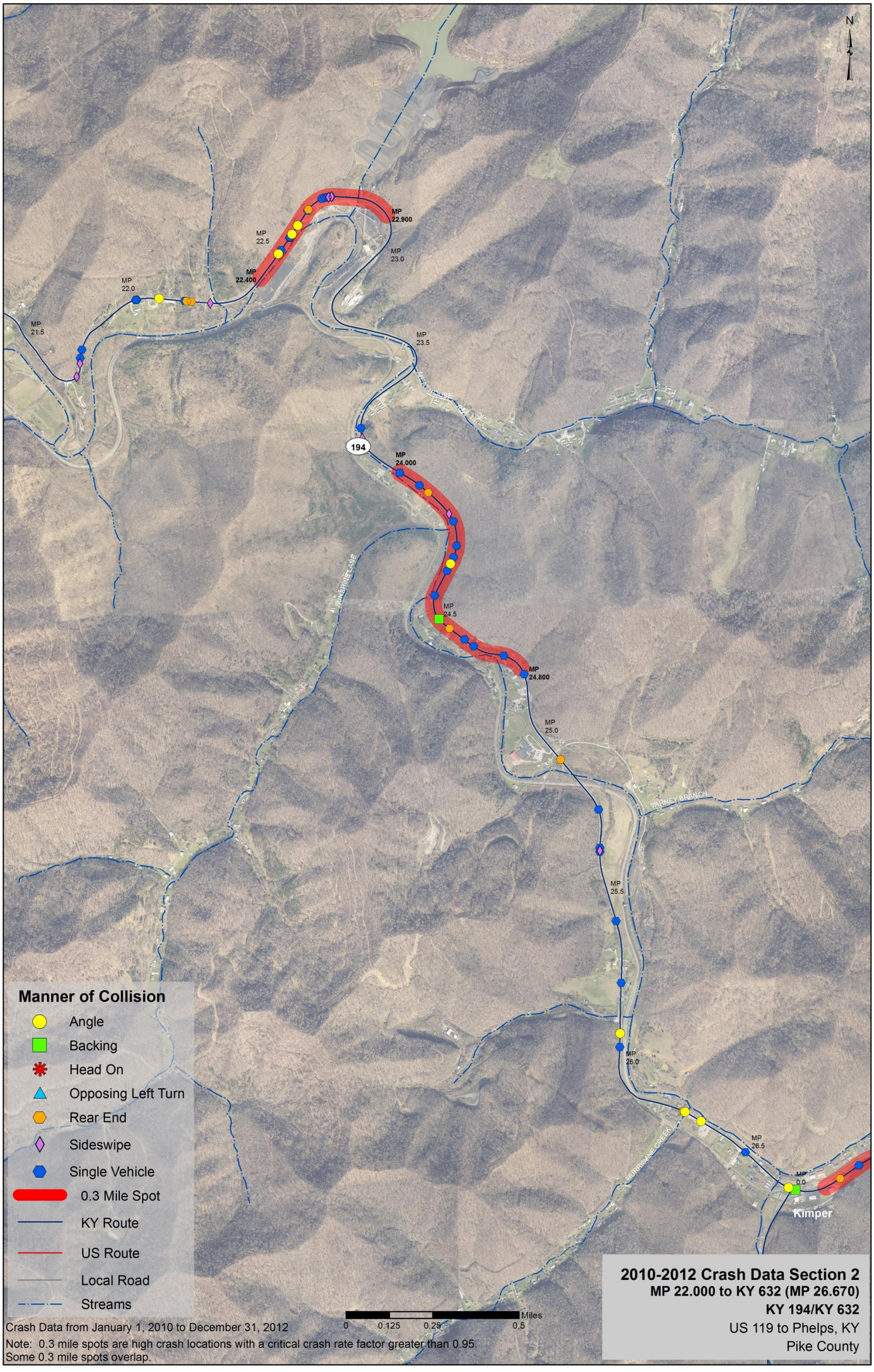


Figure 12: 2010 - 2012 Crash Data Section 2

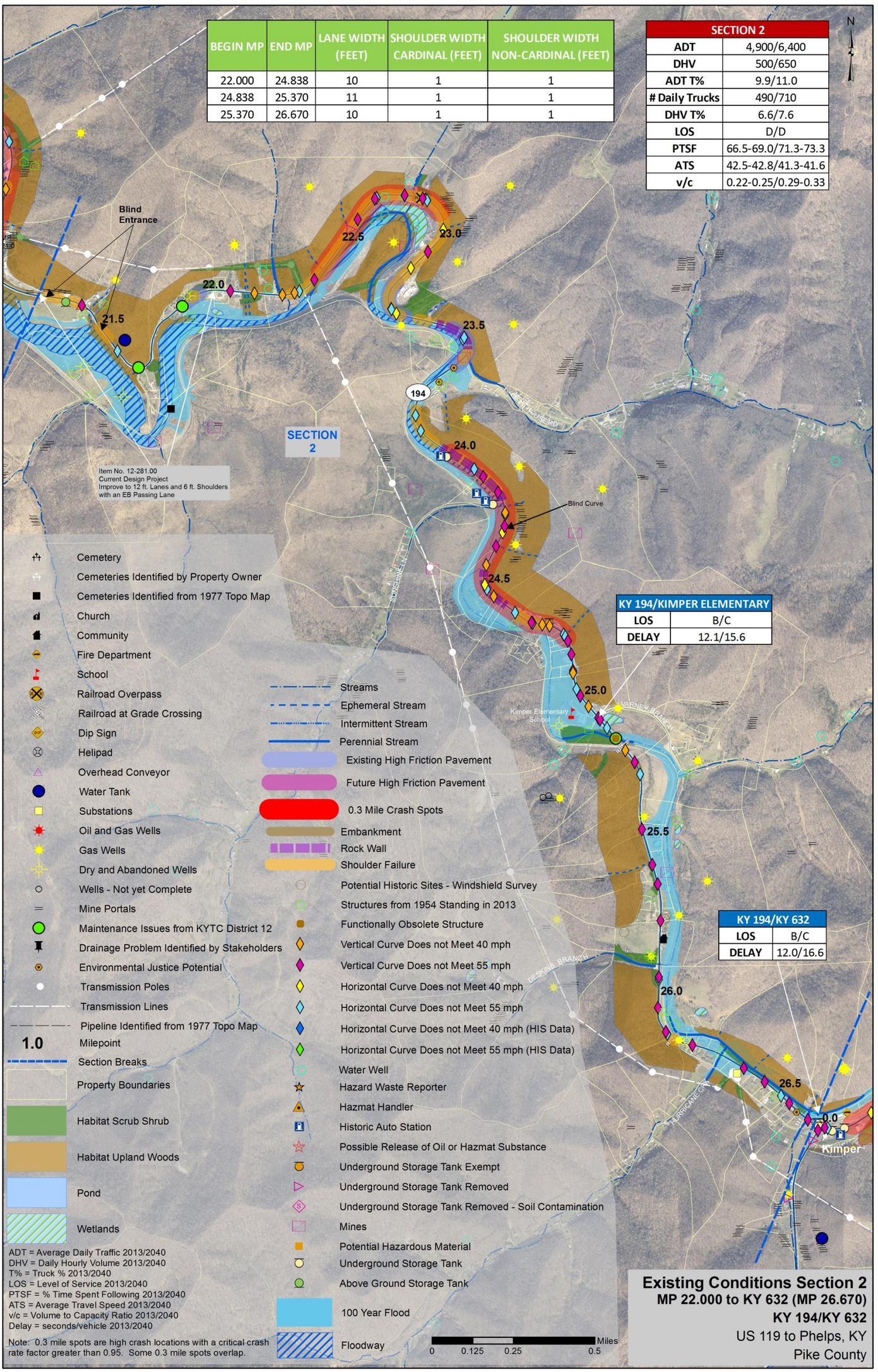


Figure 13: Existing Conditions Section 2

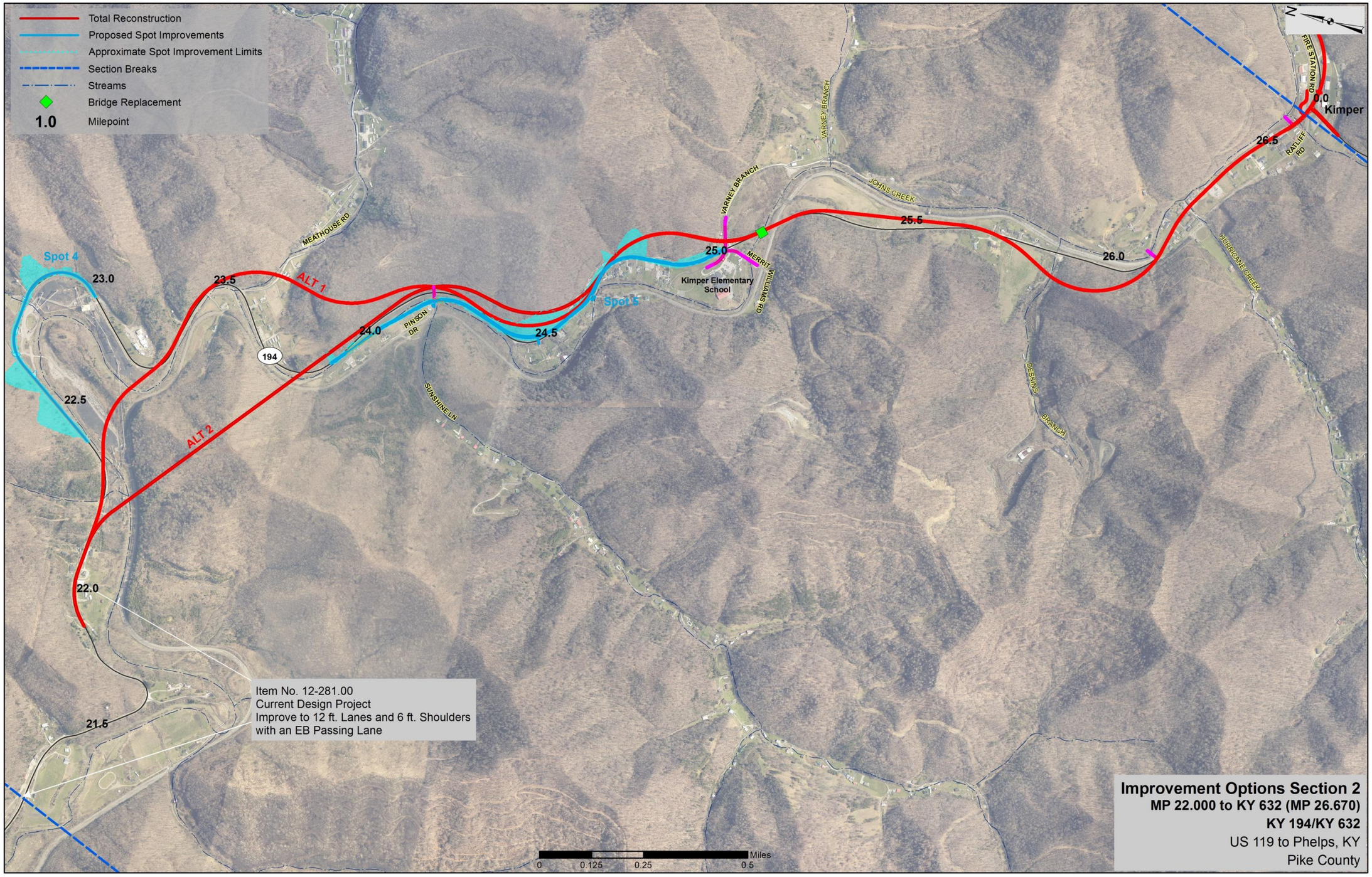


Figure 14: Improvement Options Section 2

C. Section 3

Section 3 is on KY 632 and begins at the intersection of KY 194 (MP 0.0) and extends to KY 1758, also known as Long Fork Road near MP 4.0. Section 3 is illustrated on photos (p. 38) and Figures 15-17 on pages 39-41.

1. Existing Conditions

Beginning at KY 194 (MP 0.0) and continuing to Gabriel Bridge (MP 2.0), the travel lane width is 11 feet with 3-foot-wide shoulders. From Gabriel Bridge (MP 2.0) to KY 1758 (MP 4.0), the travel lanes narrow to 10 feet. The shoulder has deteriorated in the section between KY 194 (MP 0.0) and Layne Bridge (MP 0.9).

2. Crashes

Section 3 has a Critical Crash Rate Factor (CCRF) that exceeds 1.0 (1.072) (see Table 5 continued, p. 8) indicating that crashes may not be occurring at random. A review of the crash data indicates the following: 44 total crashes, including one fatality and 20 injuries.

In Section 3 there are three locations that have overlapping 0.3-mile high crash areas: MP 0.2 to MP 0.6, MP 1.5 to MP 1.9, and MP 2.6 to MP 3.2 (see Figure 15, p. 39).

- **MP 0.2 to MP 0.6**.- There were 7 crashes, three lost control in a deficient curve, three (3) lost control (one intoxicated), and one ran off road (may have fallen asleep).
- **MP 1.5 to MP 1.9** – There were 7 crashes where five (5) lost control in a deficient curve. Six (6) were westbound; four were in wet conditions, six in the daylight. Four were injury crashes.
- **MP 2.6 to MP 3.2** - There were 15 crashes, nine (9) lost control in a deficient curve, one rear end, and one secondary crash, two lost control and went into the creek.

3. Deficiencies

Based on available existing plans on KY 632 from MP 0.0 to MP 4.0, there are a number of deficiencies in addition to lane and shoulder widths which include:

- 4 horizontal curves that do not meet 40-mph design speed.
- 17 horizontal curves that do not meet 55-mph design speed.
- 2 vertical curves that do not meet 40-mph design speed.
- 9 vertical curves that do not meet 55-mph design speed.

There is one (1) bridge at MP 1.2 that is considered functionally obsolete (FO). These deficiencies are shown on Figure 16 (p. 40).

4. Constraints Affecting Alignment

The largest constraint for this section is the large side hill cuts that are necessary to achieve a 55-mph design speed. Section 3 is estimated to have the 3rd highest linear feet of potential stream impacts within the disturbed limits. There is also concentrated development in Kimper and near KY 1758.

5. Traffic Forecasts and LOS

Existing (2013) and future design year (2040) traffic forecasts are shown in Figure 16, (p. 40). This section of the project corridor currently carries 3,000 vpd and is projected to carry 4,500 vpd in 2040. The average daily truck percentage for 2013 is 12.9% and is expected to increase to 15.0% by 2040.

Based on capacity analysis the existing and future level of service for Section 3 is LOS D with the ATS is 44.8 for existing conditions and 44.0 mph in 2040. The current PTSF is 60.4 for existing conditions and 68.2 for design year 2040. The existing and design year v/c ratios are well under 1.0 indicating that the two-lane roadway does and will continue to operate well under capacity. HCS calculations are found on the Supporting Documentation CD in the back of this report.

As indicated in Section 2, the intersection of KY 194/KY 632 is currently operating at LOS B and is expected to operate at LOS C in 2040.

6. Alternatives

Section 3 was analyzed for a 55-mph total reconstruction, and then 40-mph spot improvements were identified for possible improvements based primarily on crash history. Both the Total Reconstruction alternative and the spot improvements are depicted in Figure 17 (p. 41).

a. Total Reconstruction

Section 3 (Figure 17, p. 41) begins east of KY 194 in Kimper and includes several bridges over John's Creek. Portions of the proposed improvement are off alignment, but much of it follows the existing alignment. A passing lane is provided at MP 3.0, just east of Mining Road. The proposed westbound passing lane begins at MP 3.5. Section 3 ends near Long Branch Road (KY 1758). This section includes a current high crash location (MP 3.0) with a reverse curve that is located along a rock face.

Additional Section 3 features include:

- 3.79 miles in mountainous terrain (MP 0.20 to MP 4.0).
- Bridges over KY 632, John’s Creek, and the railroad at MP 0.4 (Sta. 406+00).
- Bridges over John’s Creek at Sta. near MP 1.0 (Sta. 431+00) and near MP 2.0 (Sta. 436+00).
- Culvert at MP 3.2 (Sta. 481+00) near Gabriel Branch.

- EB passing lane from MP 2.7 (Sta. 517+00) to MP 3.2 (Sta. 542+50), westbound passing lane from approximately MP 3.0 (Sta. 529+00) to MP 3.5 (555+00).
- Steepest grade is 3.1% through mountains.
- 5,745,000 CY Excavation, 14,400 SF Bridges.

Potential impacts highlighted include:

- Nearly 1,200 linear feet of stream impacts (not including waste areas).
- 15 acres upland woods.
- 4 parcels and structures potentially NRHP eligible.
- 7,030 linear feet of water mains.
- 29 parcels.

Potential impacts for Section 2 are summarized in Table 12 (p. 57).

b. Spot Improvements

As with the Total Reconstruction alternative, environmental resources and concerns identified in the study area could require detailed environmental assessment through the NEPA process to identify resources potential for impacts as a result of the spot improvements, and mitigation measures should those be warranted. Three spot improvements were investigated for Section 3. Spots 6, 7, and 8 are illustrated in Figure 17 (p. 41).

- **Spot 6 -** (MP 0.2 to MP 0.6). This improvement consists of a 0.4-mile-long curve reconstruction with a cost estimate of approximately $5.6 million (nearly 50% for earthwork).

- **Spot 7 -** (MP 1.5 to MP 1.9). Spot 7 improves two curves near the Huff Processing Plant and their coal stock pile location. This proposed alignment widens to the north for about 0.4 mile. The cost estimate is over $3.6 million (35% earthwork).

- **Spot 8 -** (MP 2.6 to MP 3.2). Spot 8 removes a reverse curve. The existing westbound approach to this spot location has a passing lane that ends in a curve, just before a rock wall. This spot location has been mentioned by multiple stakeholders as a problem area. A potential alignment is restricted by the location of the railroad and Upper John's Creek on the south side of the road. The cost estimate for Spot 8 is $5.2 million (43% earthwork)

.

7. Preliminary Alignment and Cost Estimates

The Total Reconstruction Alternative is estimated to be $53,300,000

The total estimated cost for spot improvements are as follows:

- Spot 6 - $6,000,000
- Spot 7 - $3,900,000
- Spot 8 - $5,620,000

Due to the terrain, the excavation required to make improvements in the corridor can become significant. In an effort to improve cost estimates, an attempt to identify waste area sites for the Total Reconstruction Alternative was made and stream impacts at that site(s) were quantified. The Total Reconstruction Alternative has estimated waste area stream impacts of 6,300 linear feet of stream. These stream impacts were estimated using $650/linear foot of stream for a total of $1,040,000. These fees are not included in the overall total cost estimate. The estimate for waste area stream impacts for Spot 6, 7, and 8 are estimated to be $286,000, $123,500, and $234,000, respectively. These waste area stream impact in-lieu fee cost estimates are not included in the total cost estimate for these spots.

Photo Tour Section 3

SNF Flomin Coal

MP 1.5, KY 632 High Crash Location

MP 1.0, KY 632 - Kimper Community Baptist Church on Hill

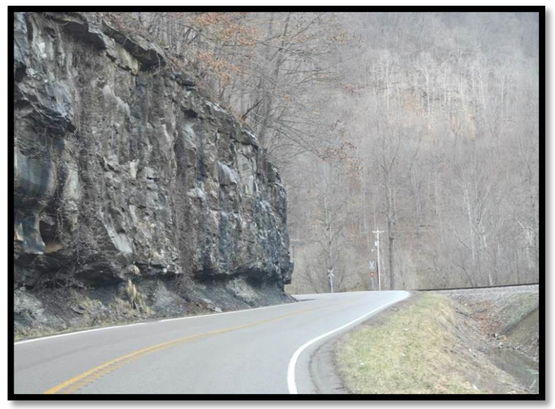
MP 2.6 to MP 3.2, Looking East KY 632

MP 0.0, Kimper Pharmacy

MP 1.5, Huff Processing Plant and Coal Tube

MP 1.158, Railroad Crossing

MP 2.6 to MP 3.2, KY 632



MP 0.5, KY 632

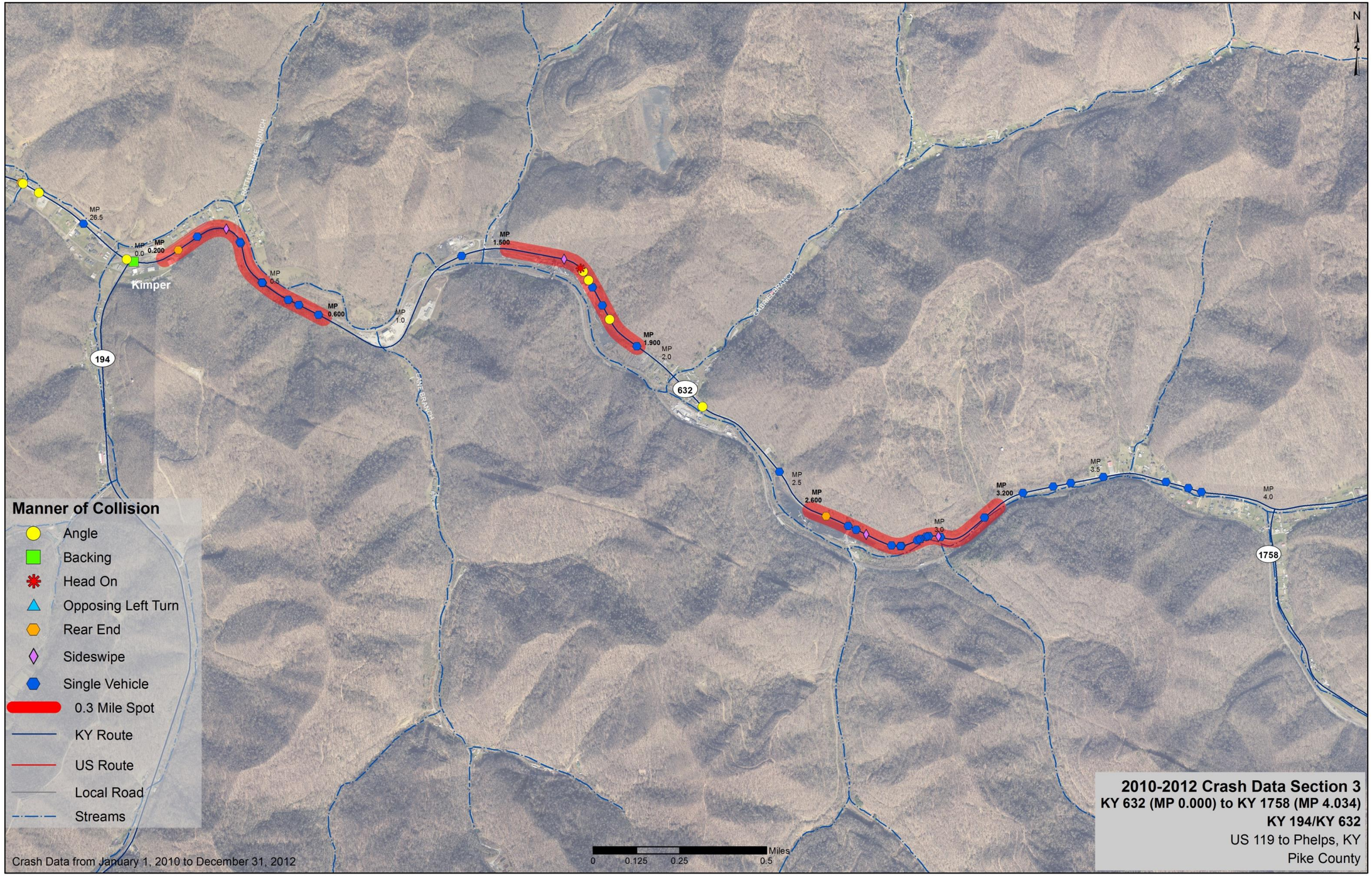


Figure 15: 2010 -2012 Crash Data Section 3

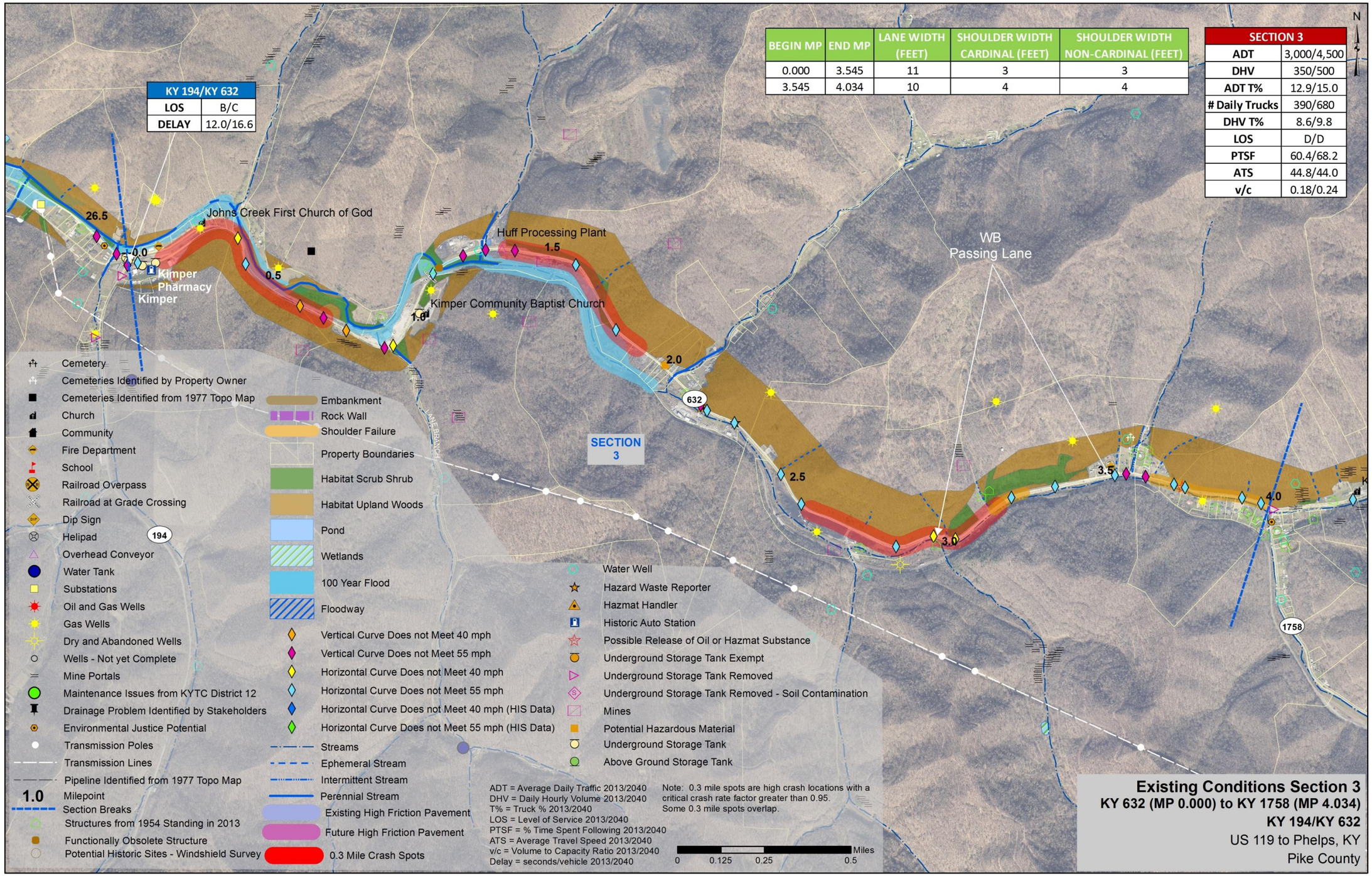


Figure 16: Existing Conditions Section 3

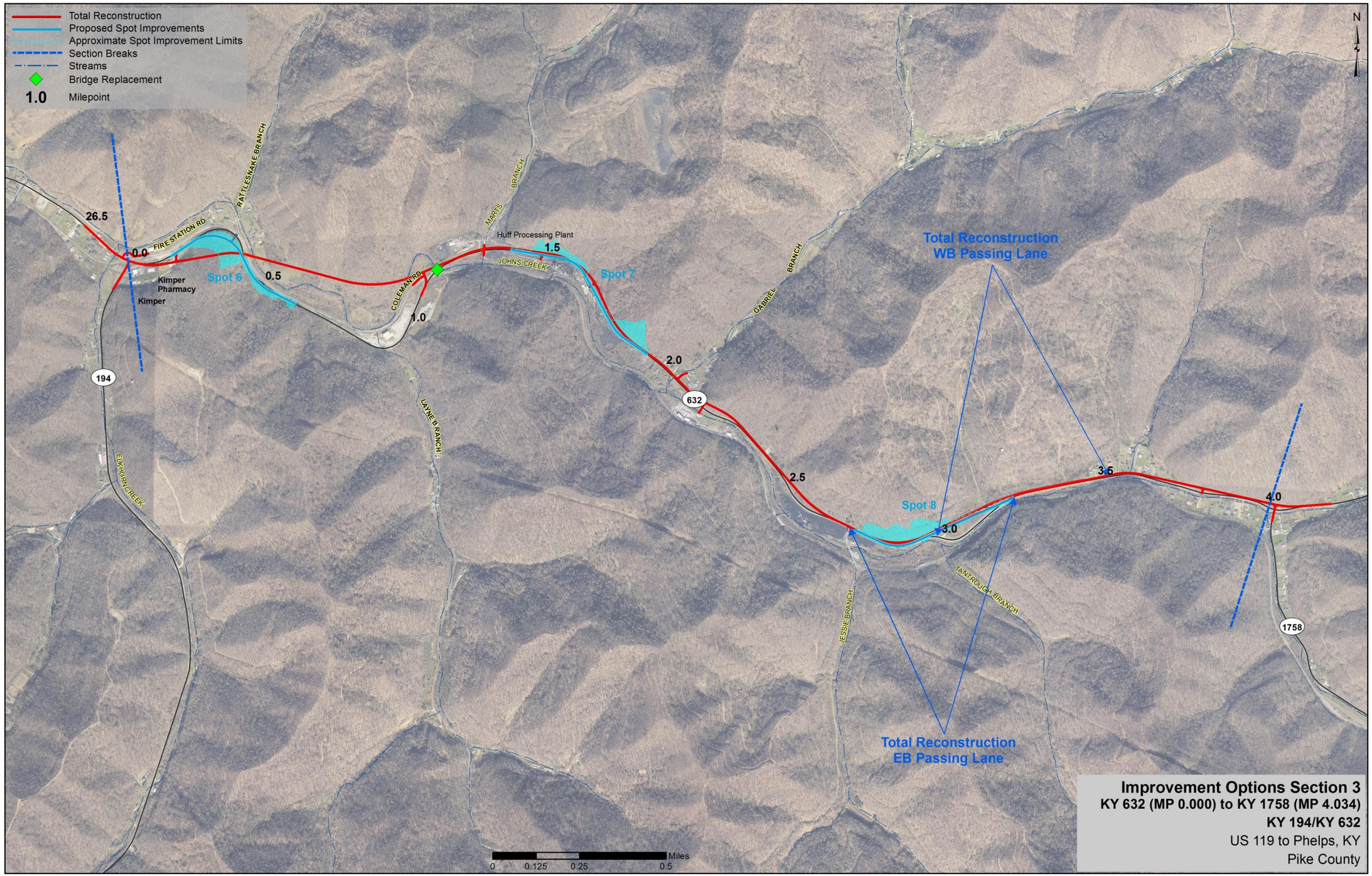


Figure 17: Improvement Options Section 3

D. Section 4

Section 4 begins at KY 1758 near MP 4.0 and extends east to KY 3419 at MP 10.5 and is illustrated in photos (p. 44) and Figures 18-20 (pp. 45-47).

1. Existing Conditions

Just east of KY 1758 (MP 4.0), KY 632 narrows to 10-foot-wide lanes with 3-foot-wide shoulders and continues to KY 199 (MP 6.7). At KY 199 and continuing to KY 3419 (MP 10.5), the travel lanes widen to 11 feet with shoulder width varying between 2 to 4 feet. This area has a considerably deficient spot from MP 9.0 to MP 10.0, however, no statistical crash issue was identified. In addition, there is concentrated development along KY 632 in this section.

2. Crashes

This section has a Critical Crash Rate Factor (CCRF) less than 0.380. A review of the crash data indicates: 22 crashes were recorded, 10 of which resulted in injuries with no fatalities.

In Section 4 there is one location that has overlapping 0.3-mile high crash areas from MP 5.3 to MP 5.8 (see Figure 18, p. 45). At this location, 5 lost control in a curve, another hit a fence, 1 ran off the road, and 1 went around a vehicle that was turning left. Seven were in the westbound direction with one direction not given with 5 on wet pavement. Although there do not appear to be deficient curves in this area, there is a cluster of development on the north side of KY 632, and the creek is very close to the road at this location, giving the motorist a narrowing effect which may have contributed to the crashes.

3. Deficiencies

Based on available existing plans for MP 4.0 to MP 10.5, there are a number of deficiencies (see Figure 19, p. 46) in addition to lane and shoulder widths. The deficiencies include:

- 12 horizontal curves do not meet 40-mph design speed.
- 16 horizontal curves do not meet 55-mph design speed.
- 2 vertical curves do not meet 40-mph design speed.

4. Constraints Affecting Alignment

There are two locations where there is concentrated development along this section. Therefore, two alignment options were developed at each location: one in front of and another behind the houses and one behind the houses at both locations (Option 4A-1, 4A-2, and 4B-1 and 4B-2). Each will need to be examined in more detail if this section progresses to the next phase.

The constraints for Section 4 are also the proximity of Peter Creek and the slope instability along this section especially between MP 8.5 to MP 10.5.

5. Traffic Forecasts and LOS

Existing (2013) and future design year (2040) traffic forecasts are shown in Figure 19, (p. 46). This section of the project corridor currently carries 3,000 vpd and is projected to carry 4,500 vpd in 2040. The average daily truck percentage for 2013 is 8.6% and is expected to increase to 9.8% by 2040.

Based on capacity analysis the existing and future level of service for Section 4 is LOS D. The ATS is 44.8 for existing conditions and an expected 44.0 mph in 2040. The current PTSF is 60.4 for existing conditions and 68.2 for design year 2040. The existing and design year v/c ratios are well under 1.0 indicating that the two-lane roadway does and will continue to operate well under capacity. HCS calculations are found on the Supporting Documentation CD in the back of the report.

6. Alternatives

Section 4 was analyzed for a 55-mph total reconstruction, and then 40 mph spot improvements were identified for possible improvements based primarily on crash history. Both the Total Reconstruction alternative and the spot improvements are depicted in Figure 20 (p. 47).

a. Total Reconstruction

Section 4 is the longest section, extending from MP 4.0 to MP 10.5. At the beginning of the section there are two options: Option 4A-1 (0.8 mile) follows the existing alignment while Option 4A-2 (0.9 mile) runs behind and to the north of the homes adjacent to KY 632. Between Options 4A and 4B there are no proposed improvements because it is currently a three- to four-lane section in front of the KYTC Maintenance Garage (two lanes each direction with passing lanes in each direction). Near MP 10.5, the Norfolk-Southern (NS) railroad is located on the north side of KY 632, a stream is located on the south side, and several houses are located south of the stream. The railroad track is used to load engines, not for transporting coal.

Option 4B-2 is located off of the existing roadway alignment to avoid many of these impacts and to improve (straighten) several curves. However, both options have considerable impacts and constructions concerns. Option 4B-2 would, however, be easier to maintain traffic during construction. Cost estimates for each option are shown at the bottom of Table 12 (p.57).

Potential impacts for Section 4 are also summarized in Table 12 (p. 57).

- 10 structures older than 50 years and potentially NRHP eligible.
- At least 36 parcels, 4,800 feet of water mains, and 6 mine portals.
- Safety concerns due to the potential for shoulder failure.

Additional Section 4 features include:

- Section 4A ends at the existing eastbound passing section at MP 7.2 (Sta. 742+00).

- Near MP 1.0, Option 4B-1 (1.6 miles) follows existing alignment, while Option 4B-2 (1.6 miles) has a long tangent crossing KY 632 and crosses behind houses.
- Steepest grade is 6.6% on Option 4A-1 at the tie-in to the existing alignment just west of MP 7.0 (Sta. 742+00 near the KYTC Maintenance Garage).
- 3,002,700 cubic yards of excavation.
- 186,000 cubic feet of bridges.
- Culverts (4 on 4B-2).
- Cost $42,242,800 (28% is earthwork).

b. Spot Improvements

As with the Total Reconstruction alternative, environmental resources and concerns identified in the study area could require detailed environmental assessment through the NEPA process to identify resources potential for impacts as a result of the spot improvements, and mitigation measures should those be warranted.

There was only one spot improvement studied in Section 4 (see Figure 20, p.47)

- **Spot 9—**(MP 5.3 to MP 5.7). This improvement would widen KY 632 through a reverse curve. The widening would be to the north to minimize impacts to the stream. The cost estimate is $2.3 million (21% earthwork).

7. Preliminary Alignment and Cost Estimates

The Total Reconstruction alternative cost is estimated to be $42,300,000. This cost includes Options 4A-1 and 4B-2.

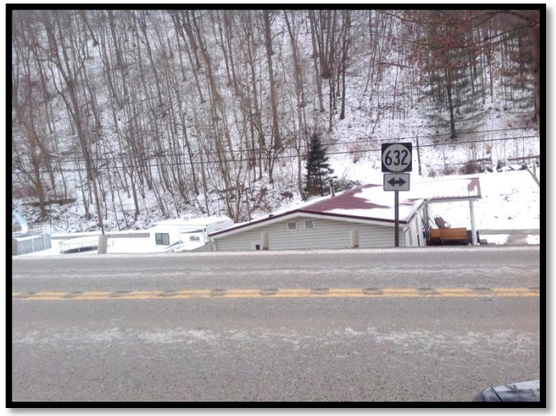
The total estimated cost for Spot Improvement 9 is $2,350,000.

Due to the terrain, the excavation required to make improvements in the corridor can become significant. In an effort to improve cost estimates, an attempt to identify waste area sites for the Total Reconstruction Alternative was made and stream impacts at that site(s) were quantified. The Total Reconstruction Alternative has estimated waste area stream impacts of 1,600 linear feet of stream. These stream impacts were estimated using $650/linear foot of stream for a total of $1,040,000. These fees are not included in the overall total cost estimate. The estimate for waste area stream impacts for Spot 9 is estimated to be $19,500. This waste area stream impact in-lieu fee cost estimate is not included in the total cost estimate for this spot improvement.

Photo Tour Section 4

MP 4.5, Kimper Church of God

MP 7.0 to MP 8.0, Existing Eastbound and Westbound Passing Lanes



MP 6.8, at KY 199 - Guardrail Needed

MP 6.1, Old Path Bible Church

MP 5.7, High Crash Spot 8 - Rare Flat Area on North Side

Old Path Bible Church Looking West

MP 9.9, Stream/Road - Looking West

MP 10.0, Stream, Railroad Ties, Road - Looking East

Looking West at a Row of Houses

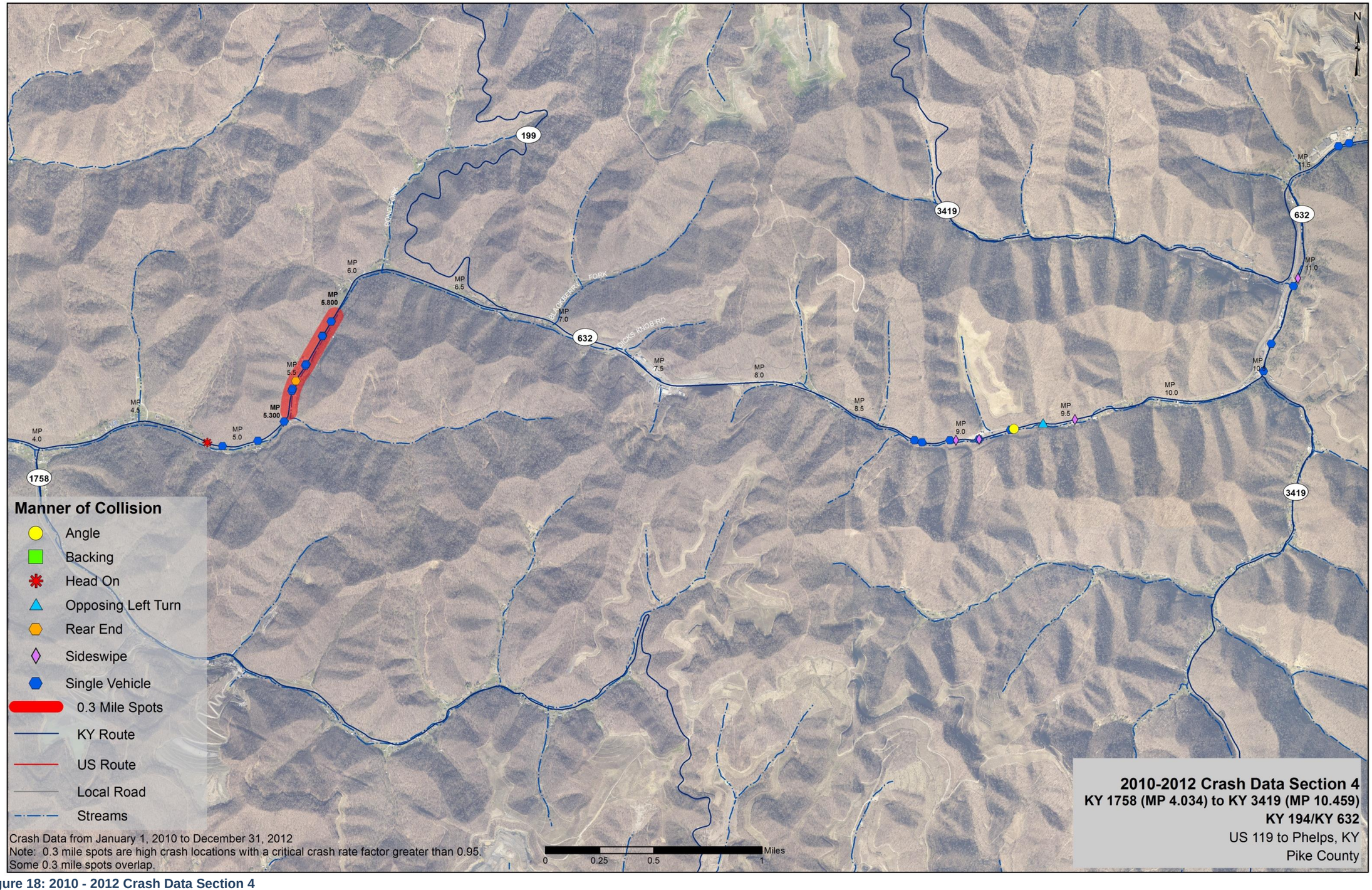


Figure 18: 2010 - 2012 Crash Data Section 4

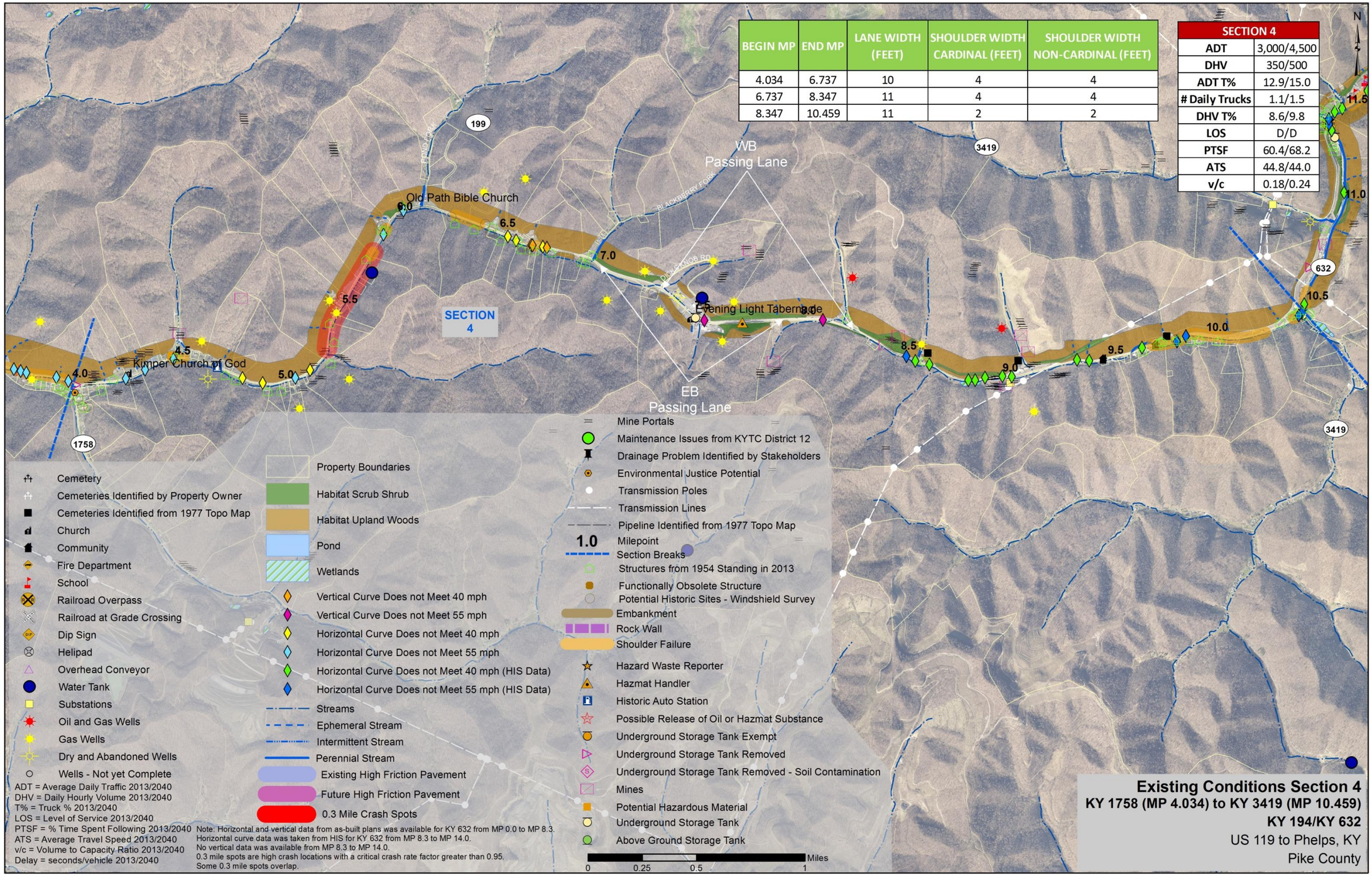


Figure 19: Existing Conditions Section 4

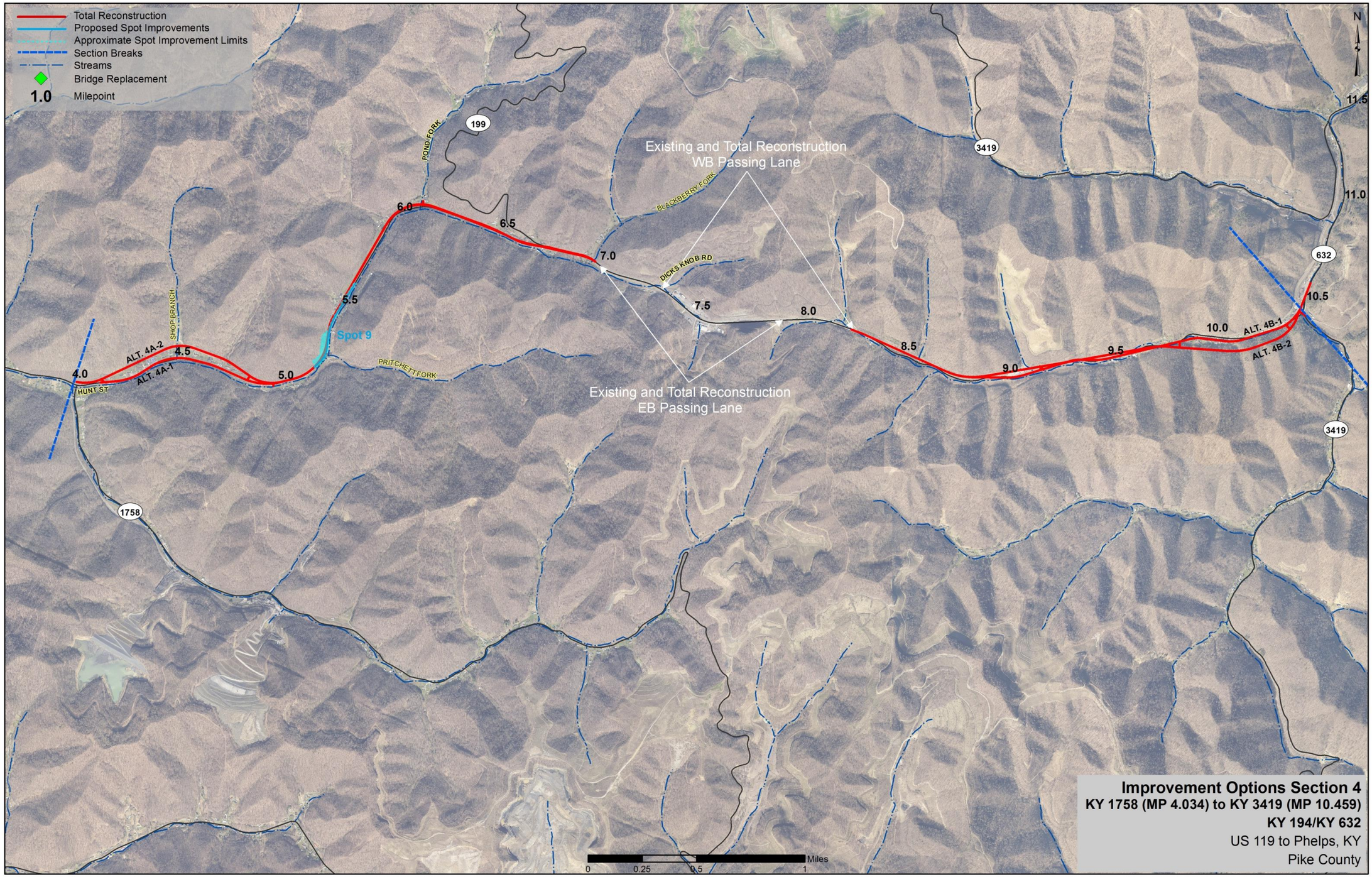


Figure 20: Improvement Options Section 4

E. Section 5

Section 5 begins at KY 3419 (MP 10.5) and extends to KY 194 in Phelps (MP 14.0) and is illustrated in photos (p. 50) and Figures 21-23 (pp. 51-53).

1. Existing Conditions

Continuing from Section 4, the travel lanes on KY 632 are 11 feet wide throughout Section 5 to the project end at KY 194. Between KY 3419 (MP 10.5) and Pecks Bridge (MP 13.7), the shoulder width is 2 feet. From Pecks Bridge to KY 194 (MP 14.0), the shoulder widens to 4 feet. In front of Phelps High School and Elementary School, the southbound shoulder has deteriorated severely. The existing conditions are illustrated in Figure 22 (p. 52).

2. Crashes

This section has a Critical Crash Rate Factor (CCRF) of 0.499 (see Table 5 continued, p.8). A review of the crash data indicates the following: 23 crashes were recorded, 8 of which resulted in injuries with no fatalities. There were no 0.3 mile spots in Section 5 with a CCRF greater than 0.9. The crash locations and manner of collision data are shown in Figure 21 (p. 51).This section has the least amount of crashes of all sections.

3. Deficiencies

Based on available existing plans for MP 10.5 to MP 14.0, there are a number of deficiencies in addition to lane and shoulder widths. The deficiencies are shown on Figure 22, p. 52 and include:

- 6 horizontal curves that do not meet 40-mph design speed.
- 15 horizontal curves that do not meet 55-mph design speed.

This section did not have sufficient readable or available plans to determine vertical deficiencies and HIS does not keep readily available, reliable, grade information. Most of the horizontal deficiencies were extracted from HIS.

4. Constraints Affecting Alignment

The constraints for Section 5 are the proximity of Peter Creek and the development alongside KY 632, the school complex from MP 11.5 to MP 12.0, the slope instability along this section especially between MP 10.5 to MP 11.0, and the concentrated development in Phelps.

5. Traffic Forecasts and LOS

Existing (2013) and future design year (2040) traffic forecasts are shown in Figure 22 (p. 52). Section 5 currently carries 4,600 vpd and is projected to carry 7,000 vpd in 2040. The average daily truck percentage for 2013 is 12.9% and is expected to increase to 15.0% by 2040.

Based on capacity analysis, the existing level of service for Section 5 is LOS D and is expected to operate at LOS E for the design year (2040). The ATS is 38.9 – 44.8 mph for existing conditions and is projected to be 37.9 – 43.9 mph in 2040. The current PTSF is 60.4% – 68.3% for existing conditions and 66.7% – 77.2% for design year 2040. The existing and design year v/c ratios are well under 1.0 indicating that the two-lane roadway does and will continue to operate well under capacity.

Four intersections located along KY 632 in Section 5 were analyzed for traffic operations: KY 632 at Phelps Bus Garage, KY 632 at Phelps High School, KY 632 and Phelps Elementary and KY 632 at KY 194. The intersections at Phelps Bus Garage and at the high school both currently operate at LOS B and are projected to operate at LOS B in 2040. The intersection at Phelps Elementary is currently operating at LOS B and is projected to operate at LOS C for the design year. The intersection of KY 632 and KY 194 is currently operating at LOS C but is projected to deteriorate to LOS F for the design year. HCS calculations are found on the Supporting Documentation CD.

These intersections were also analyzed for left- and right-turn lane warrants (Table 11, p. 16). For the intersection of KY 632 and Phelps High School, the warrant for a right-turn lane is very close for the 2040 AM peak hour. For the design year, left- and right-turn lane warrants are met for the intersection of KY 632 and Phelps Elementary for both the AM and PM peak hours. At the intersection of KY 632 and KY 194, a left-turn lane is warranted for the design year for both the AM and PM peak hours.

6. Alternatives

Section 5 was analyzed for a 55-mph total reconstruction, and then 40-mph spot improvements were identified for possible improvements based primarily on crash history. Both the Total Reconstruction alternative and the spot improvements are depicted in Figure 23 (p. 53).

a. Total Reconstruction

Section 5 continues from KY 3419 near MP 10.5 to Phelps at approximately MP 14.0. Two options were studied near the schools:

- Option 5A follows the existing alignment in front of Phelps High School (0.91 mile), then would bridge Peter Creek and cross under the Norfolk Southern railroad bridge. This option would widen the road in front of the school complex.
- Option 5B (1.13 miles) goes behind the school complex and would use existing KY 632 as a frontage road to the schools.

One benefit of Option 5B would be to avoid the railroad crossing. The construction cost estimate for 5B is $9.8 million as compared to $17 million for Option 5A to widen in front of the school (Table 12, p. 57). Widening in front of the school would include constructing a few structures, cutting into a mountain, and providing a retaining wall along the creek.

East of the schools, passing lanes are proposed for each direction. As the Total Reconstruction alternative approaches Phelps the alignment crosses the railroad and the creek to avoid a number of residential relocations. The alignment follows the existing

road to the termini in Phelps and includes a left-turn lane for eastbound traffic. The addition of a left-turn lane might require widening the existing bridge.

Additional Section 5 features include:

- Option 5A bridges over Peter Creek near MP 11.3 (Sta. 965+00) and crosses under the railroad at MP 11.5 (Sta. 975+00).
- Left- and right-turn lanes should be provided into Phelps High School and Elementary School for Option 5A.
- Channel change along the creek from about MP 11.9 to MP 12.1 is required (Sta. 995+00 to Sta. 1005+00).
- Eastbound and westbound passing lanes should be provided from east of Carter Branch Road at MP 11.9 to near MP 12.5 (Sta. 1000+00 to Sta. 1030+00).
- Bridge over Peter Creek and the Norfolk Southern Railroad at near MP 13.2 (Sta. 1067+00).
- Left-turn lane provided at KY 194.
- Steepest grade is 5.0% for Option 5B (behind school).
- 4,411,000 CY Excavation.
- 35% of the cost is earthwork.

Potential impacts highlighted in Section 5 (Figure 22, p. 52) and the Reconstruction Preliminary Impacts Matrix (Table 12, p. 57) include:

- Potential for the most stream impacts of any of the sections: 4,000 linear feet of streams (not included waste areas).
- Potential for the most linear feet of water mains: 9,000 feet.
  - 6 structures more than 50 years old and potentially NRHP eligible.
  - 3 water valves.

Due to the proximity of the Peter Creek in this area, Option 5B was considered. The benefit of Option 5B is that the alignment would go behind the school complex, allowing for the existing road to stay in place for local school traffic allowing for easier maintenance of traffic.

b. Spot Improvements

As with the Total Reconstruction alternative, environmental resources and concerns identified in the study area could require detailed environmental assessment through the NEPA process to identify resources potential for impacts as a result of the spot improvements, and mitigation measures should those be warranted.

One spot improvement was investigated for Section 5. This spot improvement was to add turn lanes at the school and improve the shoulder stability. Spot 10 is illustrated in Figure 23 (p. 53).

- **Spot 10—**(MP 11.5 to MP 12.0). This spot improvement is located at the Phelps school complex. The proposed spot improvement uses the existing KY 632 alignment and introduces turning lanes (left and right) at the high school and the elementary school. The total cost estimate is $3.2 million. A retaining wall would be needed to avoid impacts to Peter Creek and ultimately minimize impacts to the parking lot for the school complex. By providing this retaining wall, in-lieu fees of $381,000 for stream impacts would be avoided.

7. Preliminary Alignment and Cost Estimates

The total Reconstruction Alternative cost is estimated to be $49,900,000 which includes Option 5A in front of the school.

The total phase cost estimate for Spot Improvement 10 is $3,800,000.

Due to the terrain, the excavation required to make improvements in the corridor can become significant. In an effort to improve cost estimates, an attempt to identify waste area sites for the Total Reconstruction Alternative was made and stream impacts at that site(s) were quantified. The Total Reconstruction Alternative has estimated waste area stream impacts of 2,400 linear feet of stream. These stream impacts were estimated using $650/linear foot of stream for a total of $1,560,000. These fees are not included in the overall total cost estimate. The estimate for waste area stream impacts for Spot 10 is estimated to be $13,000. This waste area stream impact in-lieu fee cost estimate is not included in the total cost estimate for this spot improvement.

Photo Tour Section 5

MP 9.9, Abandoned Train Engine

MP 14.0, Phelps

Entering Phelps from the West

MP 9.9, Stream Railroad Ties, Road - Looking East

MP 11.7, Looking West from Schools

MP 11.5, School Complex

MP 11.4, Railroad Overpass

MP 13.5, Railroad Overpass

MP 10.5, Peter Creek Primitive Baptist Church

Figure 21: 2010 - 2012 Crash Data Section 5

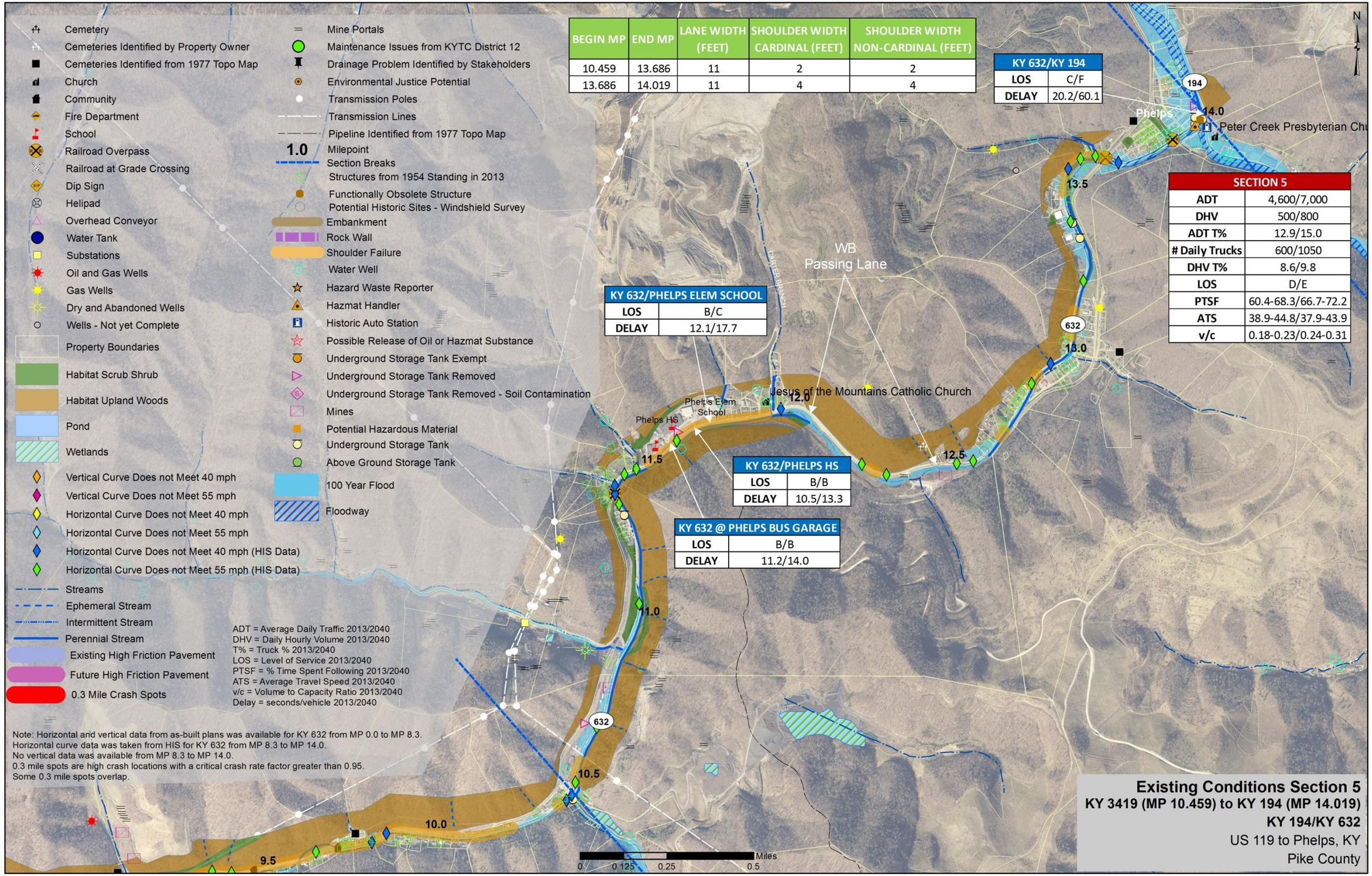


Figure 22: Existing Conditions Section 5

Figure 23: Improvement Options Section 5

VIII. Overall Corridor Improvements and Preliminary Impacts

The overall Total Reconstruction Alternative and studied spot improvements for the corridor are shown in Figures 24 and 25 (pp. 55 and 56) and in detail on the Supporting Documentation CD in the back of this report. For the Total Reconstruction alternative, a matrix of preliminary impacts was developed to summarize impacts for each Section. Those preliminary impacts are shown in Table 12 (p. 57).

IX. Maintenance Improvements

Guardrail placement and end treatments in the corridor are very challenging due to the presence of John's and Peter Creeks. However, adding some guardrail and upgrading guardrail end treatments is a maintenance item that appears to be a "quick win." There are many Type 7 guardrail end treatments along the corridor that now should be upgraded to Type 1, 3 or 4A. There are also areas where additional guardrail is needed. A list of locations needing guardrails is provided in **Appendix L** and has been given to KYTC District 12 staff. The total cost would be $380,000. These improvements must be coordinated and prioritized with other maintenance activities.

High friction surface has been utilized by KYTC in this corridor to minimize crashes or at least crash severity in wet pavement conditions and appears to be effective according to Stakeholders. Therefore, six locations are recommended for high friction surface. Estimates were made using $23/square yard based on unit bid tabulations from a similar project on KY 194 let in September 2013. Those locations are as follows:

- MP 20.5 to MP 21.0 (KY 194) - $148,000
- MP 22.4 to MP 22.9 (KY 194) - $135,000
- MP 24.0 to MP 24.8 (KY 194) - $237,000
- MP 0.1 to MP 0.7 (KY 632) - $119,000
- MP 2.6 to MP 3.2 (KY 632) - $178,000
- MP 5.3 to MP 5.8 (KY 632) - $135,000

X. Bridges

There is one bridge (B000107N) on KY 194 at MP 25.2 1.5 miles west of KY 632 that is considered functionally obsolete. On KY 632, there are two bridges (B000111N and B000136N) at MP 1.2 and 14.0, respectively, that are also considered functionally obsolete. The bridge at MP 1.2 is posted for load and is recommended for replacement by District 12 because of continual maintenance concerns. As shown in Table 6 (p.10), they have a Sufficiency Rating of 62.3, 67.40, and 67.90, respectively. **Appendix L** contains an estimate of $1,541,300 for replacing all three bridges.

XI. Future Build Traffic

New traffic was not assumed for the build scenarios; therefore, the 2040 mainline and intersection traffic volumes were the same for the build as the no build scenario. However, as shown in Figure 26 (p. 58) and Table 13 (p. 59), the Average Travel Speed did increase by as much as 5 mph due to widening the lanes and shoulders. According to HCM software, the percent time following does not change dramatically.

The sole signalized, three-legged intersection at KY 632 / KY 194 in Phelps would improve to LOS C with a left-turn lane installed on KY 632 (Table 14, p. 59).

XII. Cost Estimates

Planning level cost estimates were developed for each Total Reconstruction section and spot. Right-of-way and utility estimates were projected for Sections 2, 3, 4, and 5 utilizing the costs per mile for Section 1.

As stated within Sections 1 through 5 discussions, environmental in-lieu fees for streams impacted were calculated based on the total linear feet of ephemeral, perennial, or intermittent streams within disturbed limits. The cost per linear foot for in-lieu fees has nearly doubled in District 12 to $650/linear foot.

A waste area in-lieu fee was estimated for each reconstruction section and for spot improvements based on the cubic yards of waste and possible stream impacts at several potential waste site locations (see Figure 27, p. 62). Those figures appear in Tables 15 and 16 (pp. 60 - 61).

Earthwork for the Total Reconstruction alternative was estimated at $4/cubic yard, except for Section 1, where it was estimated to be $6/cubic yard. The earthwork for spot improvements was estimated using $7/cubic yard.

Right-of-way parcels were obtained from the Pike County Property Value Administrator's office. The information did not include property values available for this report. Right-of-way estimates were based on Section 1 estimates provided by KYTC on a per-mile basis; utility estimates were estimated as a percentage of the construction costs.

All cost estimates are shown in Tables 15 and 16 (pp. 60-61).

XIII. Utility Impacts

The Big Sandy Area Development District provided approximate locations through GIS of the following:

- Water Mains
- Affected Service Lines
- Affected Pump Stations
- Affected Water Valves

The above utilities are illustrated in Figure 28 (p. 63) and were considered when developing cost estimates for the corridor.

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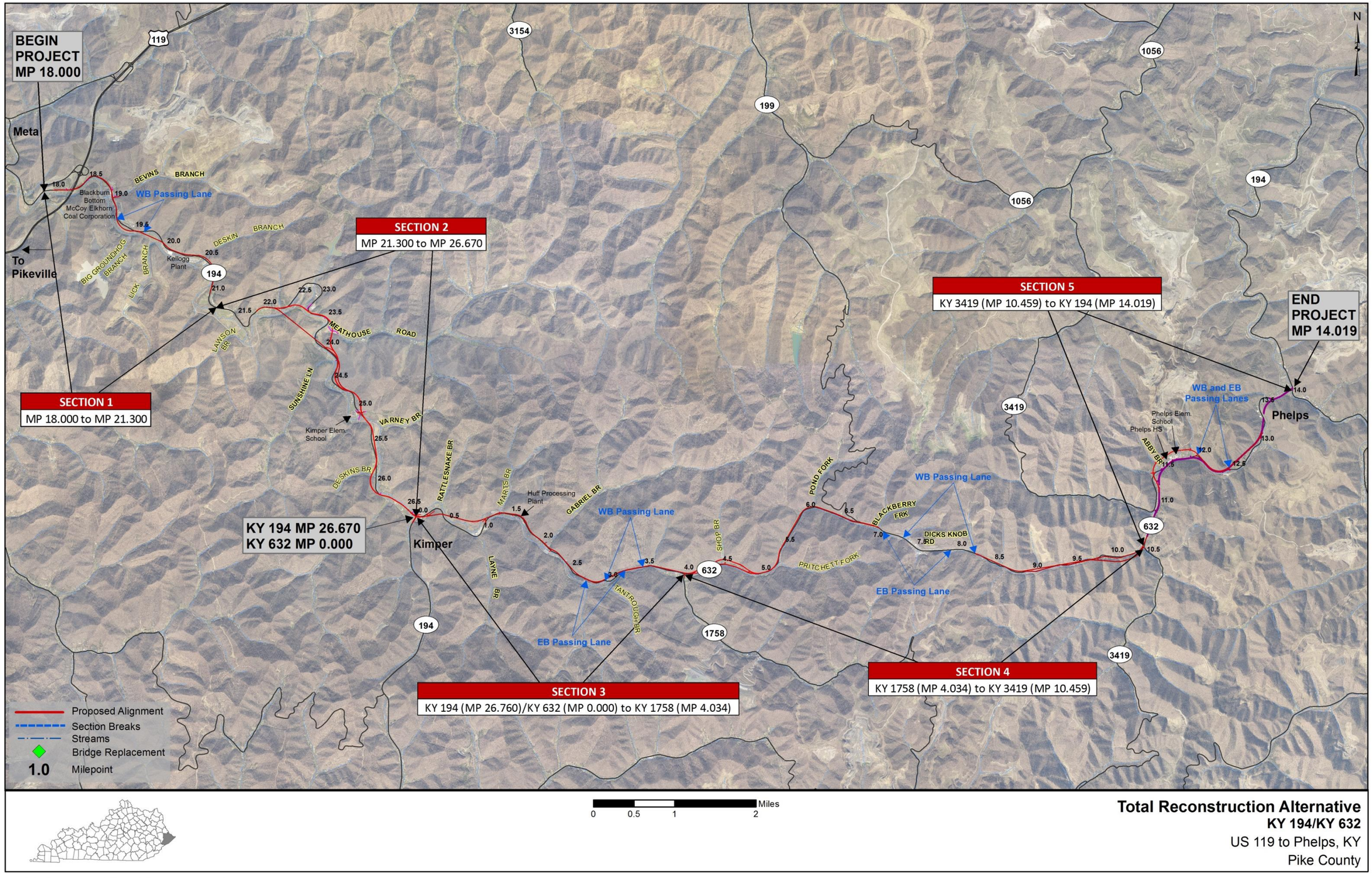

Total Reconstruction Alternative
KY 194/KY 632
US 119 to Phelps, KY
Pike County

Figure 24: Proposed Total Reconstruction

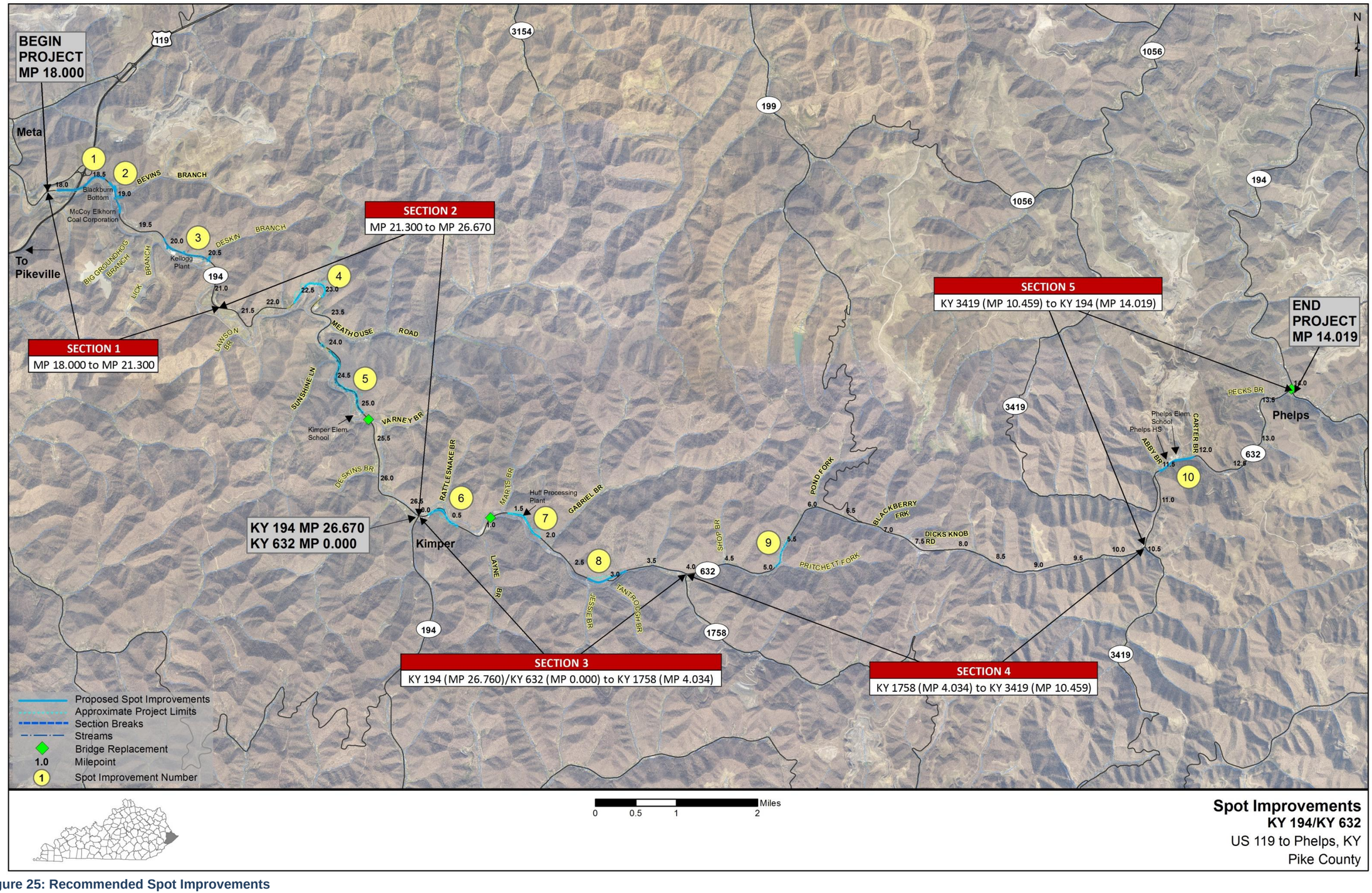

Figure 25: Recommended Spot Improvements

Table 12: Section Reconstruction Prelimimary Impacts

Section Reconstruction Preliminary Impacts

Sections	1	2	3	4	4A-1	4A-2	4B-1	4B-2	5	5A	5B
CRITERIA											
CRASH SPOTS with CCRF>0.9	2	2	3	1	0	0	0	0	0	0	0
TRAFFIC (ADT)/LOS											
2013	5,800	4,900	3,000	3,000	3,000	3,000	3,000	3,000	4,600	4,600	460
2040	8,700	6,400	4,500	4,500	4,500	4,500	4,500	4,500	7,000	7,000	700
2013 # of Trucks/%	580/9.9%	490/9.9	390/8.6%	390/8.6	390/8.6	390/8.6	390/8.6	390/8.6	600/12.9%	600/12.9%	60/1.2%
2040 # of Trucks/%	960/11%	710/11%	680/9.8%	680/9.8%	680/9.8%	680/9.8%	680/9.8%	680/9.8%	1050/9.8%	1050/9.8%	106/1%
Average Travel Speed 2040 No Build/Build	43.7/46.9	41.3/46.6	44.0/45.4	44.0/47.7	44.0/47.7	44.0/47.7	44.0/47.7	44.0/47.7	37.9/40.7	37.9/40.7	35/35
ENVIRONMENTAL											
Aquatic/Terrestrial											
Wetlands (acres)		0.1									
Pond											
Ephemeral Stream (linear ft.)	100	600	700	70		410			250		
Perennial Stream (linear ft.)	360	810	460	90			897	150	2400	1500	60
Intermittent Stream (linear ft.)			20	60		140					110
Habitat Scrub Shrub (acres)	5	3	6	6			2	3	2	1	1
Total Floodplains (acres)											
100-year Floodplain (acres)	4	8	3	5	0	0	5	1	6	3	0
Floodway (acres)	5	1	0	0	0	0	0	0	3	0	0
Habitat Upland Woods (acres)	15	70	60	22	3	17	3	15	35	10	10
Community				2	1						
Schools		1							2	2	2
Churches				2	1	1					
Cemeteries				2			2	1			
Community (cluster of houses)				2			2	2			
Fire Department			1								
Water Tank											
Historic											
Windshield Survey		0	1	5	1		1		2		1
Windshield Survey- parcel affected		2	2	3	0				5		
Structures from 1954	1	2	1	10	2		3	2			1
Structures from 1954 - parcel affected	5	4	4	13	2		10	7	6		4
Historic Auto Station				1	1						
AST				1							
UST											
UST		0	2	1	1				3		1
UST Exempt		1									
UST removed - Soil Contamination	1										
Hazmat											
Hazmat Handler									1		
Potential Hazmat			1	1	1						
Hazard Waste Reporter			1								
Environmental Justice Windshield Survey (yes or no)	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No
UTILITIES											
Transmission Lines (linear ft.)	2420	170		260			715	410			
Transmission Poles	5										
Substations											
BSADD Water Mains (linear feet)	5600	3500	7030	4800	4300	230	4810	1360	7700	1820	1140
BSADD Affected Service Lines			100								
BSADD Affected Water Pump Stations				1				1			
BSADD Affected Water Valves				1	2		1		3	3	
RIGHT OF WAY											
Parcels affected	17	60	29	36	28	16	20	19	30	12	20
GEOMETRY											
Bridges - Functionally Obsolete	1	1	1						1		
Horizontal Curve does not meet 40		1	4	12	2	2	4	3	6	1	2
Horizontal Curve does not meet 55	7	9	17	16	3		6	8	15	1	1
Vertical Curve does not meet 40		5	2	2					*	*	*
Vertical Curve does not meet 55	1*	11	9						*	*	*
OTHER											
Gas Wells		3		1							
Oil Wells											
Mines				1					2		
Mine portals		4		6	0	11	2	1			
Overhead Conveyors	2	1	1								
Railroad At-Grade Crossings		3	1		0						
Railroad Overpasses					0				1		
Helipad	1										
COSTS											
Waste Area In Lieu (linear feet)	1400										
Waste Area Costs	$910,000										
Total Cost**	$19,590,000	$90,520,000	$53,261,000	$42,152,800	$3,453,000	$7,821,600	$6,479,100	$10,159,000	$49,906,500	$17,322,300	$9,811,800

Notes

1. LOS - Level of Service
2. ADT - Average Daily Traffic
3. ATS - Average Travel Speed/vehicle in mph
4. *Portions of this area did not have archived plans
5. If there is a blank, there are no expected impacts for this category.
6. **Does not include waste area costs

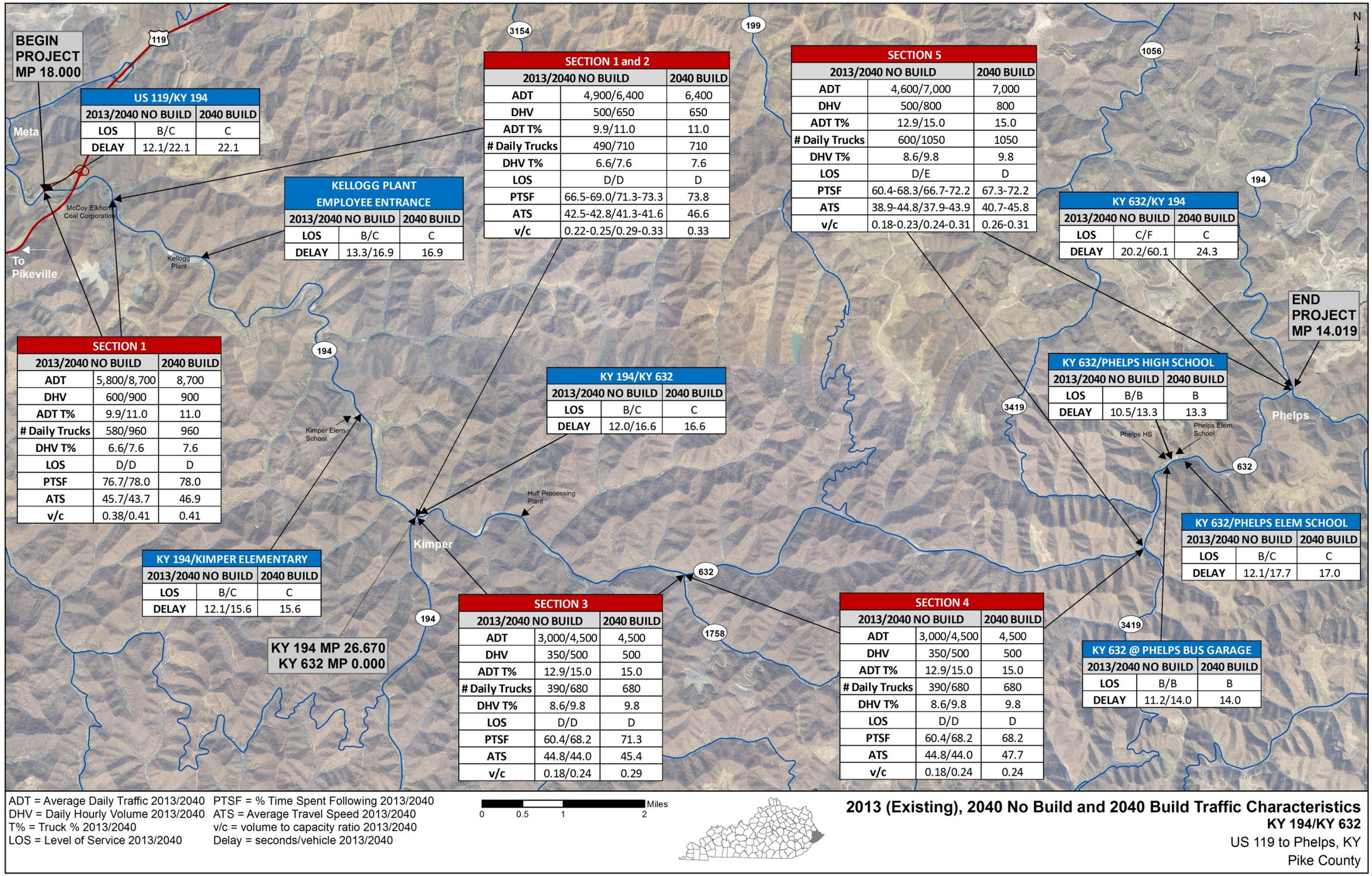

Figure 26: 2013 (Existing) 2040 No Build and 2040 Build Traffic Characteristics

Table 13: 2040 Build Mainline Capacity Analysis

SECTION DESCRIPTIONS					2040							
					Build AM				Build PM			
Section	Beginning MP Description	Beginning MP	Ending MP	Ending MP Description	LOS	% Time Spent Following (PTSF)	Average Travel Speed (ATS)	v/c Ratio	LOS	% Time Spent Following (PTSF)	Average Travel Speed (ATS)	v/c Ratio
1	US 119	18.00	21.30	Beg. Item No.12-281.00	D	78.0	46.9	0.41	D	76.7	47.3	0.38
2	End Item No. 12-281.00	22.00	26.67	KY 632	D	73.8	46.6	0.33	D	69.4	47.6	0.26
3	KY 194	0.00	4.03	KY 1758	D	71.3	45.4	0.29	D	69.5	46.4	0.29
4	KY 1758	4.03	10.46	KY 3419	D	68.2	47.7	0.24	D	66.7	47.5	0.24
5	KY 3419	10.46	11.6	Phelps Garage	D	65.8	46.2	0.23	D	67.3	45.8	0.26
6	Phelps Garage	11.6	11.7	Phelps High School	D	68.2	40.8	0.26	D	67.3	40.7	0.26
7	Phelps High School	11.7	14.02	KY 194 in Phelps	D	71.5	43.2	0.32	D	72.2	43.1	0.31

LOS – Level of Service

v/c ratio – volume/capacity Ratio

Table 14: 2040 Build Intersection Capacity Analysis

TURNING MOVEMENT NUMBER	LOCATION	AM	PM	2040 LOS AM	2040 DELAY AM	2040 LOS PM	2040 DELAY PM
1	US 119/KY 194	7:00-9:00	4:00-6:00	C	15.4	C	22.1
2	Kellogg Plant Employee Entrance	6:30-8:30	6:30-8:30	C	16.9	B	13.1
3	KY 194 / Kimper Elementary	7:00-9:00	2:00-4:00	NB – B / SB – C	NB –13.3/SB – 15.5	B	14.0
4	KY 194/KY 632	7:00-9:00	2:00-6:00	C	16.6	B	14.6
5	KY 632 @ Phelps Bus Garage	7:00-9:00	2:00-4:00	B	12.8	B	14.0
6	KY 632/ Phelps High School.	7:00-9:00	2:00-4:00	A	8.2	B	13.3
7	KY 632/ Phelps Elementary	7:00-9:00	2:00-4:00	C	15.6	C	17.0
8	KY 632 / KY 194	7:00-9:00	2:00-6:00	C	24.3	C	24.1

LOS – Level of Service

v/c ratio – volume/capacity Ratio

Table 15: Total Reconstruction Cost

KY 194/KY 632 TOTAL RECONSTRUCTION COST ESTIMATES

RECONSTRUCTION OPTION COST ESTIMATES

ITEMS, UNITS & UNIT COSTS			Reconstruction 1		Reconstruction 2		Reconstruction 3		Reconstruction 4		Reconstruction 5		Section 4 Reconstruction Options								Section 5 Reconstruction Options			
																					In front of Phelps H.S.		Behind Phelps H.S.	
Item	Unit	$ Unit Cost	ALTERNATE 1 - Full		ALTERNATE 1 - Full		ALTERNATE 1 - Full		ALTERNATE 1 with 4A-1 & 4B-2		ALTERNATE 1 - with 5A		Option 4A-1		Option 4A-2		Option 4B-1		Option 4B-2		Option 5A		Option 5B	
			Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)
Length			2.30 miles		3.99 miles		3.79 miles		5.22 miles		3.11 miles		0.83 miles		0.98 miles		1.60 miles		1.60 mile		0.91 miles		1.13 miles	
			Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP
			18.68	20.98	22.00	26.67	0.21	4.00	4.20	10.50	10.50	14.00	4.20	5.00	4.00	5.00	8.80	10.40	8.80	10.40	11.10	12.20	11.10	12.20
DESIGN	10%		*	$ 2,000,000		$ 5,669,000		$ 3,158,000		$ 2,222,000		$ 2,981,000		$ 150,000		$ 433,000		$ 278,000		$ 540,000		$ 1,140,000		$ 572,000
CONSTRUCTION																								
Pavement	SY	60	57,000	$ 3,420,000	91,400	$ 5,484,000	88,500	$ 5,310,000	112,900	$ 6,774,000	75,400	$ 4,524,000	17400	$ 1,044,000	21700	$ 1,302,000	34000	$ 2,040,000	34500	$ 2,070,000	23800	$ 1,428,000	27200	$ 1,632,000
Earthwork Alt 1**	CY	4	773,000	$ 4,638,000	11,346,000	$ 45,384,000	5,745,000	$ 22,980,000	3,002,700	$ 12,010,800	4,411,000	$ 17,644,000	98000	$ 392,000	709900	$ 2,839,600	155200	$ 620,800	172500	$ 690,000	1387200	$ 5,548,800	1009700	$ 4,038,800
Earthwork Spots	CY	7												$ -		$ -		$ -		$ -		$ -		$ -
Structures				$ -		-		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Bridges	SF	120	13,000	$ 1,560,000	27,900	$ 3,348,000	14,400	$ 1,728,000	0	$ -	38,800	$ 4,656,000	0	$ -	0	$ -	0	$ -	0	$ -	15100	$ 1,812,000	400	$ 48,000
Retaining Walls	SF	70		$ -		$ -		$ -	0	$ -	2,350	$ 165,000	0	$ -	0	$ -	0	$ -	0	$ -	2350	$ 164,500	0	$ -
Culvert	CF	15		$ -		$ -	12,200	$ 183,000	186,000	$ 2,790,000	130,200	$ 1,953,000	0	$ -	0	$ -	0	$ -	160000	$ 2,400,000	130200	$ 1,953,000	0	$ -
Drainage	3%			$ 289,000		$ 1,626,000		$ 906,000		$ 647,000		$ 868,000		$ 43,000		$ 124,000		$ 80,000		$ 155,000		$ 327,000		$ -
MOT	1.52%			$ 150,000		$ 846,000		$ 471,000		$ 337,000		$ 452,000		$ 22,000		$ 65,000		$ 42,000		$ 81,000		$ 170,000		$ -
ENVIRONMENTAL IN LIEU FEES	FT	$ 300	460	$ 138,000	1,410	$ 423,000	1,180	$ 354,000	1,117	$ 335,100	2,650	$ 795,000	0	$ -	550	$ 165,000	900	$ 270,000	150	$ 45,000	1500	$ 450,000	170	$ 51,000
UTILITIES*	0			$ 1,500,000		$ 2,600,000		$ 2,500,000		$ 3,400,000		$ 2,028,000		$ 541,000		$ 639,000		$ 1,030,000		$ 1,043,000		$ 593,000		$ 737,000
RIGHT OF WAY*	0			$ 2,000,000		$ 3,470,000		$ 3,300,000		$ 4,500,000		$ 2,704,000		$ 722,000		$ 852,000		$ 1,374,000		$ 1,391,000		791000		983000
Sub-Total				**$ 15,695,000**		**$ 68,850,000**		**$ 40,890,000**		**$ 33,016,000**		**$ 38,770,000**		**$ 2,914,000**		**$ 6,419,600**		**$ 5,734,800**		**$ 8,415,000**		**$ 14,377,300**		**$ 8,061,800**
Miscellaneous (25% excluding Design, Bridges, R/W, & Utilities)				$ 2,159,000		$ 13,441,000		$ 7,551,000		$ 5,724,000		$ 6,600,000		$ 375,000		$ 1,124,000		$ 763,000		$ 1,360,000		$ 2,510,000		$ 1,430,000
Sub-Total				**$ 17,854,000**		**$ 82,291,000**		**$ 48,441,000**		**$ 38,740,000**		**$ 45,370,000**		**$ 3,289,000**		**$ 7,543,600**		**$ 6,497,800**		**$ 9,775,000**		**$ 16,887,300**		**$ 9,491,800**
Contingencies (10%)				$ 1,785,000		$ 8,229,000		$ 4,844,000		$ 3,874,000		$ 4,537,000		$ 329,000		$ 754,400		$ 650,000		$ 978,000		$ 1,689,000		$ 949,000
TOTAL				**$ 19,639,000**		**$ 90,520,000**		**$ 53,285,000**		**$ 42,614,000**		**$ 49,907,000**		**$ 3,618,000**		**$ 8,298,000**		**$ 7,148,000**		**$ 10,753,000**		**$ 18,576,000**		**$ 10,441,000**

*Provided by KYTC

****Section 1 was estimated using $6/cu yd.**	D	2,000,000	6,000,000	3,200,000	2,300,000	3,000,000	150,000	500,000	300,000	700,000	1,200,000	570,000
*Does not include Waste Area "In Lieu" Fees	R	2,000,000	3,500,000	3,300,000	4,500,000	2,700,000	722,000	850,000	1,400,000	1,400,000	800,000	1,000,000
	U	1,500,000	2,600,000	2,500,000	3,400,000	2,100,000	595,000	640,000	1,000,000	1,050,000	600,000	740,000
	C	14,139,000	78,420,000	44,285,000	32,414,000	42,107,000	2,151,000	6,308,000	4,448,000	7,603,000	15,976,000	8,131,000
	Total*	19,639,000	90,520,000	53,285,000	42,614,000	49,907,000	3,618,000	8,298,000	7,148,000	10,753,000	18,576,000	10,441,000
		2,000,000	5,700,000	3,200,000	2,300,000	3,000,000	150,000	500,000	300,000	700,000	1,200,000	600,000
		2,000,000	3,500,000	3,300,000	4,500,000	2,700,000	750,000	850,000	1,400,000	1,400,000	800,000	1,000,000
	For Programming Purposes*	1,500,000	2,600,000	2,500,000	3,400,000	2,100,000	550,000	650,000	1,000,000	1,050,000	600,000	750,000
		14,139,000	78,720,000	44,300,000	32,100,000	42,100,000	$ 2,200,000	6,300,000	4,450,000	7,650,000	16,000,000	8,100,000
		19,639,000	90,520,000	53,300,000	42,300,000	49,900,000	3,650,000	8,300,000	7,150,000	10,800,000	18,600,000	10,450,000
	Waste Area Stream Linear Feet	1,400	1,400	6,300	1,600	2,400						
	Waste Area "In Lieu" Fees Estimate	$ 910,000	$ 910,000	$ 4,095,000	$ 1,040,000	$ 1,560,000	$ 33,900.00	$ 245,900.00	$ 53,800.00	$ 59,700.00	$ 490,600.00	$ 357,100.00

Notes:

1. Milepoints represent the approximate termini of each section given today's MPs. They will not match the project length. The Length represents the length of the improvement.
2. Section 4 ties into an existing WB and EB passing lane that is approximately 1.2 miles in length.

Table 16: Proposed Spot Improvement Costs

PROPOSED SPOT IMPROVEMENT COST ESTIMATES AND PRIORITIES

ITEMS, UNITS & UNIT COSTS			SECTION 1						SECTION 2				SECTION 3						SECTION 4		SECTION 5	
			Spot Improvements						Spot Improvements				Spot Improvements						Spot Improvements		Spot Improvements	
			Priority 16		Included in Priority #1				Priority 15		Priority 19		Priority 18		Priority 14		Priority 9		Priority 12		Priority 13	
			Spot 1		Spot 2		Spot 3		Spot 4		Spot 5		Spot 6		Spot 7		Spot 8		Spot 9		Spot 10	
			Shoulder Widening		Bevin's Branch		Kellogg Plant														Phelps School Zone	
Item	Unit	$ Unit Cost	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)	Quantity	Cost ($)
Length			0.63 mile		0.35 mile		0.70 mile		0.63 mile		0.97 mile		0.46 mile		0.53 mile		0.50 mile		0.44 mile		0.46 mile	
			Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP	Beg MP	End MP
			18.06	18.68	18.8	19.15	19.82	20.52	22.40	23.00	24.00	25.00	0.10	0.56	1.38	1.91	2.70	3.20	5.30	5.70	11.50	12.00
DESIGN	10%			217,000		100,000		224,000		283,000		672,000		353,000		199,000		316,000		104,000		167,000
CONSTRUCTION																						
Pavement	SY	60	11,200	672,000	5,250	315,000	16,000	960,000	14,108	846,500	21,950	1,317,000	9,850	591,000	11,950	717,000	12,250	735,000	9,300	558,000	12,900	774,000
Earthwork Alt 1	CY	4																				
Earthwork Spots	CY	7	201,000	1,407,000	31,500	220,500	172,000	1,204,000	265,300	1,857,100	379,500	2,656,500	397,600	2,783,200	169,500	1,186,500	326,700	2,286,900	62,700	438,900	6,700	46,900
Structures	LF			0	90	1,400	90	1,400		0		0		0		0		0		0		0
Bridges	SF	120		0		0		0		0	17,900	2,148,000		0		0		0	0	0	0	0
Retaining Walls	SF	70		0		0		0		0		0		0		0		0	0	0	11,100	777,000
Culvert	CF	15								0	20,800	312,000		0		0			0	0	0	0
Drainage	3%			62,000		16,100		65,000		81,000		183,600		101,000		57,100		90,700		30,000		48,000
MOT	1.52%		0	32,000		8,400		11,200		42,000		100,200		53,000		29,700		47,200		16,000		25,000
ENVIRONMENTAL IN LIEU FEES	FT	$ 300	35	11,000	60	18,000	45	13,500	100	30,000	40	12,000	0	0	0	0	210	63,000	20	6,000	1,270	381,000
UTILITIES*	0			411,000		228,000		457,000		410,000		630,000		300,000		350,000		330,000		287,000		300,000
RIGHT OF WAY*	0			548,000		304,000		609,000		550,000		845,000		400,000		460,000		435,000		380,000		400,000
Sub-Total				**3,360,000**		**1,211,400**		**3,545,100**		**4,099,600**		**8,876,300**		**4,581,200**		**2,999,300**		**4,303,800**		**1,819,900**		**2,918,900**
Miscellaneous (25% excluding Design, Bridges, R/W and Utilities)				546,000		145,000		564,000		714,000		1,145,000		882,000		498,000		806,000		262,000		513,000
Sub-Total				**3,906,000**		**1,356,400**		**4,109,100**		**4,813,600**		**10,021,300**		**5,463,200**		**3,497,300**		**5,109,800**		**2,081,900**		**3,431,900**
Contingencies (10%)				391,000		135,600		410,900		481,000		1,002,100		546,000		349,700		511,000		208,000		343,000
TOTAL				**4,297,000**		**1,492,000**		**4,520,000**		**5,294,600**		**11,023,400**		**6,009,200**		**3,847,000**		**5,620,800**		**2,289,900**		**3,774,900**
*Used Section 1 cost per mile			Design	300,000		100,000		300,000		300,000		700,000		400,000		300,000		350,000		150,000		200,000
Rounded for Programming Purposes			R/W	550,000		300,000		600,000		600,000		850,000		400,000		450,000		440,000		400,000		400,000
			Utilities	400,000		230,000		500,000		400,000		650,000		300,000		350,000		330,000		300,000		300,000
			Const.	3,050,000		862,000		3,200,000		4,000,000		8,900,000		4,900,000		2,800,000		4,500,000		1,500,000		2,900,000
			Totals	4,300,000		1,492,000		4,600,000		5,300,000		11,100,000		6,000,000		3,900,000		5,620,000		2,350,000		3,800,000
Waste Area Stream Linear Feet				360		60		310		150		210		440		190		360		30		20
Waste Area In Lieu Fees ($)				234,000		39,000		201,500		97,500		136,500		286,000		123,500		234,000		19,500		13,000

KY 194 Guardrail

Description	Unit	Quantity	Unit Cost	Cost
Guardrail-Steel W Beam-S Face	LF	625	$ 25	$ 15,625
End Treatments	Each	54	$ 2,000	$ 108,000
Total				$ 123,625
Total Rounded			Rounded	$ 130,000

KY 632 Guardrail

Description	Unit	Quantity	Unit Cost	Cost
Guardrail-Steel W Beam-S Face	LF	1425	$ 25	$ 35,625
End Treatments -	Each	102	$ 2,000	$ 204,000
Total				$ 239,625
Total Rounded			Rounded	$ 250,000

High Friction Pavement

	BEG MP	END MP	TOTAL LENGTH (ft)	COST / SQ YD*	LANE WIDTH (ft)	TOTAL COST (rounded)	PRIORITY
High Friction Pavement	20.5	21.0	0.5	$ 23	11	$ 148,000	7
	22.4	22.9	0.5	$ 23	10	$ 135,000	3
	24.0	24.8	0.8	$ 23	11	$ 237,000	8
	0.1	0.7	0.6	$ 23	11	$ 178,000	4
	1.5	1.9	0.4	$ 23	11	$ 119,000	5
	2.6	3.2	0.6	$ 23	11	$ 178,000	2
	5.3	5.8	0.5	$ 23	10	$ 135,000	6

*Unit Bid Tabulation from KY 194 HSIP High Friction September 2013 letting averaged $23/sq yd.

	Route	Bridge #	Milepoint	Feature Crossed	Description	Length (feet)	Type	Condition	Approach Width (feet)	Curb to Curb Width (feet)	Skew (degrees)	Design Load	Bridge Posting	Posting Status	Sufficiency Rating	Estimated Cost to Replace full width	X 0.25% Design, MOT, & Cont.	TOTAL	PRIORITY
3 Functionally Obsolete Bridges	KY 194*	107N	25.16	JOHNS CREEK	1.5 MI E OF JCT KY 632	131.89	4 Span Concrete Tee Beam	Functionally Obsolete	22	22	45	H 15	5 At/Above Legal Loads	No Restriction	62.30	$ 593,500	$ 148,400	$ 741,900	17
	KY 632	111N	1.19	JOHNS CREEK	1.3 MI SE OF JCT KY 194	65.94	2-Span Concrete Tee Beam	Functionally Obsolete	22	24	0	H 15	P Posted for load	Posted for Load	67.40	$ 297,000	$ 74,300	$ 371,300	10
	KY 632	136N	14.00	PETER CREEK	W @ JCT KY 194 @PHELPS	76.12	2-Span Concrete Tee Beam	Functionally Obsolete	28.9	25.9	30	H 20	5 At/Above Legal Loads	No Restriction	67.90	$ 342,500	$ 85,600	$ 428,100	11
																		$ 1,541,300	

*Could be extended 1000' to take care of recurring maintenance issue would add approximately $1,500,000.

Notes:

1. Milepoints in the top table represent the approximate termini of each section given today's MPs. They will not match the project length. The length represents the length of improvement
2. The length represents the length of the improvement

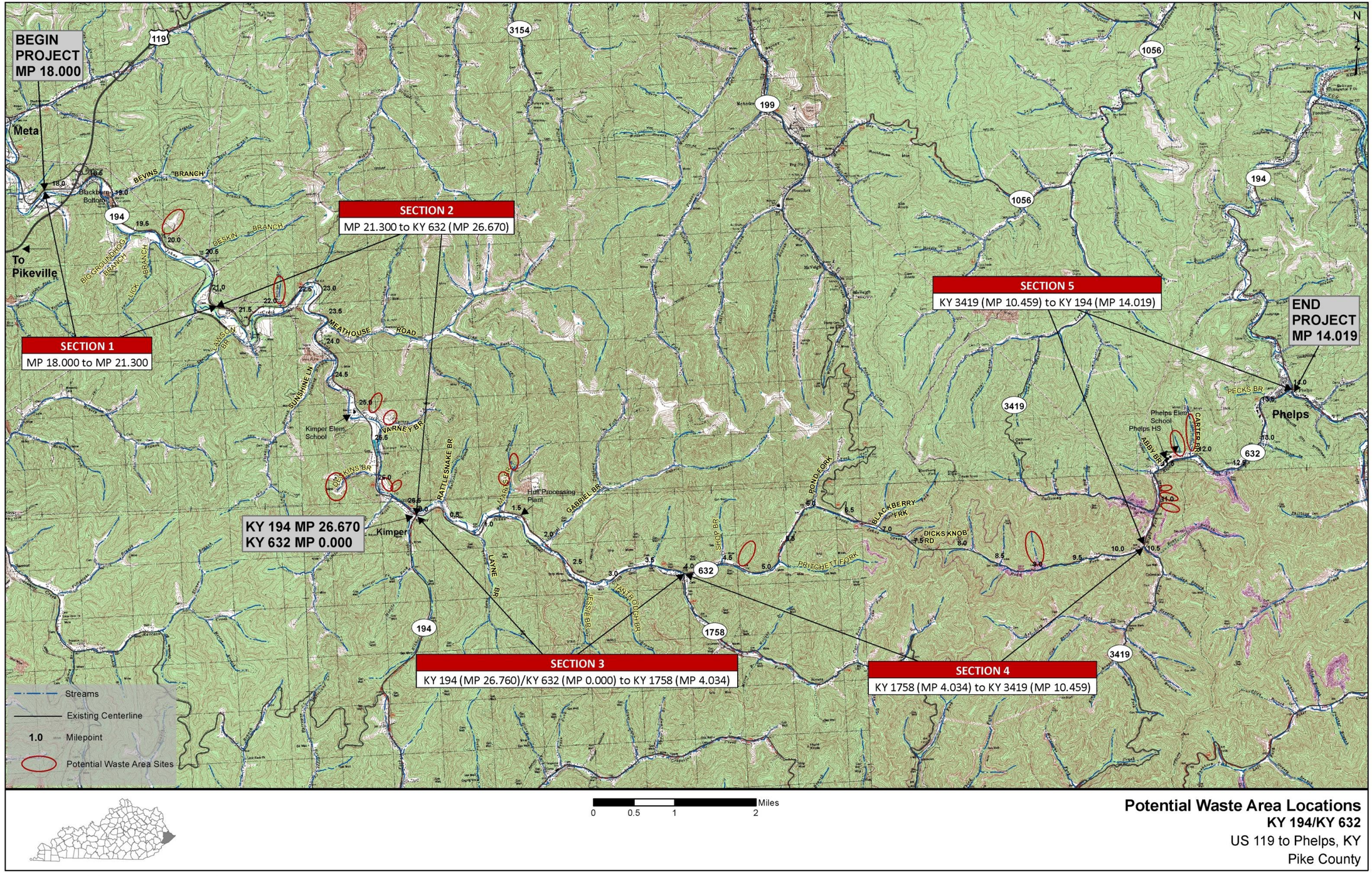

Figure 27: Potential Waste Area Locations

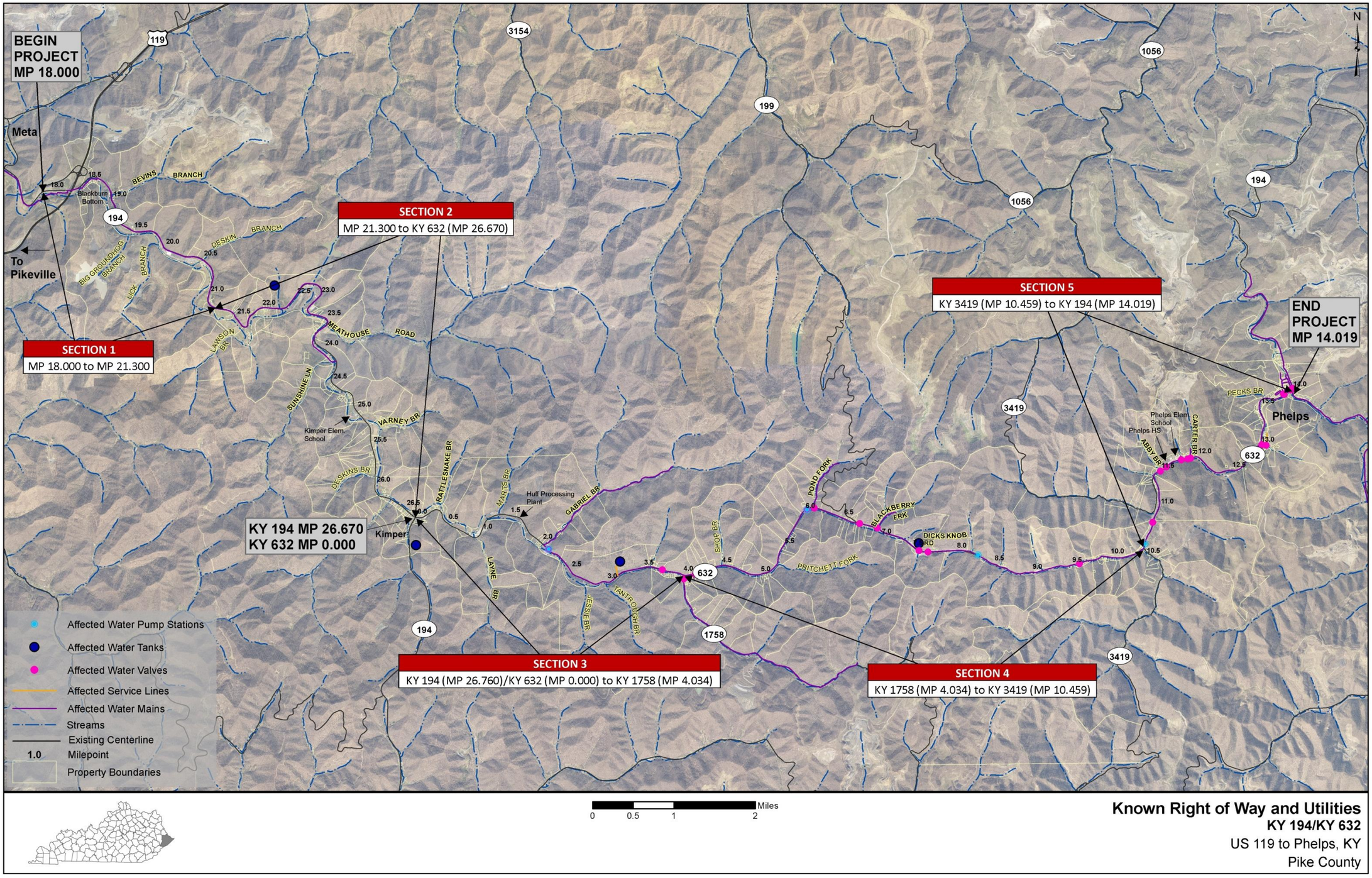

Figure 28: Known Right of Way and Utilities

XIV. Public Involvement

A. Local Officials/Stakeholder Meeting #1

The first Local Officials/Stakeholder Meeting was held on March 26, 2014, at the KYTC District 12 Office in Pikeville. The stakeholders consisted of representatives from Kellogg, KYTC, the Pike County Government, Fiscal Court, Emergency Management, KY Berwind Land, the Ross Harris Group, and the Big Sandy Area Development District (BSADD). Existing conditions were presented at this meeting, and the group was asked to share any questions or concerns they may have regarding this project. The items of discussion or concerns are listed below:

- Entrances.
- Blind curves.
- Deep ditches.
- Flooding.
- Lack of shoulders.
- Slow moving trucks causing congestion.
- Issues with trucks entering and exiting the roadway.
- The need for three-lane passing opportunities, turn lanes at Kellogg.
- Possible high friction surface.
- The potential to utilize coal seams and leave the existing road in place.
- The need for jobs.
- The ability to use “coal to roads” to fund construction.
- The “community is due” because of the large amount of coal that has been removed from this area, and issues with utilities.
- Location of water lines is critical.
- Bypassing existing KY 194 beginning at US 119, then proceeding along a new alignment either north or south of the existing roadway, connecting back to existing KY 194 near Kellogg’s Plant. This option was previously discussed with the District 12 staff, and it was dismissed from consideration due to the impacts on the operation of the existing interchange, the potential for a new interchange construction, impacts to mining operations, and increased project costs due to additional excavation required.

B. Local Officials/Stakeholders Meeting #2

An additional Local Officials/Stakeholders’ Meeting was held on July 2, 2014, at the KYTC District12 Office. This meeting sought input from members from the KYTC, Berkeley Energy, Pike County Fiscal Court, Emergency Management, and BSADD. Details of the discussion were:

The traffic forecast for the year 2040 indicate that a two-lane roadway is all that is needed, and that the existing and future year (2040) build LOS would be "D," or less than desirable. According to the calculations from the Highway Capacity Manual, the average travel speed will only increase in some places 4 to 5 mph. The stated goal of the project is to improve safety, and mobility, from US 119 to Phelps.

A magistrate asked if we had considered building a new road along the ridge since a reconstruction would still operate at LOS D, and only increase the average travel speed 4 to 5 mph. He noted that the coal companies would be willing to partner with KYTC. KYTC responded that during the future design stage, various alignments would be considered, including one or more on new alignment. However, it was noted that the objective of this current study is to look at what it would take to rebuild the existing road along the existing corridor. The information from this study could be used as a baseline and comparison for "ridge top" alignments in the future. The magistrate reiterated that during future phases, coordination with the coal companies could be beneficial to both them and KYTC.

C. Project Team Meeting #1

Project Team Meeting #1 was held on March 26, 2014, to focus on a presentation regarding an overview of the Scope of Work, and a detailed look at existing conditions and design options for Section 1. Environmental concerns and costs were also discussed. Representatives from KYTC and BSADD were in attendance. KYTC requested the following changes to be made to the cost estimate for Section 1:

- Increase the estimated bridge cost/square foot from $80 to $120
- Increase the earthwork cost/cubic yard from $5 to $6 on the Total Reconstruction alternative due to manner that material must be handled, and the proximity of the work to the existing road.
- Increase the MOT cost from $43,000 to $150,000.
- Add a line in the estimate specifically for in-lieu fees.

Other issues discussed were concerns over blasting near the deep mine locations, a check of traffic generators for possible issues such as sight distance, and the investigation into the use of high friction surface just west of the Kellogg Plant and the curve near MP 3.0 on Section 3.

- Also, minor corrections in traffic volumes were made.
- District 12 staff requested to add the bridge replacement in Kimper to the spot improvements. This bridge continually presents issues for District 12.

D. Project Team Meeting #2

Project Meeting #2 was held on July 2, 2014 at KYTC District 12 Office. Information given to the group centered on the Total Reconstruction Alternative, followed by spot improvements. Representatives from KTYC and the BSADD were in attendance. A summary of the minutes are shared below.

Questions were raised regarding whether some sections could be left in place that were not as substandard as others and the future road would just tie into the existing roadway, as a measure to save cost. The objective of the planning study, however, was to look at total reconstruction for the corridor with 12-foot-wide lanes and 6-foot-wide shoulders. Therefore, this option was not studied; however, it is an option that could be examined in the future and can be noted in this study. Most of

this section remains on the existing alignment, and proposes widening away from the existing stream to minimize stream impacts. However, KYTC noted they would investigate whether railroad right-of-way would be available. The charge of this study was to not impact railroad right-of-way.

Another question was whether reducing the typical section to 11-foot-wide lanes with 4-foot-wide shoulder would reduce costs. It was estimated a reduction in cost of in the range of 10% to 15%. This might also be an option to consider if these spot improvements advance to the design phase. As noted early on, the spot improvements were to match Item Number 12-281.00 currently in process.

Recommendations were expected to follow Section 1 with short-term safety projects:

- Installing high friction pavement at high crash locations.
- Upgrading existing guardrail (locations provided to District 12 staff) end treatments.
- Spot 8 in Section 3 would be the next priority.

A request was made to document the number of miles of road that would be a candidate to be transferred to the county by the reconstruction of each section. Those results are presented in Table 19 (p. 67).

E. Project Team Meeting #3

A final Project Team Meeting to present and discuss priorities was held on August 26, 2014, at the KYTC District 12 Office. Only representatives of KYTC and BSADD were present. The priorities were presented and followed this basic order:

- From MP 18.68 to MP 20.98 to Item Number 12-281.00 near Deskins Branch—the only Total Reconstruction alternative recommended.
- High friction pavement at high crash locations—relatively inexpensive and effective.
- Spot 8—MP 2.7 to MP 3.2, a curve that is in a transition from a westbound passing lane with a crash history.
- Functionally Obsolete bridge replacements with the first priority bridge a District 12 maintenance issue.

The remaining priorities were recommended considering crashes.

If funding were to become available for total reconstruction of the corridor, it is recommended to continue east with Section 2 then 3, 4, and 5. Section 2 might need to be broken into two construction sub-sections.

A question as to why structures were so high on the priority list was raised. It was explained that they were relatively low cost improvements, functionally obsolete, one had a continual maintenance issue, and were narrow.

A footnote was clarified to note that if Section 2 Spot 5 is selected for improvement, KYTC may want to extend the project to include the bridge over John's Creek at MP 25.2. KYTC stated that if the Kimper Elementary School remains for some time at its present location, the spot improvement near the school may rank higher, but it is twice the cost. The school was contacted but did not participate in the study.

In-lieu fee rates were recently raised to $600–$650 per linear foot; therefore, it was suggested using a placeholder for in-lieu fees for waste areas also (perhaps $500,000–$750,000); or a cost/lineal foot for waste areas for a small, medium, and large project in District 12, and perhaps for each Section 1 through 5 use a ratio for the in-lieu fees based on the cubic yards of excavation and add that cost as a footnote in the cost estimate summaries.

The question was raised regarding using a lesser typical section for the spot improvements. However, the study Scope of Work stated that the typical section would be 12-foot-wide lanes and 6-foot-wide paved shoulders for spot improvements. Reducing the typical section, however, would probably save at least 15%.

Priorities were not changed in this meeting.

XV. Total Reconstruction Alternative for All Sections

Chapter VII discusses each of the five project sections including issues and concerns, crash history, roadway geometric deficiencies (including functionally obsolete bridges), constraints affecting alignment and forecasted future traffic volumes. Several types of improvements to address roadway deficiencies were also identified.

A total reconstruction of the corridor was one alternative improvement option developed for discussion and prioritization. The estimated cost of total reconstructing this 22.7-mile roadway exceeds $255 million. Section 1, already in the 2014 Highway Plan, constitutes only $20 million of this total. In accordance with the project scope, section priorities were recommended and discussed with the KYTC Project Team. Various factors were considered in developing these recommended priorities, including: current and future traffic volumes (including truck percentages), horizontal and vertical curve deficiencies, cost, the estimated increase in average travel speed resulting from improvements, environmental concerns, utility issues, and the number of right-of-parcels affected. After reviewing these factors, there appeared to be no compelling reason for anything other than consecutive sequencing of project improvements in the event that funding materializes to complete a total reconstruction. Since Section 1 has been included in the 2014 Highway Plan, the logical sequence of subsequent Total Reconstruction improvements is Sections 2, 3, 4, and 5. Given that the estimated cost of Section 2 approaches $100 million that section would likely be subdivided into two subsections for implementation were Total Reconstruction pursued by KYTC (see Table 17). Only Section 1 was recommended to progress to future phases (see Table 17, p. 66 and Figure 29, p.68).

Table 17: Recommended Priorities for Total Reconstruction Alternative

		Recommended Priorities for Total Reconstruction	Cost Estimate
		In Highway Plan	
	*	Curve & Passing Lanes near Deskins Branch 12-281	$8,300,000
	*	CR 1458 to Deskins Branch Culvert	$18,000,000
		Recommended	
1	**KY 194**	**Section 1***	**$19,639,000**
2	KY 194	Section 2a (MP 22-24.3)	$53,120,000
3	KY 194	Section 2b (MP 24.3-26.6)	$37,400,000
4	KY 632	Section 3	$53,300,000
5	KY 632	Section 4 (including Options 4A-1 & 4B-1)	$42,300,000
6	KY 632	Section 5 (including Option 5B)	$49,900,000

*In Highway Plan
Note 1: Cost Estimates do not include waste area in-lieu fees
Note 2: Pink shading matches Figure 29, p. 68

XVI. Spot Improvements and Recommendations

Recognizing that a commitment for the total reconstruction improvement option might not be made, lower cost alternatives were developed as discussed in Chapter VII. These alternatives include geometric improvements at spot locations ranging from 0.4 mile to 1.0 mile, resurfacing with high friction pavement at similar spots ranging from 0.4 mile to 0.8 mile, and replacing three functionally obsolete bridges. Spots considered for geometric improvements were identified based on crash history and stakeholder input. Cost estimates for implementing these spot improvements range from $2.35 million to $11.1 million and total $42.4 million. Given the relatively high cost of these geometric improvements at spot locations, and the dominance in the crash reports at these locations of wet weather crashes (55%), cost estimates were prepared for resurfacing similar spots with high friction pavement. This treatment is relatively inexpensive and thus could likely be implemented more rapidly. Cost estimates for resurfacing both lanes at these spot locations ranged from $119,000 to $237,000 and totaled $1.13 million.

Finally, cost estimates were also prepared to replace three bridges in the project corridor which were functionally obsolete. The Bridge Sufficiency Rating for each of these three structures is greater than 50, meaning replacement of them would not be eligible for the Highway Bridge Replacement & Rehabilitation Program (HBRRP) and hence would need to be selected for funding in future Highway Plans on a competitive basis. Cost estimates for these bridge replacement projects ranged from $371,300 to $741,000 and totaled $1.54 million.

Priority recommendations were based on two criteria: (a) the estimated cost to implement the improvement with the number of crashes reported in that location (“cost per crash”), and (b) preferences expressed by the KYTC Project Team. It was recognized that not all crashes could reasonably be expected to be eliminated by implementing these spot improvements or bridge replacement projects, and the use of the “cost per crash” metric is not meant to imply differently. Nevertheless this was an index of locations that lower cost improvements could be implemented where more crashes had occurred. “Cost per crash” figures are shown in Table 18.

The KYTC Project Team articulated a high priority for all the pavement resurfacing projects, for geometric improvements at Spot 8, and for replacement of Bridge 111N at KY 632 MP 1.2. Those candidate projects were listed as early priorities. The seven pavement resurfacing projects were ranked from low to high “cost per crash” (without in-lieu fees). Following those nine projects, the remaining two bridge replacement projects and the remaining seven spots proposed for geometric improvements were ranked from low to high “cost per crash.” The estimated cost of all 18 improvements totals slightly more than $45 million. Table 18 shading corresponds with Figure 29 on page 69. When considering priorities and available funding, combining spot improvements that are close together e.g. Spots 6, 7, and 8 should be considered to make a homogenous section of the corridor.

Table 18: Recommended Priorities for Spots Improvements

Route	Section	Spot	Milepoint Range or Bridge Number	# Crashes	Cost Estimate	"Cost per Crash"	Recommended Priority
KY 632	3	8	2.60 - 3.20	23	$178,000	$7,739	2
KY 194	2	4	22.40 - 22.90	15	$135,000	$9,000	3
KY 632	3	6	0.10 - 0.70	18	$178,000	$9,889	4
KY 632	3	7	1.50 - 1.90	12	$119,000	$9,917	5
KY 632	4	9	5.30 - 5.80	12	$135,000	$11,250	6
KY 194	1		20.50 - 21.00	12	$148,000	$12,333	7
KY 194	2	5	24.00 - 24.80	15	$237,000	$15,800	8
KY 632	3	8	2.70 - 3.20	14	$5,620,000	$401,429	9
KY 632	3	111N	1.19	2	$371,300	$185,650	10
KY 632	5	136N	14.00	7	$428,100	$61,157	11
KY 632	4	9	5.30 - 5.70	18	$2,350,000	$130,556	12
KY 632	5	10	11.50 - 12.00	15	$3,800,000	$253,333	13
KY 632	3	7	1.38 - 1.91	7	$3,900,000	$557,143	14
KY 632	2	4	22.40 - 23.00	8	$5,300,000	$662,500	15
KY 194	1	1	18.06 - 18.68	6	$4,300,000	$716,667	16
KY 194	2	107N	25.16	1	$741,000	$741,000	17
KY 632	3	6	0.10 - 0.60	7	$6,000,000	$857,143	18
KY 194	2	5	24.00 - 25.00	5	$11,100,000	$2,220,000	19

XVII. Candidates for Local Road Designation

With the Total Reconstruction alternative, there are segments of the existing road that would be left in place as potential frontage roads. At the request of KYTC, an attempt was made to quantify the mileage per section. Those segments are summarized in Table 19. If the Total Reconstruction alternative is ever funded, or individual sections are reconstructed, Table 19 lists the roadway segments that would be ideal to resurface if necessary to make attractive to the local officials to take over routine maintenance so that KYTC has the staff and funding to focus their maintenance efforts on any new roadway sections. This list has not been coordinated with local officials; however, the general idea was discussed with them at stakeholder meetings.

Table 19: Candidates for Local Road Designation

Route	BMP	EMP	Total Miles	Section	Total Miles Per Section	Description
KY 194	19.227	19.500	0.27	1		
	19.576	20.086	0.51	1		
	20.256	20.683	0.43	1		
				1 Total	**1.21**	
	22.335	23.267	0.93	2		
	23.500	24.281	0.78	2		
	24.343	24.623	0.28	2		
	24.764	25.118	0.35	2		
	25.285	25.652	0.37	2		
	25.747	26.142	0.40	2		
				2 Total	**3.11**	
KY 632	0.050	1.220	1.17	3		
	2.121	2.278	0.16	3		
	2.443	2.653	0.21	3		
	2.961	3.247	0.29	3		
	3.680	3.800	0.12	3		
				3 Total	**1.94**	
	4.000	5.000	1.00	4		If Section 4A-2 is used
	8.377	8.926	0.55	4		Section 4
	8.926	9.145	0.22	4		Section 4A-2
	9.383	10.500	1.12	4		Section 4B-2
	9.639	9.763	0.12	4		Section 4-B-1
	9.866	10.177	0.31	4		Section 4B-1
	10.397	10.500	0.10	4		Section 4B-1
				4 Total	**3.42**	
	12.500	13.686	1.19	5		Section 5 with Option
	11.300	12.300	1.00	5		Section 5 Opt 5B
				5 Total	**2.19**	
	Total				**11.87**	

XVIII. Summary

During this study, Section 1 of this corridor was placed in the current Highway Plan for Design Funds in 2015 as Item Number 12-198.00.

Based on an examination of nearly 23 miles of roadway that has narrow lanes and narrow shoulder widths, numerous geometric deficiencies, failing shoulders, traffic characteristics and projections, and the study of improved alignments, the total 55-mph reconstruction is estimated to be approximately $256,000,000 (not including waste area in-lieu fees) using as much of the existing corridor as possible. According to the Highway Capacity Manual methodologies, the improved two-lane roadway would have improved travel speeds ranging from 1 to 5 mph; however, the percent time spent following will remain nearly the same if the corridor is reconstructed. There will be approximately 12 miles of the existing roadway that will be left to maintain by some entity. With a total reconstruction, safety will improve. Wider lanes and shoulders will provide for recovery of vehicle run off the road crashes, will reduce head on and injury crashes, and provide a safe haven for emergency situations. Due to the present economy and overwhelming needs across Kentucky and in District 12, it is recommended that the priorities addressed in Section XV, Total Reconstruction Alternative for All Sections, be implemented as funding becomes available. If a Total Reconstruction option is funded, it is recommended that Sections 2, 3, 4 and 5 be improved in that order.

However, as shown in Figure 29 (p. 68), several spot improvements are recommended for implementation as funding becomes available. Spots considered for geometric improvements were identified based on crash history and stakeholder input. The following priorities were recommended:

- Installing high friction pavement at high crash locations (priorities 2 through 8).
- Upgrading existing guardrail (locations provided to District 12 staff) end treatments.
- Replacement of functionally obsolete structures (priorities 10 through 12).
- Spot 8 in Section 3 identified by all stakeholders as a problem area (priority 9).

Using general Crash Modification Factors for Rural, 2-Lane Roads in the Highway Safety Manual and from the Crash Modification Factor Clearinghouse, increasing roadway width from an average of 10.5 feet to 12 feet can be expected to reduce single vehicle run-off-the-road and multiple vehicle head-on, and same and opposite direction sideswipe crashes by 17%. Increasing shoulder width from an average of 3 feet to 6 feet is expected to reduce all crashes by 25%. Thus, overall crashes could be expected to be reduced by at least 25% for Spot 8.

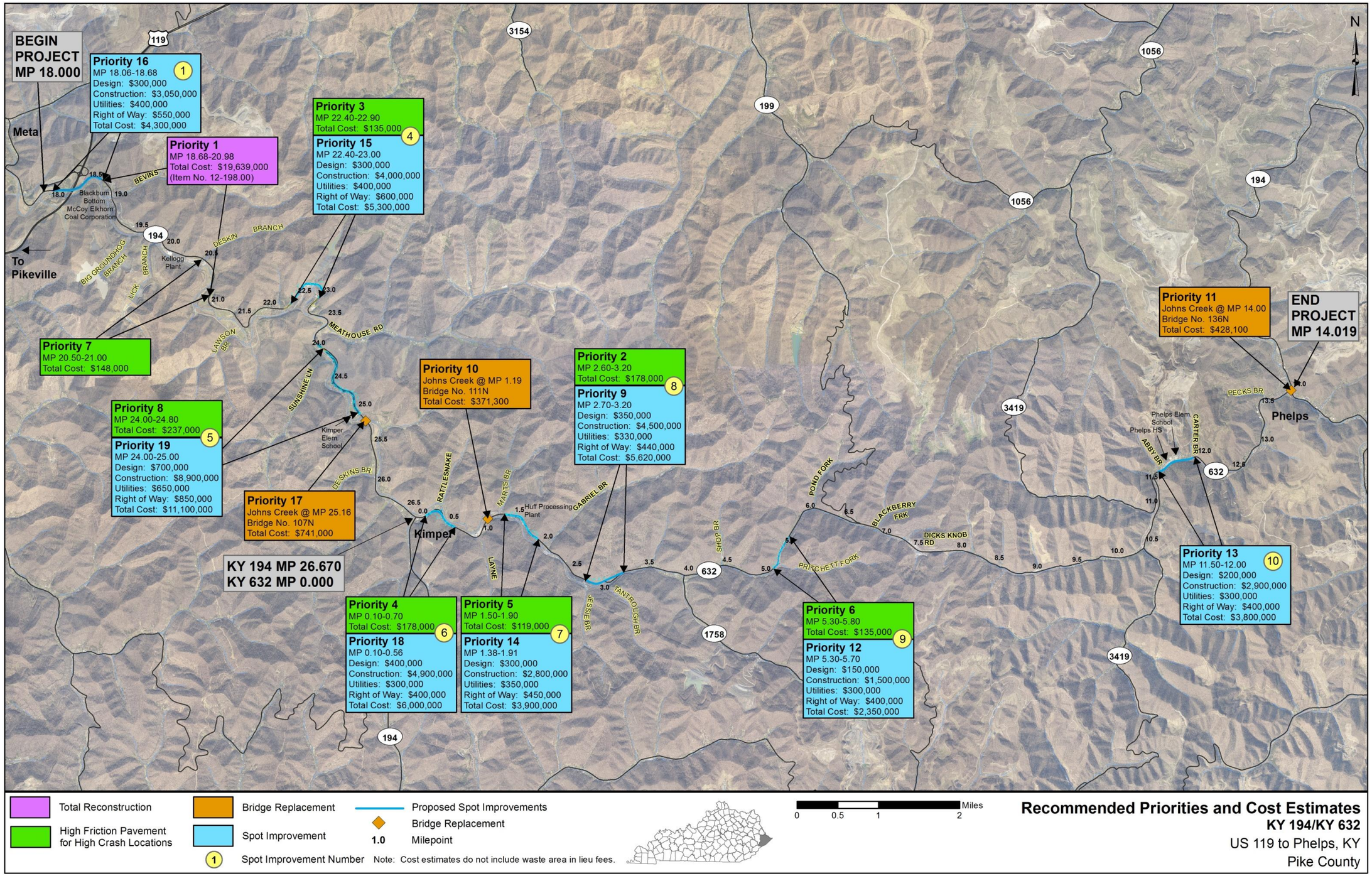

Figure 29: Recommended Priorities and Cost Estimates