Appendix I

KYTC

Geotechnical Report

P-006-2014

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M E M O R A N D U M

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DATE: August 25, 2014

SUBJECT: **Pike County**
KY 194/KY 632
US 119 to Phelps, KY
12FO C35 D625 12 FH02 0410 C098 E143
Mars 8931407P
Preliminary Geotechnical Assessment

The Division of Planning is conducting a study for options for either a total reconstruction or spot improvements for KY 194/KY 632 from US 119 to Phelps in Pike County. This abbreviated review will discuss some general geotechnical concerns with the area.

The study area is located in the Eastern Kentucky Coal Field Physiographic Region. The Kentucky Geological Survey web site states that:

The Eastern Kentucky Coal Field is part of a larger physiographic region called the Cumberland Plateau (which extends from Pennsylvania to Alabama). The interior of the Eastern Kentucky Coal Field is dominated by forested hills and highly dissected by V-shaped valleys. In general, the elevations of the hills are highest in southeastern Kentucky.

The approximate coordinates for the center of this site are: 37.485814 degrees North and -82.307092 degrees West. The site is located in the Meta, Belfry, Lick Creek, Matewan, and Jamboree Geologic Quadrangles.

Available geologic mapping indicates that the project is underlain by bedrock of the Breathitt Formation. The general dip of the bedrock is from the Southeast to the Northwest. Alluvium is present near the waterways. The Breathitt Formation consists of shale, limestone, siltstone, sandstone, coal and clay. The sandstones can be friable and the shales can be highly weatherable. For estimation of right of way for rock cuts in this area it is typical to assume from a 1V:1H to 1.5V:1H for cut slopes. Previous mine works can have a substantial impact on cut slope design. There will be numerous places throughout the area where manmade fills are present. These could be from mining operations or previous grading for various projects. Some of these areas will not be compacted and will require remediation for a roadway project.

Existing cut slope in Breathitt Formation showing undercut due to highly weatherable shales

Numerous mines are located throughout the study area. It appears that strip mining, auger mining and multi level deep mining have taken place in the area. It is also likely that there are numerous locations where small scale "house coal" mining operations have taken place. The extent of these small scale mines is not known. In some areas mine maps are available for in-depth study of future alignments. Numerous mine areas with potential alignment overlays are located in the appendix. These overlays indicate deep mining for various seams. Additional mines not noted on the attached map could be encountered during design and construction. Deep mines encountered during construction likely will contain water. Mitigation of the mining areas may be required. It is likely that areas of uncompacted or loosely compacted mine spoil exist in the area. These areas can be problematic for road construction.

Mapping indicates that the primary mineable coal seams in order are:

Coal Seam	Coal Seam Index Number	State File #	Approximate Elev. (ft)
Hamlin Coal Bed	095	17910	1845 – 1895
Fire Clay Rider Coal Bed	132		
Fire Clay coal bed	136	11813 08100-2	1730-1755
Whitesburg Coal Zone	150	07084-1 09848 10925-13	1750-1800 1660-1695
Williamson Coal Bed	170	10925-14 07435-1	1535-1565

Elkhorn No. 3 Coal Bed (Cedar Grove)	205	14783-2 13617 17806 14245	1040-1080 915-925 910-1010 940-1000
Elkhorn No. 2 Coal Bed	210	16258 18124-3 18779 16079-30 08816-2 18704-4	1385-1425 1335-1425 1385 1240-1300 920
Elkhorn No. 1 Coal Bed (Alma)	215	10925-19 16358-1 18105-6	845-915 1365-1375
Pond Creek Coal Bed (Lower Elkhorn)	225	09283-1 09283 13418-3 10925-11 10925-2 10925-1 14882-1 12568-3 12568-5 11105-3 07435-6 08923-1 11795 11795-2 11528-1 11528 10978 8332 12596 09884-2 03848 03848-2 13429 13787-2 17697 17536	1245-1265 1140-1160 770-850
Clintwood Coal Bed	255	08923-1 11795-1	950
Eagle Coal Bed	260		

Cedar Coal Bed (Millard)	266	59619 59887	405-430

The Pond Creek Coal Bed has been extensively mined in the area. At this time there are numerous active permitted mine boundaries in the project corridor.

Coal Refuse Waste area near current alignment

Foundations for bridges in this area would typically be founded 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 on soil or bedrock. Mined areas can be problematic for structure foundations. Detailed study of structure locations would need to include evaluation of past mining.

Soil strata in this area tend to be relatively thin. The soils encountered in the area are generally suitable for embankment construction. Generally, embankments built from the native soils and durable bedrock can be constructed to a height of 60 feet with 2H:1V side slopes if the foundation is suitable and proper compaction methods are used. Building embankments with non-durable shales may require special methods to obtain acceptable long term results. Soil cuts over approximately 10 feet often require analyses to design proper side slopes. In no case should soil cuts be steeper than 2H:1V. 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.

Railroad Rail Retaining Wall near school

California Bearing Ratio (CBR) values used in pavement design generally range from 2-4 for soils subgrades in the area and 9-11 for a 2 foot durable rock road bed. Wet areas could require undercutting and replacement of soils. It is likely that soils under the existing pavement are very wet. Cat tails were located in numerous ditch areas throughout the area indicating continuous wet areas.

Previously completed Geotechnical Investigations within the vicinity of the study area are:

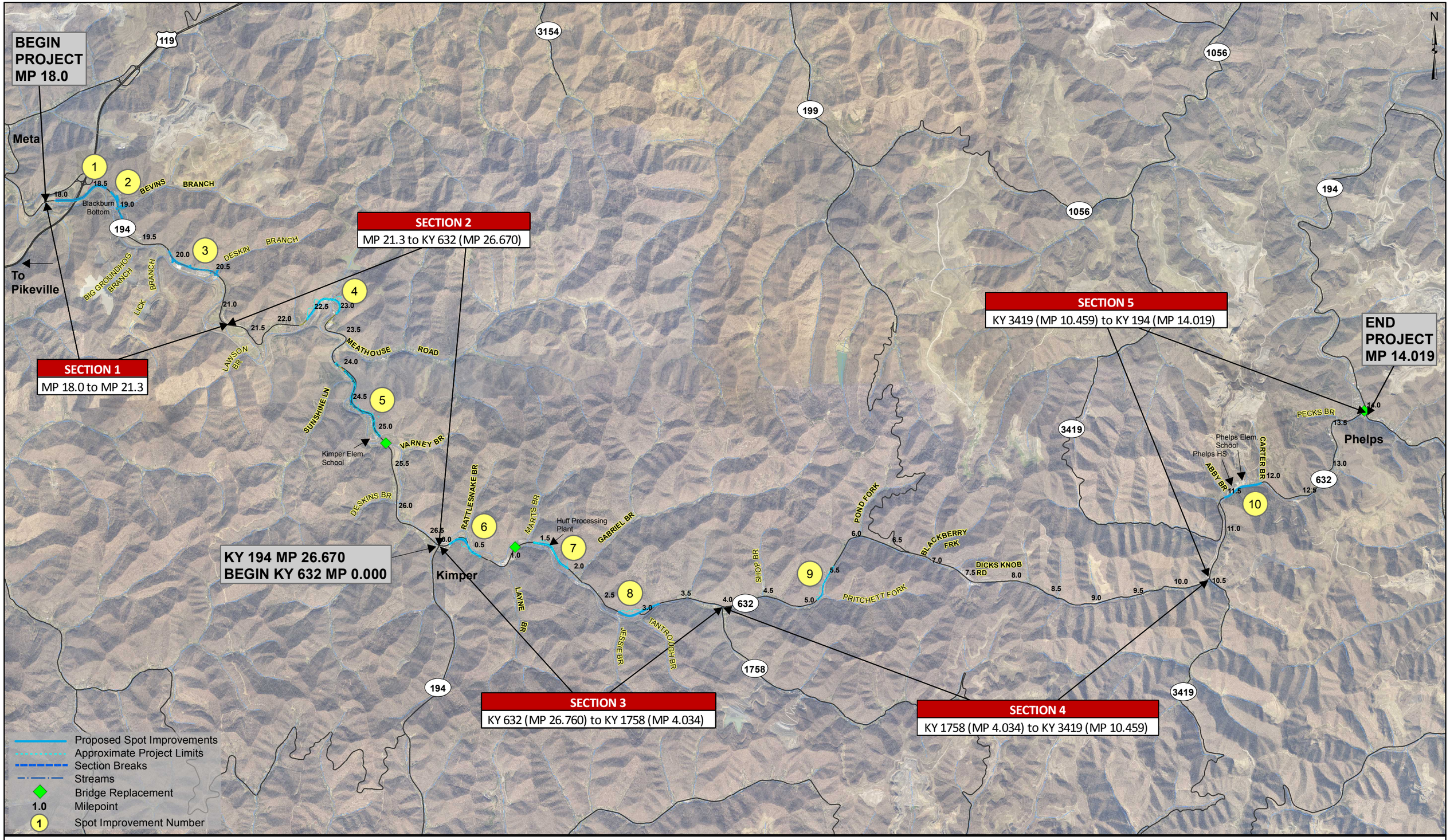
Report No.	Route	Structure Over	Report Type	Description
S-118-2000	KY-3419	Smith Fork	State Bridge	0.25 Mi SE of KY 632
S-085-1982	KY-632		Culvert	Culvert at Station 400+53
R-004-2004	KY-194		Roadway	From Sta. 39+50 to 76+04.5 See S-064-2004
RA-009-2013	KY-194		Roadway	Curve revision and passing lanes on KY-194 near Deskins Branch. (Extension of previous project limits. Need)
S-064-2004	KY-194	under Johns Creek Rd	Culvert	4' x 4' RCBC Extension @ Sta. 62+23.01 near Deskins Branch
R-044-1998	US-119		Roadway	From Sta. 506+340 to 512+000
S-058-1989	KY-194	Johns Creek	Culvert	8'x5'x100' RCBC @ KY 194 & Johns Creek
S-067-1988	KY-194	Johns Creek	Culvert	Dbl. 14' X 10' X 100' RCBC @ Sta. 22+91
S-035-2000	US-119		Culvert	2700x1800 RCBC @ Sta. 508+325.10, under KY 194
S-043-2000	US-119		State Bridge	3.3 km SE of Meta & Jct of existing US 119 & KY 194

The reports are located on the KYTC Geotechnical Branch Database which can be accessed through the KYTC Division of Structural Designs home page (Click on Geotech and Search KYTC Completed Projects).

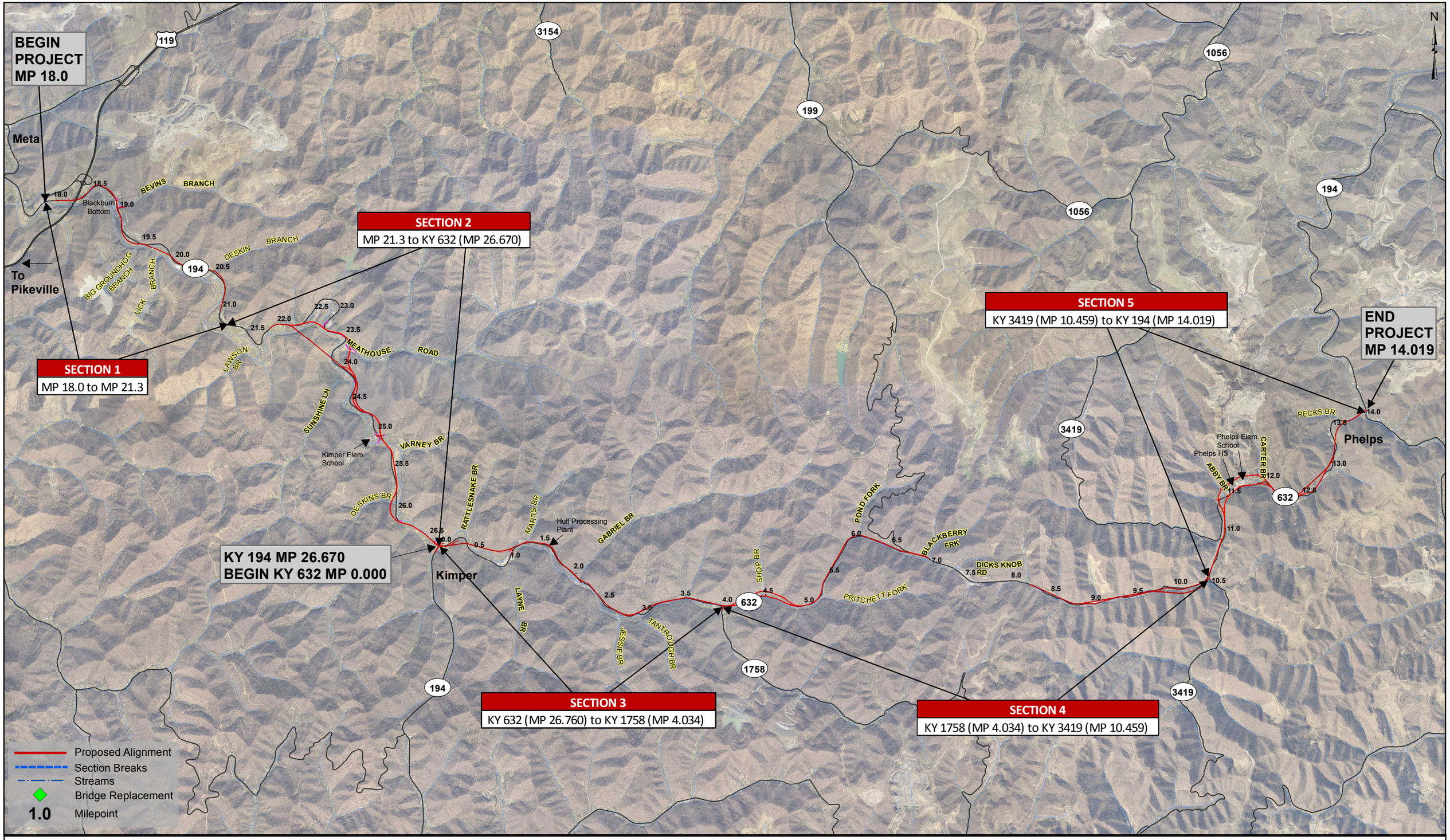
Site specific Geotechnical investigations are critical in this region for design, particularly in areas where mining is suspected.

Please feel free to contact this office for additional information.

Attachments:
Site Map
GQ Site Map
Mine Overview Maps



Proposed Spot Improvements
KY 194/KY 632
US 119 to Phelps, KY
Pike County



Proposed Total Reconstruction

KY 194/KY 632

US 119 to Phelps, KY

Pike County

N

881
119
3154
319
1426
1945
2169
1056
194
Meta
Belfry
Matewan
194
199
3419
632
Lick Creek
Jamboree
3419
1758
194
194

Legend

Proposed Alignment

US Highways

State Roads

Local Roads

Qal Alluvium

Breathitt Formation

Pb

Pb

Pb

0 5,000 10,000 20,000 Feet

N

881
1426
119
3154
1056
1945
194
199
3419
632
1758

Meta
Belfry
Matewan
Jamboree

Legend

Proposed Alignment
US Highways
State Roads
Local Roads

Active Permitted Mine Boundaries

Mine Type

Surface
Underground incl. Auger

0 5,000 10,000 20,000 Feet

Kentucky Division of Geographic Information (DGI) & USGS

N

881
119
1426
2169
3154
319
1056
194S
194
199
3419
632
1758
194

Meta
Belfry
Matewan
Lick Creek
Jamboree

Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Cedar Coal Bed

0 5,000 10,000 20,000 Feet

N

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1426
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194S
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Meta
Belfry
Matewan
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Lick Creek
Jamboree
3419
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194

Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Clintwood Coal Bed

0 5,000 10,000 20,000 Feet

USGS, DGI, Kentucky Geological Survey, U.S. Geological Survey

N

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Meta
Belfry
Matewan
Lick Creek
Jamboree

Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Elkhorn No.3 Coal Bed
- Elkhorn No.2 Coal Bed
- Elkhorn No.1 Coal Bed

0 5,000 10,000 20,000 Feet

USGS, DGI, Kentucky Geological Survey, U.S. Geological Survey

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Meta
Belfry
Matewan
Lick Creek
Jamboree

Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Fire Clay Coal Bed

0 5,000 10,000 20,000 Feet

N

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Meta
Belfry
Matewan
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Lick Creek
Jamboree
3419
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Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Fire Clay Rider Coal Bed

0 5,000 10,000 20,000 Feet

USGS, DGI, Kentucky Geological Survey, U.S. Geological Survey

N

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Lick Creek
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Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Hamlin Coal Bed

0 5,000 10,000 20,000 Feet

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Lick Creek
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Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Pond Creek Coal Bed

0 5,000 10,000 20,000 Feet

USGS, DGI, Kentucky Geological Survey, U.S. Geological Survey

N

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Meta
Belfry
Matewan
Lick Creek
Jamboree

Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Whitesburg Coal Zone

0 5,000 10,000 20,000 Feet

N

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Belfry
Matewan
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Lick Creek
Jamboree
3419
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Legend

- Proposed Alignment
- US Highways
- State Roads
- Local Roads
- Williamson Coal Bed

0 5,000 10,000 20,000 Feet