

Appendix C - GEOTECHNICAL OVERVIEW

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MEMORANDUM

TO: John Moore, P.E.
Director, Division of Planning

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DATE: April 14, 2014

**SUBJECT: Green and Metcalfe Counties
US 68 Corridor and Greensburg Connector
1100 C35 D625 03 FD04 1550 C085 E143
Mars # 8780001P
Item# - 3-203.00
Preliminary Geotechnical Assessment**

The Division of Planning is conducting a scoping study for US 68 in Green and Metcalfe Counties from the Cumberland Parkway to KY 61/KY 3535 in Greensburg. This abbreviated review will discuss some general geotechnical concerns with the area.

The approximate coordinates of the termini of this study are: Beginning: 37.005761 degrees North and -85.614272 degrees West, End: 37.269856 degrees North and -85.497739 degrees west.

The site is located in the Edmonton, Sulphur Well, East Fork, Center, Exie, Summersville, and Greensburg Geologic Quadrangles as depicted on the attached maps.

The study area is located in the Mississippian Plateau or Pennyryle Physiographic Region. The study area is well known for its rolling terrain, red clay soils (residual material remaining after the soluble elements of the bedrock have dissolved) and the Karst behavior of the underlying bedrock (Karst features may include sinkholes, caves and solution features in the bedrock). The study area is part of the Greensburg Oil Pool and Edmonton North Oil Field. Numerous gas and oil wells have been drilled in the area and could be a concern for any alignment shift.

The Kentucky Geological Survey states that the physiographic region encompassing the area:

consists of a limestone plain characterized by tens of thousands of sink holes, sinking streams, streamless valleys, springs, and caverns. The term "karst" is used to define this type of terrain. The Karst terrain of the Mississippian Plateau occurs because the bedrock in the eastern and southern parts of the region is dominated by thick deposits of Mississippian-age limestones. These limestones are soluble (i.e. will dissolve) under the right conditions, which means they can easily be eroded by waters moving through the ground. These groundwaters can form miles of passages beneath the surface, from tiny paths only inches wide, to large caverns and rooms more than 100 feet wide

The available mapping indicates that this area has numerous karst features (sinkholes). Numerous karst areas such as sinkholes and springs were evident during the site visit.

Green and Metcalfe Counties

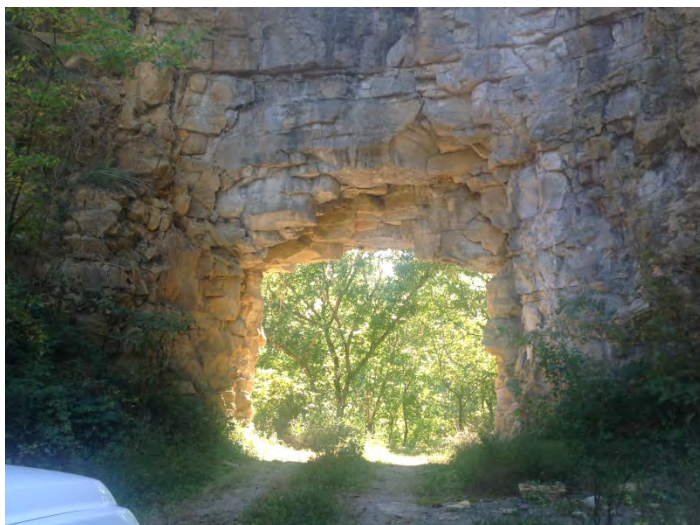
P-010-2014

US 68 Corridor



Karst feature in rock cut adjacent to US 68 near Curves north of Foundation Church

This area is predominately comprised of limestone with layers of siltstone and shale bedrocks. Some of these limestone formations are highly susceptible to karst related issues. Local variations in the bedrock surface should be anticipated due to the karst nature of the site. Non-durable shales can be problematic for construction. The limestone formations in the region weather to moderately and highly plastic clay soils and tend to leave small to large pieces of chert in the weathered soil residue.



Man-made tunnel near Russell Creek Hill

Alluvium will be present at the creek and river crossings. Artificial fill should be anticipated due to the amount of development in the area. What would appear to be an old quarry was noted near the KY 70 intersection. Any alignment shift into this area may require additional investigation to determine what has taken place in this area. With more investigation it may be determined that this is some type of natural feature.



Potential abandoned quarry near KY 70 intersection

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. Karst areas can be problematic for structure foundations.

Soils in the area are generally suitable for embankment construction. Generally embankments built from the native soils and bedrock can be constructed to a height of 60 feet with 2H:1V sideslopes if the foundation is suitable and proper compaction methods are used. Soil cuts in the native soils have been historically problematic. Soil cuts over approximately 10 feet often require analyses to design proper sideslopes. In no case should soil cuts be steeper than 2H:1V.

California Bearing Ratio (CBR) values used in pavement design generally range from 2-5 for soils subgrades in the area. The use of rock roadbed is a common practice in the area. Chemical modification of subgrade is sometimes used in the area, however past projects have indicated large cobbles and boulders (chert) in the soils which could make chemical modification problematic. Wet areas could require undercutting and/or rock stabilization for embankment construction. It is likely that subgrade under existing pavements could be very wet and might require some type of stabilization if pavements are removed.

Rock cuts in the area can be problematic due to the Karst nature of the bedrock. Solution features can cause the bedrock surface to be erratic.

Previously completed geotechnical investigations within the vicinity of the study area are located

Green and Metcalfe Counties

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US 68 Corridor

in the appendix. 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 extremely critical in this region for design due to the karst potential of the area and the potential for problematic soils and shales.

Please feel free to contact this office for additional information.

Attachments:

Project Site Maps

Geologic Quadrangle Site Maps

List of Previous projects near the study area

US 68 Corridor

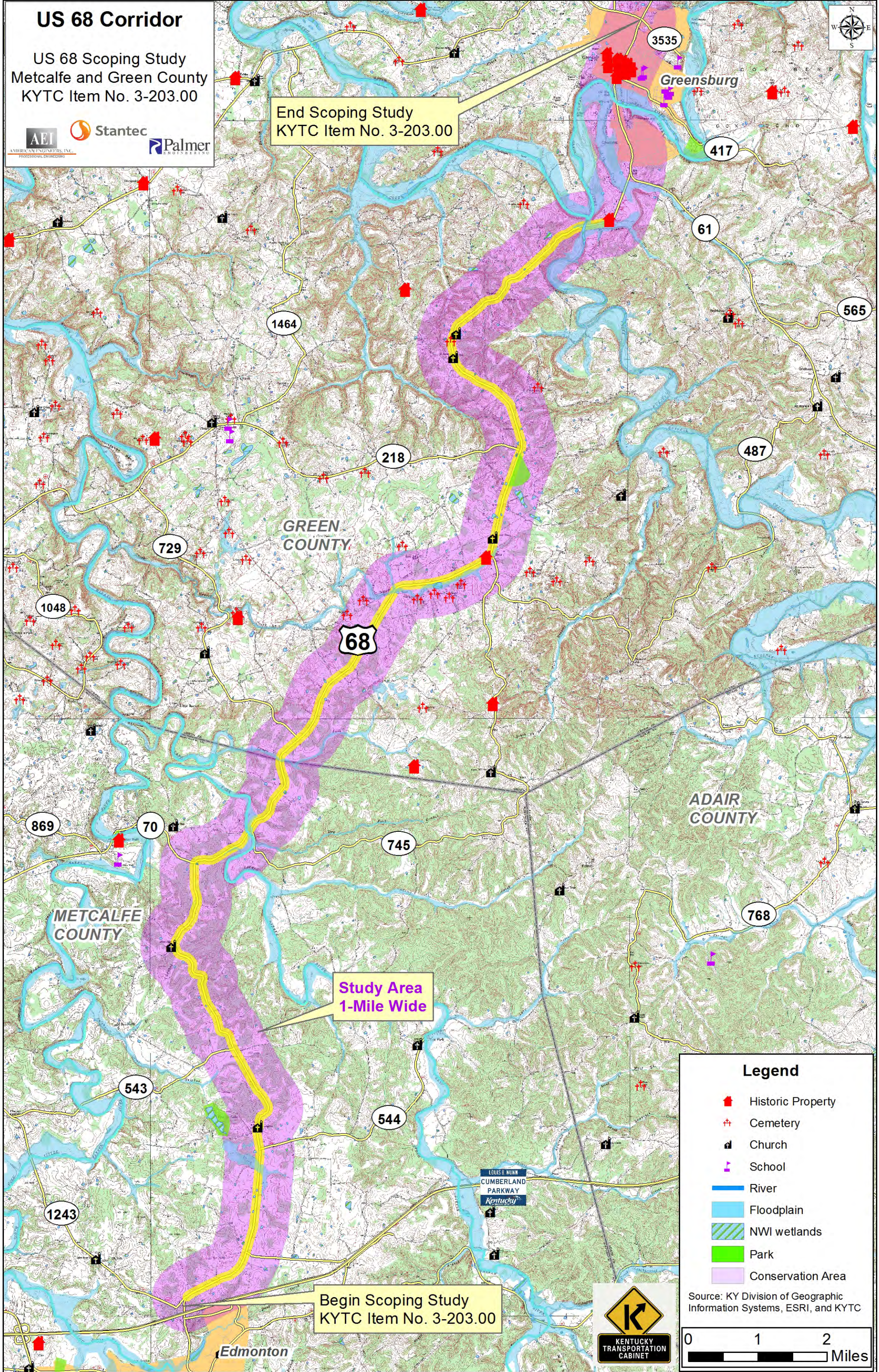
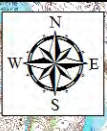
US 68 Scoping Study
Metcalfe and Green County
KYTC Item No. 3-203.00



End Scoping Study
KYTC Item No. 3-203.00

Study Area
1-Mile Wide

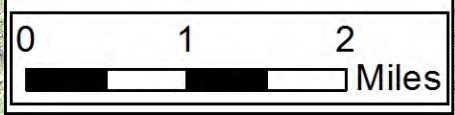
Begin Scoping Study
KYTC Item No. 3-203.00



Legend

- Historic Property
- Cemetery
- Church
- School
- River
- Floodplain
- NWI wetlands
- Park
- Conservation Area

Source: KY Division of Geographic Information Systems, ESRI, and KYTC



US 68 Corridor

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11. Russell Creek Hill

10. Area South of
Russell Creek Hill

12. / 12A. Vaughn Curve

9. Curves north of
Mt. Lebanon Church

13. Realignment from North of
KY 218 to Russell Creek Hill

8. Curves North of
Whippoorwill Lane

7. Curve at Pruitt Rd.
(blind spot)

5. KY 70 to Green
County Line

6. Bridge over
Caney Fork

4. KY 70 Intersection

3. Curves near Denzil Park
Rd. and Fishback Ln.

2. Curves North of
Toby Hill Rd. (KY 543)

1. Curves North of
Foundation Church

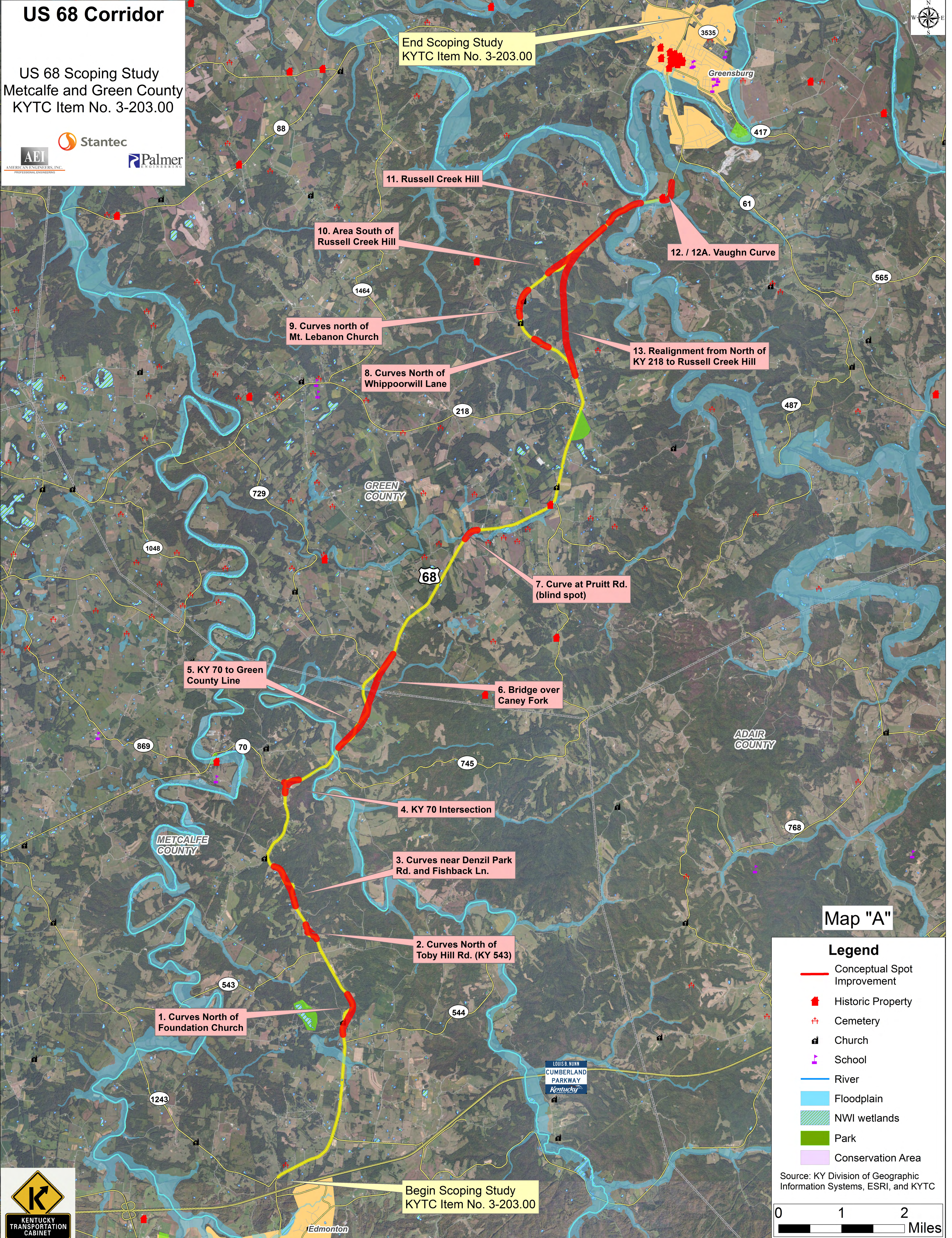
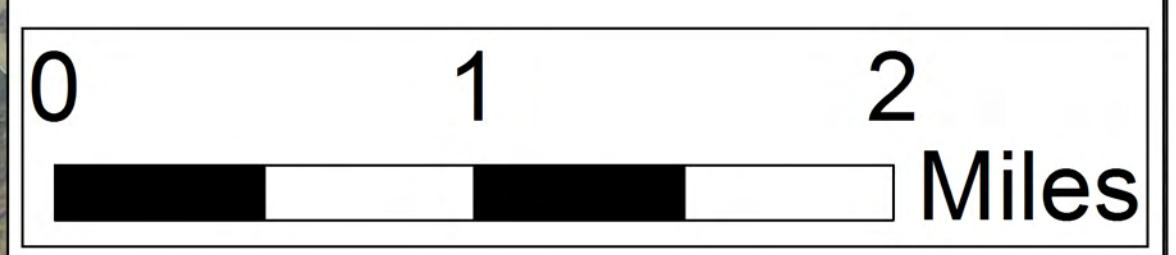
Begin Scoping Study
KYTC Item No. 3-203.00

Map "A"

Legend

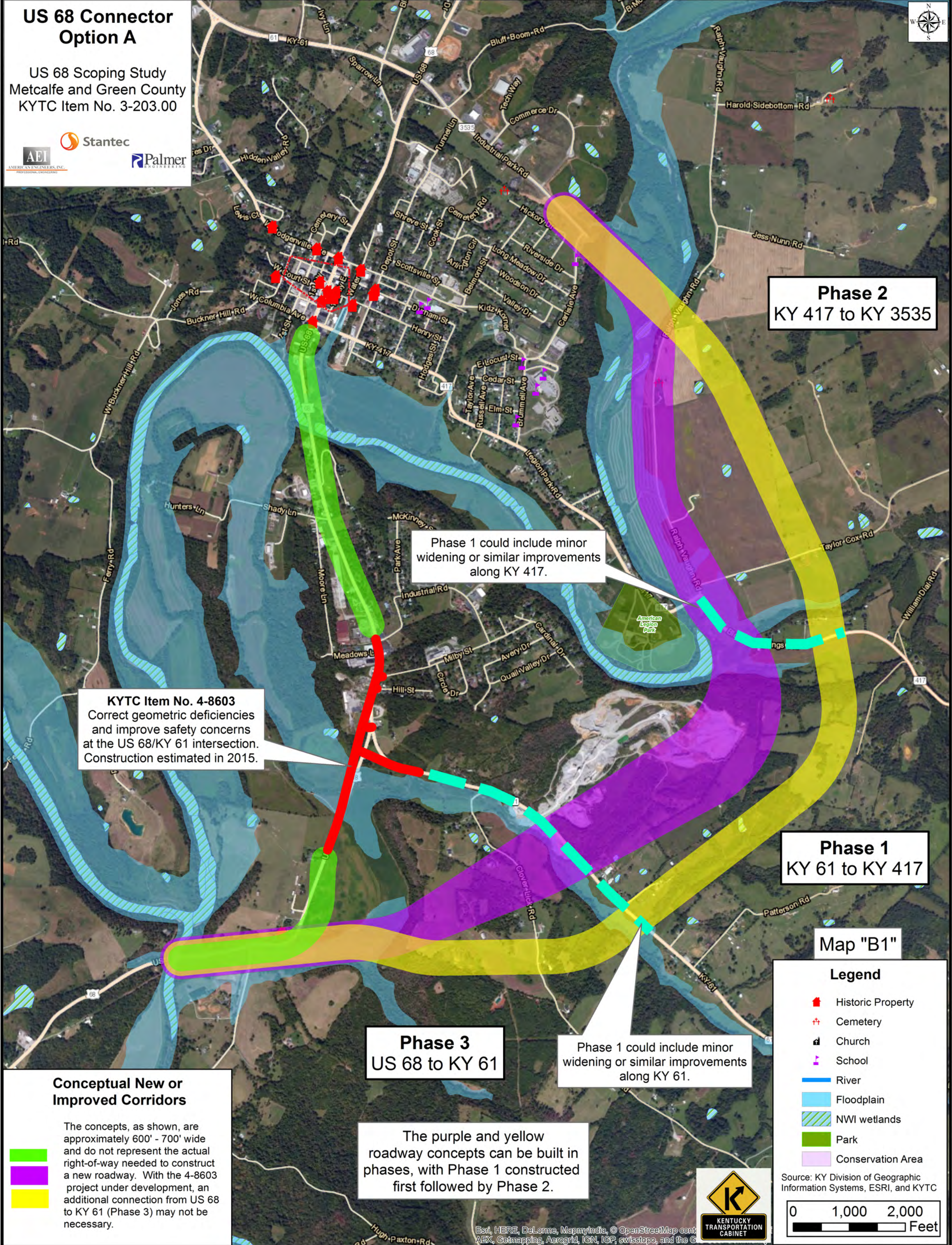
- Conceptual Spot Improvement
- Historic Property
- Cemetery
- Church
- School
- River
- Floodplain
- NWI wetlands
- Park
- Conservation Area

Source: KY Division of Geographic Information Systems, ESRI, and KYTC



US 68 Connector Option A

US 68 Scoping Study
Metcalf and Green County
KYTC Item No. 3-203.00



Phase 2
KY 417 to KY 3535

Phase 1 could include minor widening or similar improvements along KY 417.

KYTC Item No. 4-8603
Correct geometric deficiencies and improve safety concerns at the US 68/KY 61 intersection. Construction estimated in 2015.

Phase 1
KY 61 to KY 417

Map "B1"

Phase 3
US 68 to KY 61

Phase 1 could include minor widening or similar improvements along KY 61.

The purple and yellow roadway concepts can be built in phases, with Phase 1 constructed first followed by Phase 2.

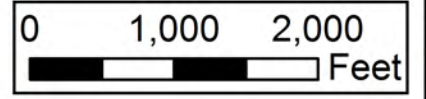
Conceptual New or Improved Corridors

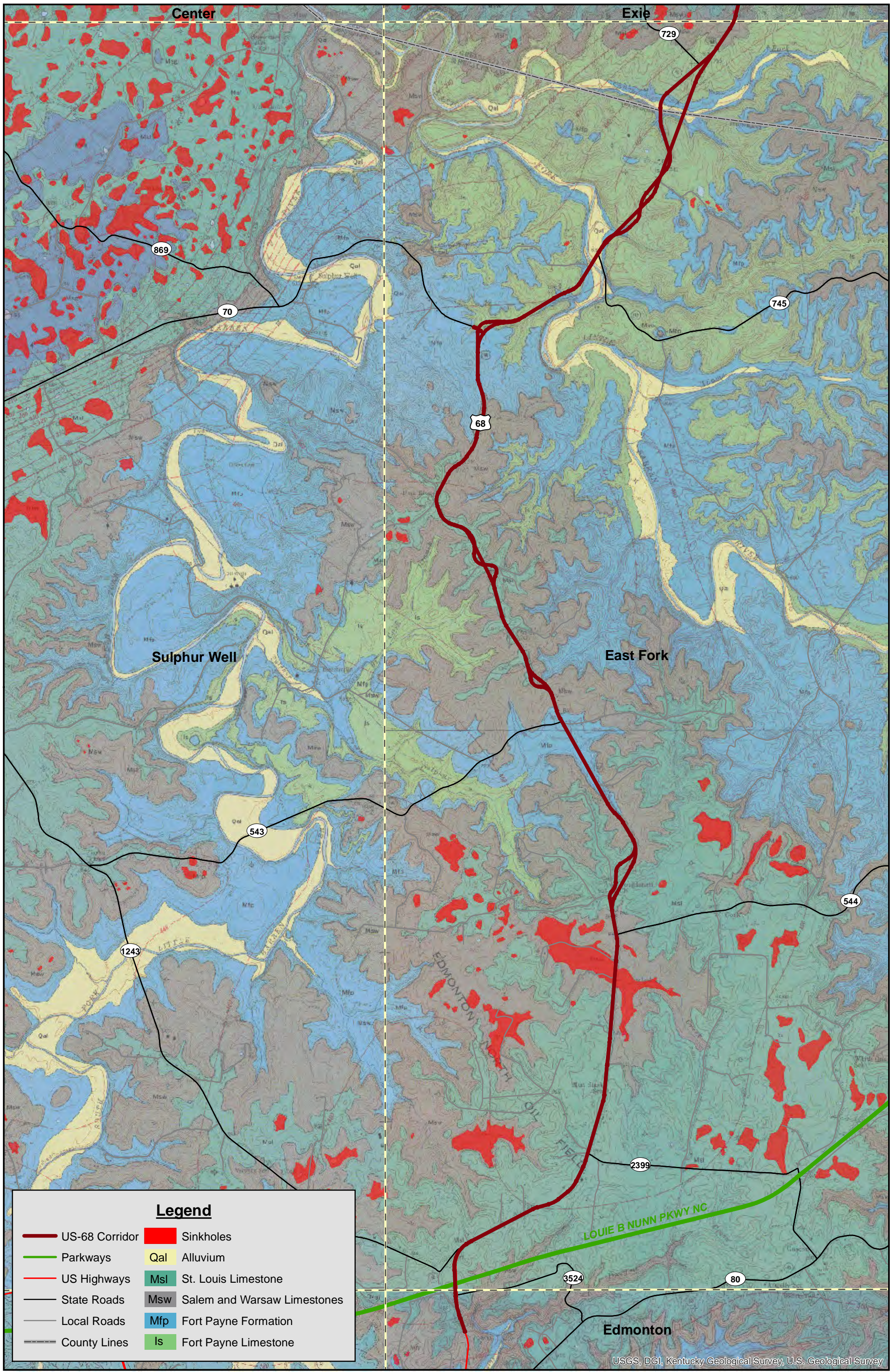
The concepts, as shown, are approximately 600' - 700' wide and do not represent the actual right-of-way needed to construct a new roadway. With the 4-8603 project under development, an additional connection from US 68 to KY 61 (Phase 3) may not be necessary.

Legend

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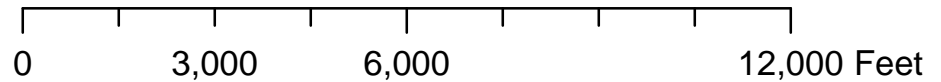
Source: KY Division of Geographic Information Systems, ESRI, and KYTC

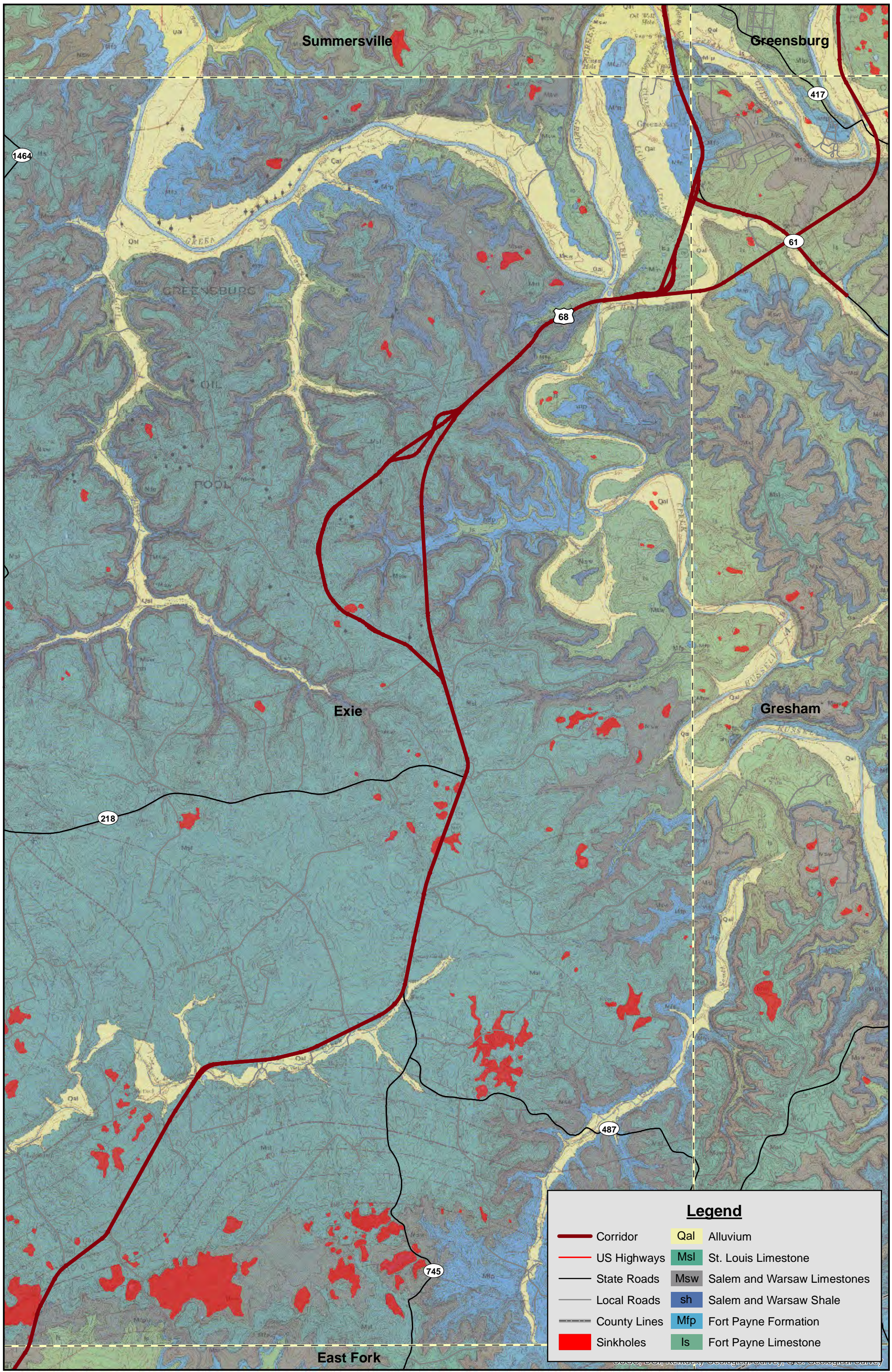




Legend

- US-68 Corridor
- Parkways
- US Highways
- State Roads
- Local Roads
- - - County Lines
- Sinkholes
- Qal Alluvium
- Msl St. Louis Limestone
- Msw Salem and Warsaw Limestones
- Mfp Fort Payne Formation
- Is Fort Payne Limestone

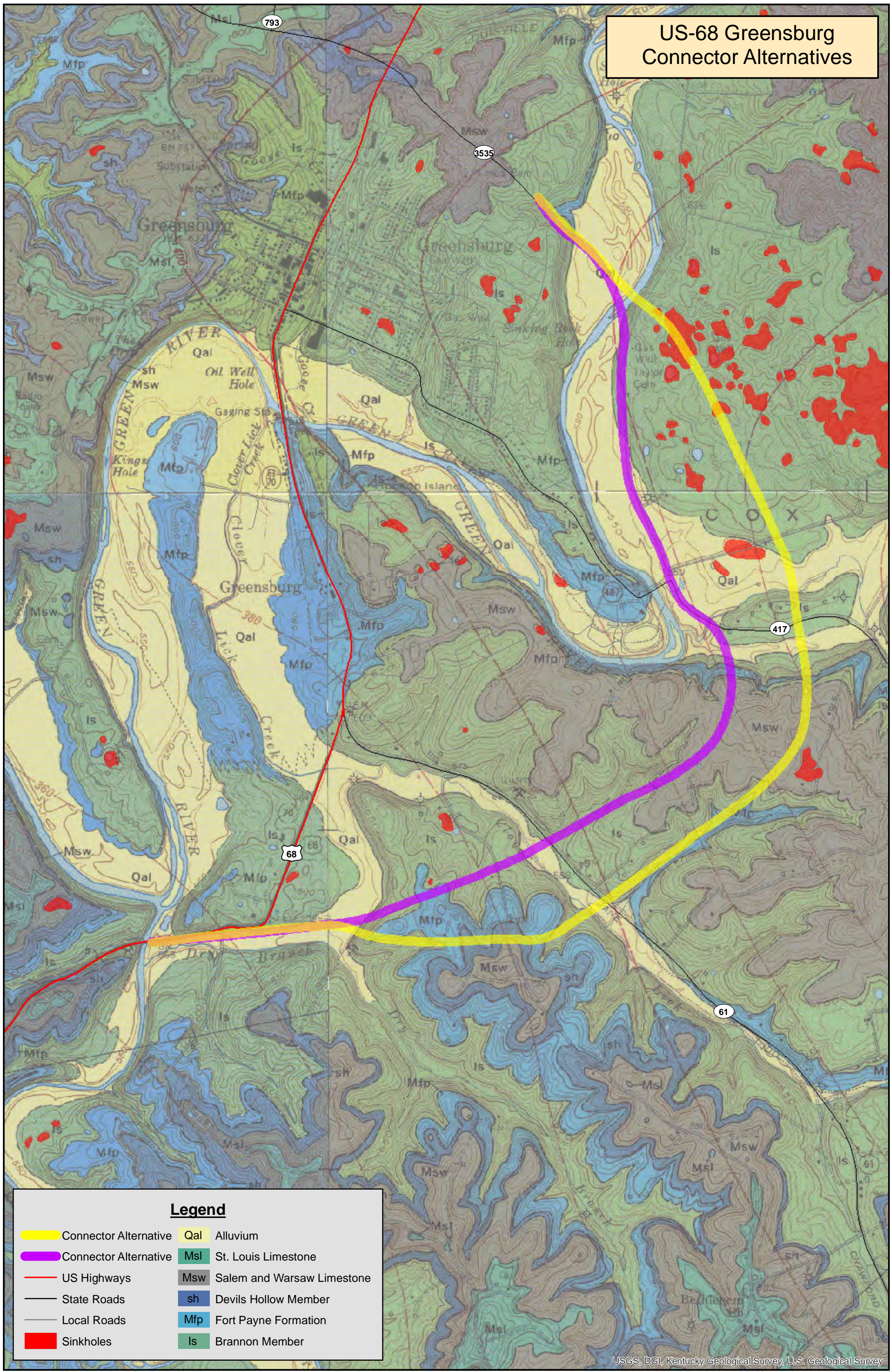




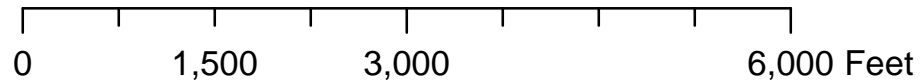
Legend			
	Corridor		Qal Alluvium
	US Highways		Msl St. Louis Limestone
	State Roads		Msw Salem and Warsaw Limestones
	Local Roads		sh Salem and Warsaw Shale
	County Lines		Mfp Fort Payne Formation
	Sinkholes		ls Fort Payne Limestone

0 3,000 6,000 12,000 Feet

US-68 Greensburg Connector Alternatives



Legend			
	Connector Alternative		Qal Alluvium
	Connector Alternative		Msl St. Louis Limestone
	US Highways		Msw Salem and Warsaw Limestone
	State Roads		sh Devils Hollow Member
	Local Roads		Mfp Fort Payne Formation
	Sinkholes		Is Brannon Member



<u>Report No.</u>	<u>Route</u>	<u>Structure Over</u>	<u>Project Type</u>	<u>Description</u>
S-001-2005	KY-61	Abandoned Railroad Tunnel	State Bridge	Green Co. - Bridge over Abandoned Railroad Tunnel - Structure Report
R-044-2001	KY-61		Roadway	Revised Report for Greensburg Southeast Loop
S-062-2001	KY-61		Culvert	Box Culvert at Sta. 128+00
R-013-2007	KY-61		Roadway	RECONSTRUCT KY 61 FROM US 68 IN GREENSBURG TO COLUMBIA From Station 139+40 to Station 419+85
S-055-1984	KY-417	Green River	State Bridge	Greensburg-Blowing Springs Road over Green River @ STA 16+75
R-020-1987	US-68		Roadway	From Station 10+00 to Station 114+00
S-008-1992	US-68		Culvert	3x2 RCBC Ext. @ Station 63+02.77 and 5x4 RCBC Ext. @ Station 92+23.36
R-022-2013	US-68		Roadway	Correct geometric deficiencies and improve safety concerns at US-68/KY-61 intersection.
S-052-2013	US-68	Clover Lick Creek	State Bridge	Correct geometric deficiencies and improve safety concerns at US-68/KY-61 intersection.
S-050-1978	US-68	Russell Creek	State Bridge	Bridge is located 0.3 miles west of junction of US-68 and CR-1506
R-018-2011	US-68		Roadway	Interchange from US 68 South onto Cumberland Parkway
S-031-2011	US-68	Cumberland Parkway	State Bridge	Interchange from US 68 South onto Cumberland Parkway 4-Span Bridge over the Parkway, 47-80-80-47, Sta. 517+63.02, 15 deg Sk Lt
RA-003-2012	US-68		Roadway	Interchange from US 68 South onto Cumberland Parkway - Steepen slopes from 3:1 to 2:1 to avoid blue line stream @ the KY 3524 approach