

Appendix C – GEOTECHNICAL OVERVIEW

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MEMORANDUM

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

BY: Bart Asher, P.E., P.L.S.
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DATE: August 14, 2014

SUBJECT: **Bullitt County**
New Route from KY 480 TO KY 44
With Salt River Crossing
Mars # 8753101P
Item # 5-8709
Preliminary Geotechnical Assessment

The Division of Planning is conducting a study for a new route in Bullitt County, Kentucky from KY 480 to KY 44 with a crossing of the Salt River and tributaries. There are numerous alternates as shown on the supplied conceptual plan. This abbreviated review will discuss some general geotechnical concerns with the study area.

The approximate coordinates for this site are:
- 38.672167 degrees North and -85.650153 degrees West.

Previous Geotechnical reports completed in or near this study area are listed in a table in the attachments to this report. These reports can be accessed in the KYTC Geotechnical Branch data base. A review of these reports was made and findings were incorporated into this document.

The site is located in the Brooks and Shepherdsville Geologic Quadrangles. The area of interest is located in the near the interface with the Outer Bluegrass Physiographic Region and the Knobs Region.

There are numerous bedrock formations in this area as depicted on the attached map. Bedrock is exposed in numerous places. The Louisville Limestone Formation is the predominant formation in this area. The Louisville Limestone formation consists of dolimitic limestone and dolomite. It is relatively thin bedded in the upper portions and thick bedded at its base. The Louisville Limestone Formation is susceptible to developing karst related issues. Numerous mapped sinkholes are present in the study area and sinkholes were noted during the site visit. Also of note, due to construction difficulties related to these formations, are the New Albany Shale, Waldron Shale and the Osgood Formation. The New Albany Shale is often described as "Black" shale and has a propensity to produce acidic runoff due to its large concentration of pyrite. Mitigation to treat acidic runoff is often necessary where the New Albany Shale is exposed or used in embankments. Mitigation methods can include encapsulating the shale in cuts and fills or treating runoff water. In addition measures must be taken to protect buried structures that may be in contact or close proximity to the New Albany. The Waldron Shale is a generally thin layer of clay shale that can weather quickly once exposed and can be problematic in cuts and fills due to its highly weatherable nature and its propensity to shrink and swell based on the water content. Waldron shale can also be pyritic with similar issues to the New Albany Shale.

P-005-2014
Bullitt County
New Route Study

The Waldron shale is fairly impermeable and springs are often found atop this layer. These springs can be problematic for road construction. Often these springs are “wet weather” springs which can be hard to locate in a field investigation during dry times. The Osgood Formation is interbedded clay shale and dolomite. The clay shales can be of poor quality for road construction and can be very susceptible to weathering. Much like the Waldron Shale, springs are often located atop the Osgood Formation. Laurel Dolomite, which is also present, is generally well suited for road construction.



Bedrock outcrop on existing KY 1442



Typical sinkhole in area

Rock cut slopes in the area require site specific design. Cut slopes can generally range from ½:1 to 2:1 depending on the type of rock and site conditions. Rogers Group operates a stone quarry at the North end of this proposed project. No mapping could be found. The Division of Material was contacted and verified that this location is presently open pit mining only and they do not presently have underground works.

Mapped soils indicate the presence of alluvium, lacustrine deposits and terrace deposits. Artificial fill is mapped in some areas and should be anticipated due to the amount of development in the area. Generally, overburden in upland areas of this region are relatively thin. Most borings available in the study area indicate soil depths of less than 20 feet, however soils depths of 60 feet or more could be encountered near the creeks and the river.

Soils in the area are generally suitable for embankment construction although soft depositional areas may be encountered. Generally, embankments built from the native soils can be constructed to a height of 30 feet or more with 2H:1V slopes if the foundation is suitable and proper compaction methods are used. Soil cuts over approximately 10 feet often require analyses to design proper slopes. In no case should soil cuts be steeper than 2H:1V. Suitable rock for embankment construction and rock roadbed is readily available in this area of the state. Shales can be problematic for construction and may require special methods for placement. In areas where soils are underlain by shale, landslides can be an issue.

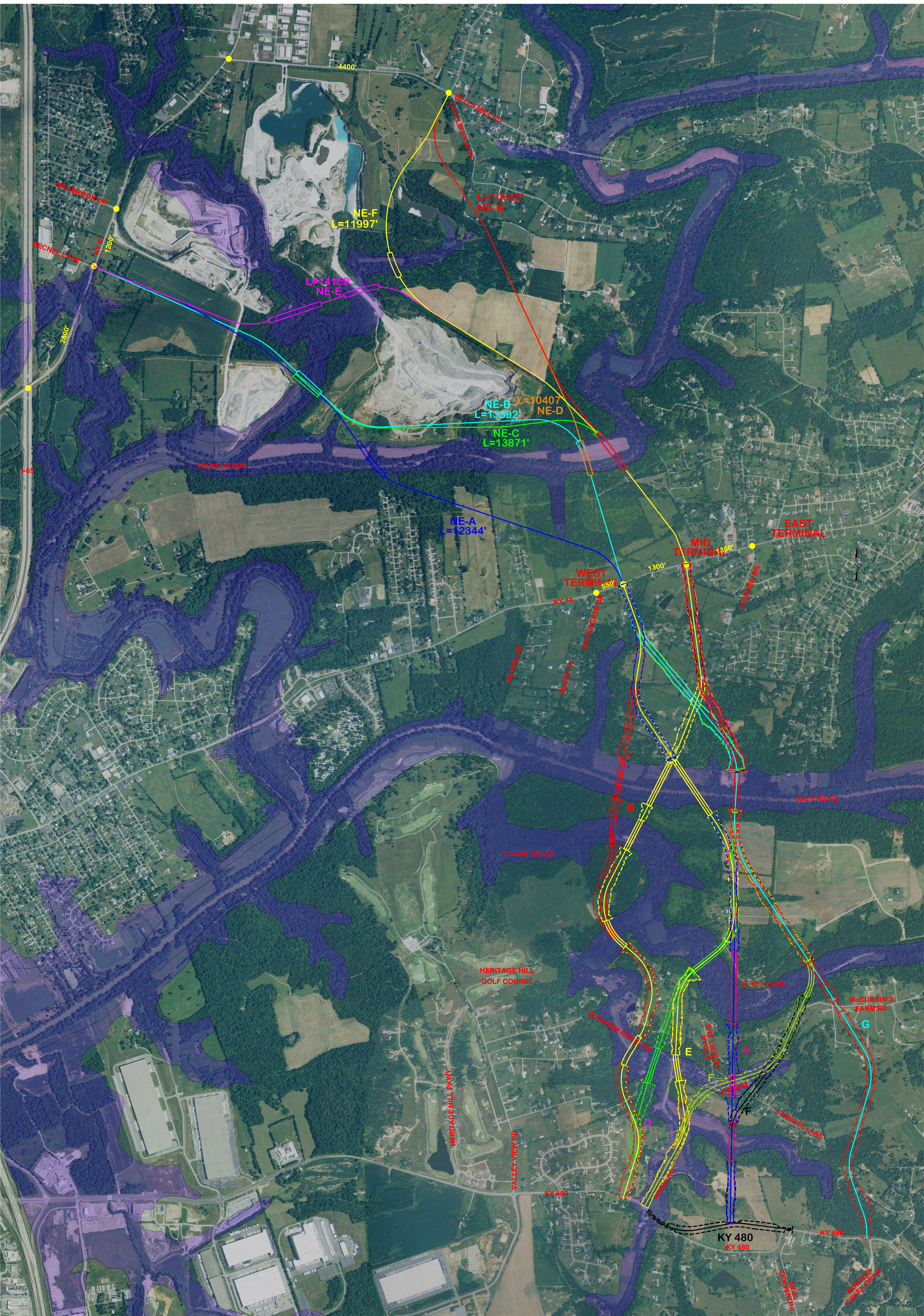
California Bearing Ratio (CBR) values used in pavement design generally range from 2-5 for soils subgrades in the area. The use of rock roadbed is a common practice in the area. Chemical modification of subgrade is also used in the area. Wet areas could require undercutting and/or rock stabilization 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. Undercutting where shales are encountered at the roadway grades in cuts will be required.

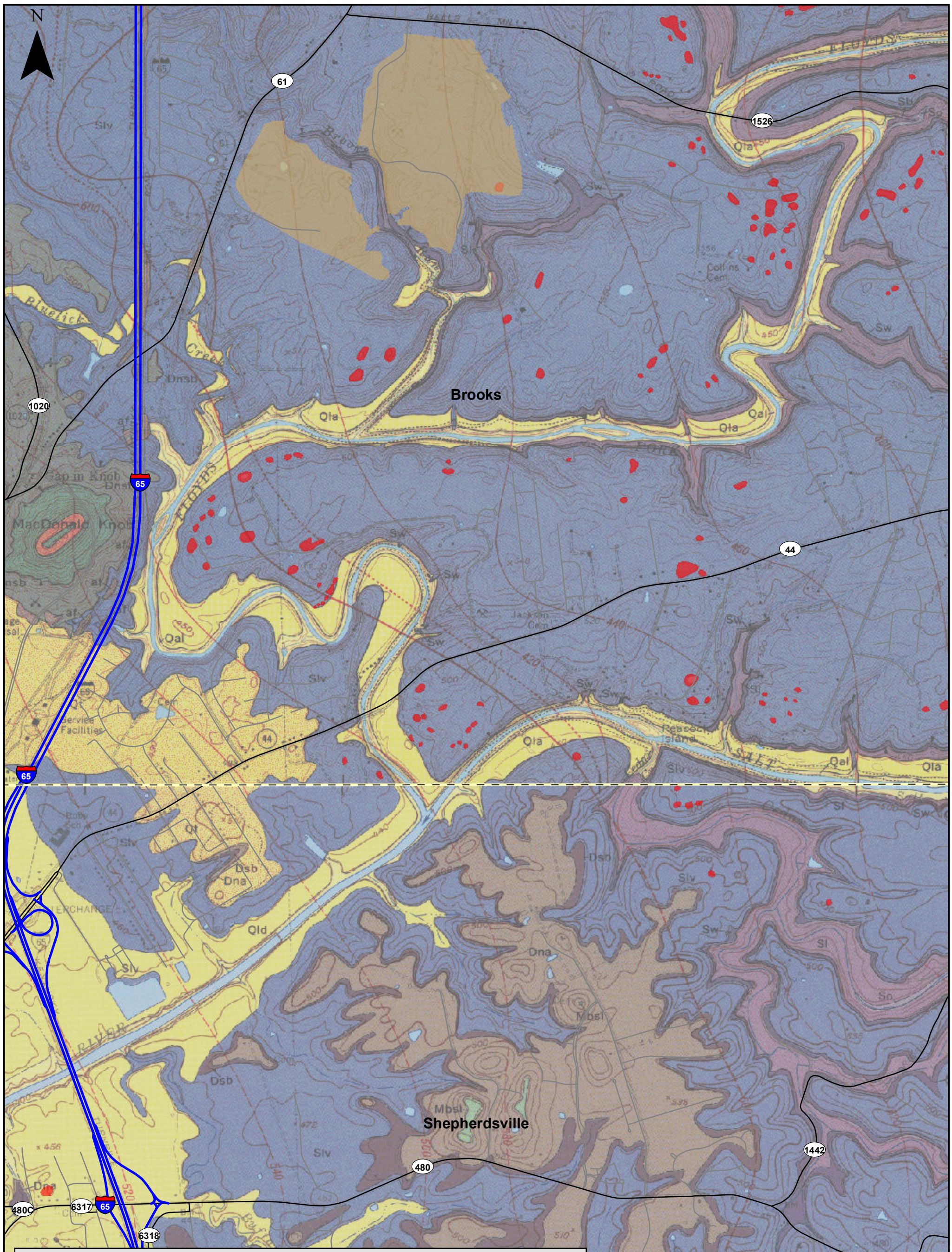
Foundations for bridges in this area would typically be founded on bedrock. Shallow foundations (spread footings on bedrock) or deep foundations (steel H-piles driven to bedrock or drilled shafts socketed into bedrock) would be typical. Soils in this area can be susceptible to problems related to settlement where embankments are constructed near structures. A hydraulic analysis, including scour potential, will be critical for bridges at wet crossings. Aerial photography of the location was reviewed and it would appear that Floyds Fork meanders and tends to cut itself off and change channel course occasionally. Alternate NE-E crosses a tributary to Floyds Fork at a significant bend in the creek. Situations similar to that have caused major issue with bridge foundations in the past. Culverts and walls are typically supported on shallow (either yielding or non-yielding) foundations on soil or bedrock.

Site specific Geotechnical investigations are critical in this region for design.

Please feel free to contact this office for additional information.

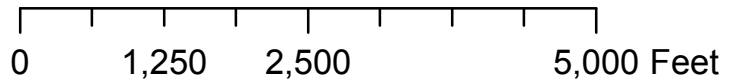
**Attachments: Supplied Study Area map GQ Area Map
 List of previous Geotechnical Studies in or near area**





Legend

Interstates	Qal Alluvium	Mbsl Borden Formation lower part of shale member
State Roads	Qla Lacustrine Deposits	Slv Louisville Limestone
Local Roads	Qt Terrace Deposits	Sw Waldron Shale
Quarries	Dna New Albany Shale	Sl Laurel Dolomite
Sinkholes	Dsb Beechwood Limestone Member of Sellersburg Limestone	So Osgood Formation



<u>Report No.</u>	<u>Route</u>	<u>Structure Over</u>	<u>Project Type</u>	<u>Description</u>
R-036-2013	KY-480		Roadway	WIDEN KY-480 FROM I-65 TO VALLEY VIEW DRIVE
RA-016-2013	KY-480		Roadway Addendum	WIDEN KY-480 (Cedar Grove Road) FROM I-65 TO VALLEY VIEW DRIVE
P-016-2007	KY-480		Planning	WIDEN KY-480 FROM I-65 TO VALLEY VIEW DRIVE
R-018-1997	KY-44		Roadway	From Sta. 1 +060 to 1 +760
S-034-1997	KY-44	Floyds Fork	State Bridge	0.6 miles E of Shepardsville
R-007-2009	KY-480		Roadway	WIDEN KY-480 FROM I-65 TO VALLEY VIEW DRIVE
S-013-2009	KY-480	Buffalo Run Creek	County Bridge	KY 480 over Buffalo Run Creek
R-014-1998	KY-61		Roadway	From Sta. 1 +050 to 10+000
RA-009-2007	KY-61		Roadway Addendum	From Sta. 1 +050 to 10+000