

# **REPORT OF GEOTECHNICAL OVERVIEW**

**KY 163 ALTERNATIVES STUDY FROM KY 90 TO THE  
LOUIE B. NUNN (CUMBERLAND) PARKWAY IN  
METCALFE COUNTY  
KYTC ITEM NO. 3-129.00**



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**KYTC ITEM NO. 3-129.00**

**Prepared for:**

**KENTUCKY TRANSPORTATION CABINET  
DIVISION OF PLANNING**

**Prepared by:**

**WILBUR SMITH ASSOCIATES – GEOTECHNICAL DIVISION**

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## **1.0 INTRODUCTION**

The corridor of Kentucky Route 163 is currently being studied by Wilbur Smith Associates to allow evaluation of alternate alignments from KY 90 to the Louie B. Nunn (Cumberland) Parkway near Edmonton, Kentucky. The study limits for the KY 163 corridor approximately lie within a triangle-shaped area as shown on the Location Map in the Appendix. The southern end of the study area is about 2,000 feet on either side of existing KY 163 and its intersection with KY 90. The study area broadens to the north extending to an approximately 5 mile width along the Louie B. Nunn Parkway. The northwestern limit of the study area is a major interchange at Louie B. Nunn Parkway. The northeastern limit of the corridor is the intersection of KY 2399 and Louie B. Nunn Parkway.

The objectives of the geotechnical study were to review readily available data to identify potential geotechnical and/or geological features that could impact the planning, design, and/or construction of a new or modified roadway along the proposed corridor. Additionally, this report identifies potential geotechnical hazards and provides recommendations of areas that should be avoided if possible during the selection of possible corridor routes.



## **2.0 SITE CONDITIONS**

### **2.1 SITE VISIT OBSERVATIONS**

A site visit was made on December 29, 2006 by Mr. J. Christopher McMichael, a Professional Geologist with WSA. The visit included a visual survey of public and private properties that were observed from KY 163, KY 3234 and several of the crossroads in the corridor study limits. The land use was observed to be predominantly farmland with numerous farm ponds. Much of the land adjacent to KY 163 is gently rolling with occasional wooded areas. Private residences were irregularly spaced along both sides of KY 163 outside of Edmonton, Kentucky.

Both shale and limestone outcroppings were observed along the existing KY 163 alignment (Photograph 1). Shale outcroppings were observed across the area's lower elevations. The limestone outcroppings were observed less frequently; they were only found along road cuts at the higher elevations. The depth to bedrock was observed to be less than 2 feet at one residence near the intersection of KY 163 and Rogers Creek (Photograph 2).



Photograph 1 - Rock outcropping along KY 163



Photograph 2 - Shallow rock at residence near KY 163 and Rogers Creek

Groundwater seepage was observed from an outcropping of shale along KY 163 at approximately 4 miles north of KY 90. Water levels at the observed stream crossings along existing KY 163 were generally less than 2 feet deep.

## **2.2 TOPOGRAPHY**

The project site traverses the rolling hills of Kentucky farmland. The existing KY 163 alignment has its highest elevation at the southernmost end of the study area where KY 163 crosses KY 90 (EL +1,149 feet). As KY 163 heads north from KY 90, grades decrease until Rogers Creek (EL +800 feet), then rise again to EL +900 feet before dropping back down to the Black Rock Creek stream valley (EL 799 feet). From there, grades increase as KY 163 approaches Edmonton, KY (EL +843 feet). The maximum difference in elevation between any two points in the study area is about 350 feet. The general topography of this area is depicted in the Topographic Overview in the Appendix.

## **3.0 GEOLOGIC CONDITIONS**

### **3.1 GEOLOGIC OVERVIEW**

Based on the published USGS Geologic Quadrangle for the existing alignment, KY 163 is located on the Mississippian Plateau physiographic province. The Mississippian Plateau is dominated by thick deposits of horizontal to slightly dipping limestone bedrock. This region exhibits the typical “karst” topography, including: sinkholes, sinking streams, streamless valleys, springs and caverns.

### **3.2 GEOLOGIC FORMATIONS**

Four geologic formations are within the vicinity of the study area, including the St. Louis Formation, the Ft. Payne Limestone, the Salem and Warsaw Limestones, and the associated quaternary alluvium along the valley bottoms. Each of these formations is described below. The approximate locations of these formations are shown in the Geologic Map in the Appendix.

**St. Louis Limestone** - The St. Louis Limestone is only present at the higher elevations of the project site where it caps the localized ridges. It is within this formation that Kentucky GIS mapping indicates a major risk for potential sinkhole development. The St. Louis Limestone is a medium to dark gray, coarse-grained limestone. The formation contains nodules of gray banded chert and is very fossiliferous. The St. Louis Limestone weathers to a dark-red clay soil with abundant light gray chert fragments.

**Salem and Warsaw Limestones** - The Salem and Warsaw Limestones are, like the St. Louis Limestone, located along the higher elevations. It is within this formation that Kentucky GIS mapping indicates a slight risk for sinkhole development. The Salem and Warsaw Limestones are medium gray to grayish brown, coarse- to very coarse-grained limestones. Locally, the limestones are argillaceous, shaly, and cherty. There are also some tongues or beds of siltstone. The limestone commonly weathers to a light red soil.

**Ft. Payne Formation** - The Ft. Payne Formation is the predominant geologic formation underlying the existing project alignment. It is comprised of silty shale, siltstone, and limestone. The shales and siltstones are light gray to brownish gray and have a calcareous or dolomitic matrix. The limestone is light gray to dark brown and contains abundant chert. The Ft. Payne Formation weathers to a reddish yellow or grayish yellow soil.

**Alluvium** - The Quaternary Alluvium within the study area are comprised of clay, sand, and gravel. These soils are poorly consolidated floodplain deposits and are located along the larger stream terraces.

### **3.3 UNDERGROUND OPENINGS**

Available mapping indicates numerous large sinkholes in the southern and northeastern extents of the study area. Published maps classify the area in the vicinity of the interchange between KY 2399 and Nunn Parkway as a major karst area. Likewise, the KY 90 and KY 163 interchange is located in a major karst area. These major karst areas are denoted on the Corridor Features map in the Appendix. Apart from these two areas, only four other sinkholes were observed on published mapping of the study area.

Although not observed by WSA, Third Rock Consultants noted a large cave in their environmental overview summary (dated January 5, 2007). This cave, Harvey Cave near KY 90 and Kingsford Manufacturing, is located in the southern portion of the study area and reportedly has a free-flowing spring.

## **4.0 MISCELLANEOUS FEATURES**

### **4.1 SURFACE OR DEEP MINING ACTIVITIES**

No surface or deep mining activities were observed in the field or on published maps.

### **4.2 GAS AND OIL WELLS/PIPELINES**

Based on published maps, numerous dry and abandoned wells are located in the study corridor. Less than ten active oil wells are identified to the south of Louie B. Nunn Parkway within the corridor.

### **4.3 UNDERGROUND STORAGE TANKS**

Underground storage tank concerns are addressed by Third Rock Consultants, LLC in their KY 163 “Red Flags” Summary.

## **5.0 GEOTECHNICAL ISSUES AND RECOMMENDATIONS**

The two key geotechnical issues for this corridor are the presence of karst producing bedrock along the southern and northeastern portions of the corridor and the anticipated shallow depth to bedrock along the entire corridor.

From a geotechnical perspective, we recommend that two sensitive areas be avoided, if possible:

- The existing intersection of KY 2399 and Louie B. Nunn Parkway; and
- The significant sinkhole west of existing KY 163 at the bend in KY 861, which lies near the center of the study area.

However, it is recognized that other factors must be considered and geotechnical issues may not be the final determinant in the development of alternatives and final recommendations.

Also, given the karst activity in the southern portion of the study area, it is advisable to limit the east-west shifting of the southern terminus of alternative alignments away from the existing KY 163 and KY 90 intersection.

The shallow depth to bedrock can adversely affect cut/fill quantities, increase excavation costs, and result in additional engineering design and inspection requirements. Deeper cuts may also extend into bedrock requiring potential mixed face (i.e., soil/rock) slope designs and/or encounter zones of weathered rock that require special consideration. However, due to the apparently horizontal bedding of the bedrock, stability of permanent rock slopes should be readily engineered and constructed.

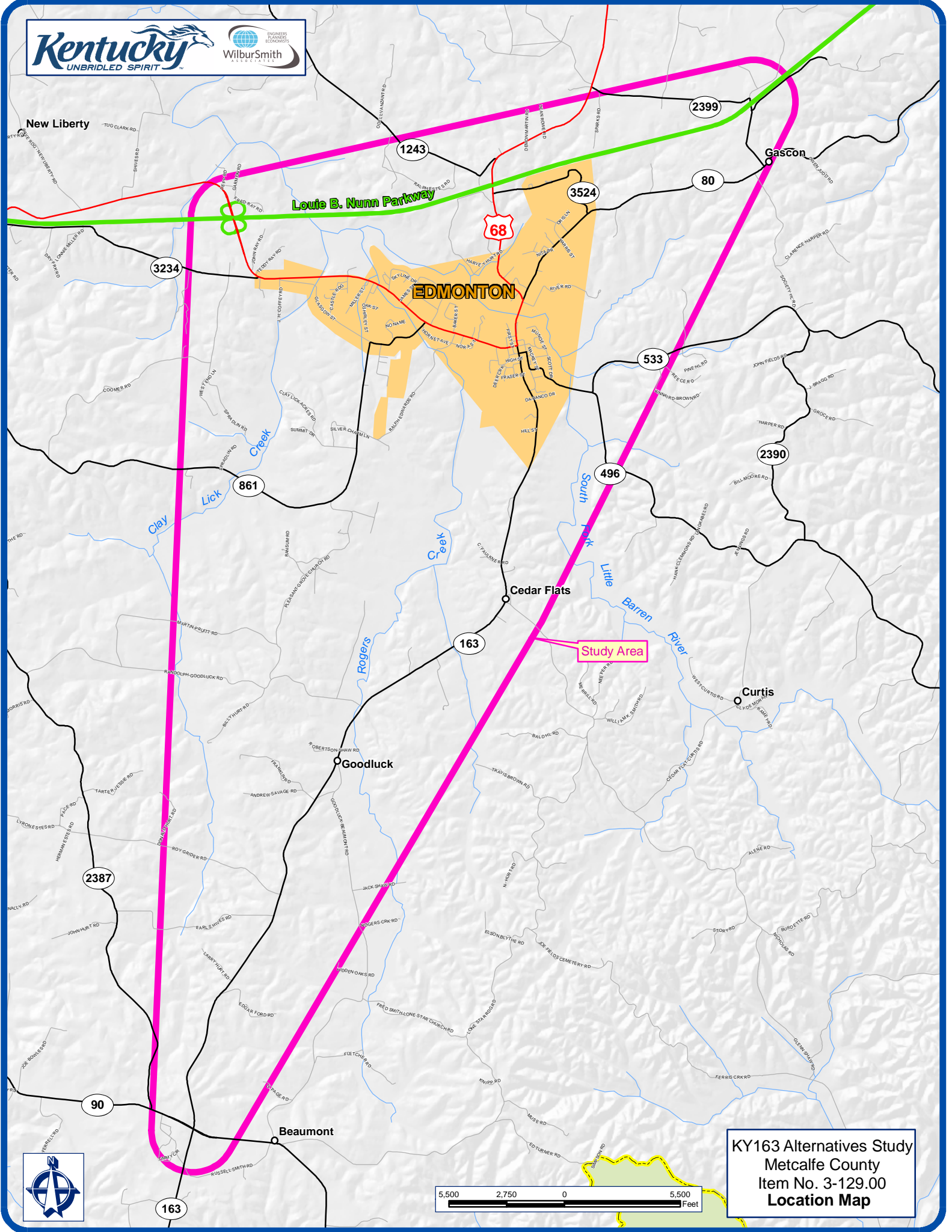
## **6.0 LIMITATIONS**

The evaluations within this report are based on review of available published information and limited site reconnaissance over a large study area. As such, the geotechnical recommendations are necessarily broad based and by no means comprehensively cover all potential geotechnical issues that may be associated with this project. Detailed geotechnical exploration should be performed for the final selected alignment in accordance with KYTC guidelines.

## **APPENDIX**

**LOCATION MAP  
TOPOGRAPHIC OVERVIEW  
GEOLOGIC MAP  
CORRIDOR FEATURES**





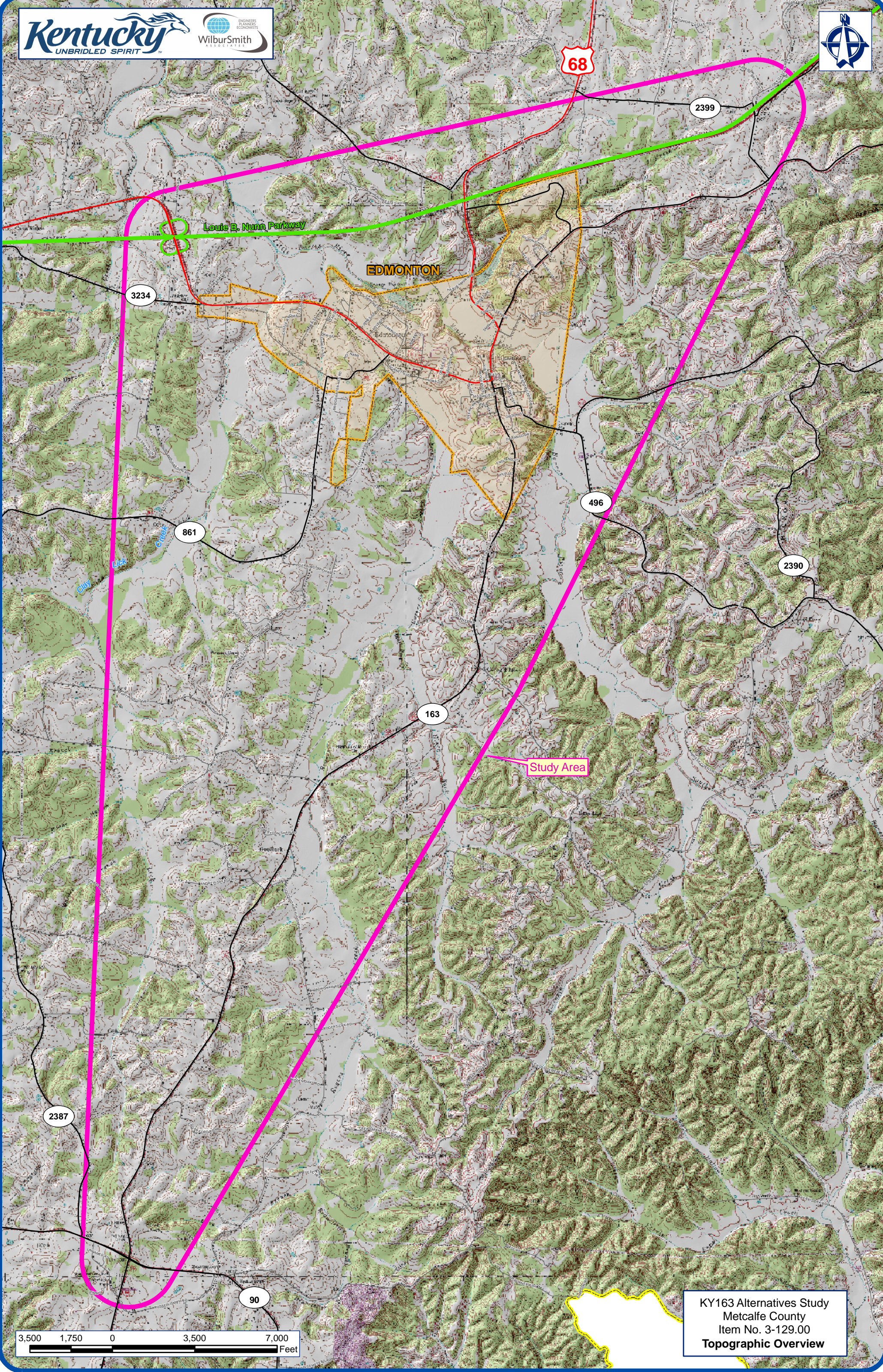
Louisville B. Nunn Parkway

EDMONTON

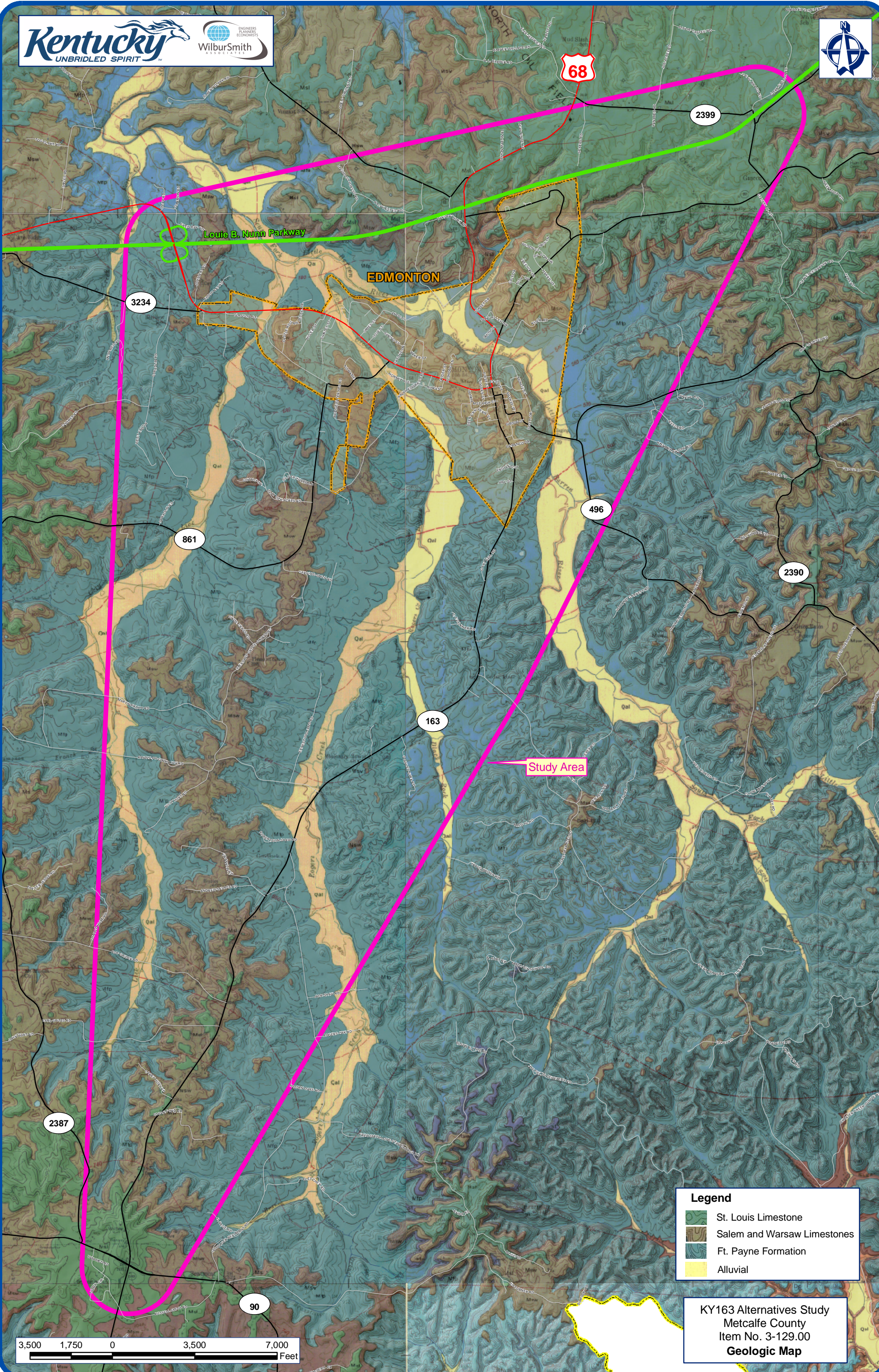
Study Area

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**Location Map**









Louie B. Nunn Parkway

EDMONTON

3234

861

163

496

2390

68





2399

2387

90

Study Area

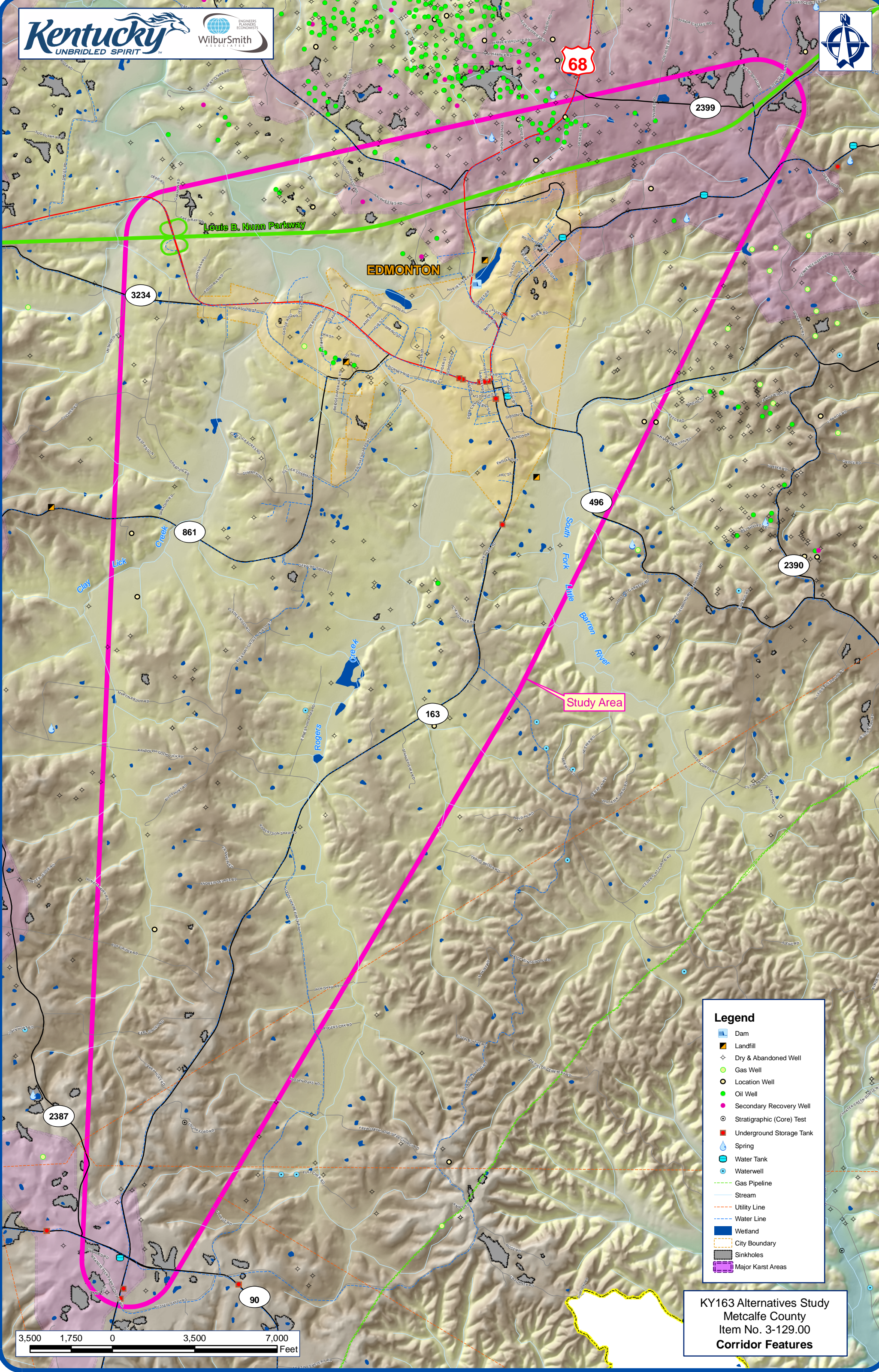
Legend

-  St. Louis Limestone
-  Salem and Warsaw Limestones
-  Ft. Payne Formation
-  Alluvial


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**Geologic Map**











**Legend**


 Dam


 Landfill


 Dry & Abandoned Well


 Gas Well


 Location Well


 Oil Well


 Secondary Recovery Well


 Stratigraphic (Core) Test


 Underground Storage Tank


 Spring


 Water Tank


 Waterwell


 Gas Pipeline


 Stream


 Utility Line

 Water Line

 Wetland

 City Boundary

 Sinkholes

 Major Karst Areas

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Corridor Features