Brent Spence Bridge
Replacement/Rehabilitation Project

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

KENTUCKY TRANSPORTATION CABINET

Red Flag Summary

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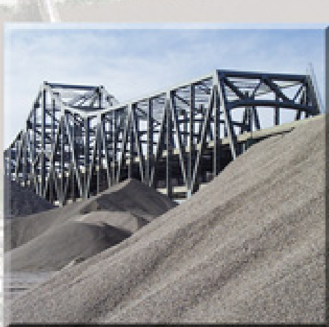





PARSONS BRINCKERHOFF

In Association with:
TranSystems Corporation
Wilbur Smith Associates

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1.0 INTRODUCTION

This document is intended to identify “Red Flags” for the Brent Spence Bridge Rehabilitation/Replacement Project. The Red Flag information contained in this document identifies potentially sensitive locations that may require additional coordination activities. Red Flags may also affect the anticipated project design, estimated project budget, construction schedule or scope of work for any proposed transportation project associated with this study.

2.0 PROJECT HISTORY AND SETTING

Originally opened in 1963, The Brent Spence Bridge (BSB) and its approaches are key elements of the nation’s Interstate Highway System. This facility carries both I-75 and I-71 traffic through the Greater Cincinnati/Northern Kentucky area. This important river crossing is vital to long-distance state and national commerce, as well as being a major thoroughfare for local and regional mobility.

Interstate 75 connects the Greater Cincinnati/Northern Kentucky region with Detroit, Michigan to the north and Miami, Florida to the south. It also connects with I-74 and US 50 to the east and west. I-75 and the railroads that run parallel to it through this region are among the nations busiest. This transportation system is the backbone of commerce and travel through the region. According to Federal Highway Administration (FHWA) estimates, I-75 is one of the busiest trucking routes in North America with truck traffic approaching six billion miles annually. In addition, more than 250 freight trains per day pass through or have destinations within the I-75 corridor. The interstate portions of this transportation system are nearly 50 years old and significant safety and capacity problems exist.

Cincinnati, Ohio and Covington, Kentucky were originally settled in the late 1700’s. The built environment surrounding I-75 and the BSB is characterized by highly disturbed, dense urban development with historic districts and properties nearby. Interstate 75 in Cincinnati is a typical downtown freeway with closely spaced ramps and poor roadway geometry. Improvements to several of the downtown streets were made during the Fort Washington Way reconstruction. Improvements to the connections in Covington were built during the I-75 “Cut in the Hill” project. Within the past few years, several rehabilitation projects were performed in addition to painting the I-471 Bridge.

3.0 STUDY AREA

The project study area is located along a 6.5 mile segment of I-75 within the Commonwealth of Kentucky and the State of Ohio. The southern limit of the project is 2,800 feet south of the midpoint of the interchange of I-75 and Kyles Lane in Kentucky (Exit 189). The northern limit of the project is 1,500 feet north of the midpoint of the interchange of I-75 and the Western Hills Viaduct in Ohio (Exit 2B).

The eastern and western limits of the study area follow the existing alignment of I-75. In Kentucky, the study area is a 1,500-foot wide corridor centered on I-75 south of the City of Covington. At Covington, the eastern and western study area boundaries widen and follow city streets as described below.

The eastern limit of the project:

- In the City of Covington, the eastern boundary follows Philadelphia Street to its intersection with 5th Street.
- The eastern boundary follows 5th Street to its intersection with Main Street and then follows Main Street to the Ohio River.
- The eastern boundary parallels the Clay Wade Bailey Bridge across the Ohio River to Pete Rose Way in the City of Cincinnati.
- Through downtown Cincinnati, the eastern boundary follows Second Street and US Route 50 eastbound to approximately I-471 (Daniel Carter Beard Bridge) and Eggleston Avenue, then Third Street, Pike Street and Fourth Street to Elm Street and then northward to west Court Street.
- From west of Court Street, the eastern boundary extends west to Linn Street, where it follows Linn Street to Central Parkway.
- The boundary extends north paralleling Central Parkway to Linn Street.
- From Linn Street, the eastern boundary extends westerly to Bank Street.
- From Bank Street, the eastern limits extend in the northerly direction with a consistent 750-foot offset from the I-75 centerline.

The western limit of the project:

- At 5th Street in the City of Covington, the western boundary extends in the northwesterly direction across the Ohio River to State Route 50, approximately 1,000 feet west of the Freeman Avenue interchange.
- The western limit extends north parallel to Dalton Avenue to Hopkins Street.
- The western limit extends westerly along Hopkins Street to the western limits of Union Terminal, where it then extends northerly along the western limits of Union Terminal to Kenner Street.
- The western limit follows easterly along Kenner Street until the intersection with Dalton Avenue.
- The western limit parallels Dalton Avenue to north of Findlay Street, where it follows in the northerly direction with a consistent 750-foot offset from the I-75 centerline.

4.0 PROJECT GOALS AND OBJECTIVES

The National Bridge Inventory lists the Brent Spence Bridge as functionally obsolete due to the capacity, sight distance, and safety concerns associated with its current configuration. These concerns have led to this project being considered a top priority by the Kentucky Transportation Cabinet (KYTC), the Ohio Department of Transportation (ODOT), the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) and the cities of Covington, Kentucky and Cincinnati, Ohio.

Specific goals of the Brent Spence Bridge Rehabilitation/Replacement Project, including the entire corridor study area between the Kyles Lane Interchange in Kentucky to the Western Hills Viaduct in Ohio, are as follows:

- Improve safety
- Correct substandard design features
- Adequately address current and future traffic volumes through design and capacity improvements
- Minimize impacts to local communities, i.e., access, R/W, and user's costs, and maximize potential economic development opportunities
- Minimize environmental conflicts
- Minimize R/W and Construction costs
- Provide safe, efficient, and cost effective Maintenance of Traffic

This project has not yet reached a point in the project development process where specific transportation alternatives are analyzed. A No Build alternative will be developed and carried throughout the study as one possible study outcome. In addition, passenger rail alternatives developed by the North South Transportation Initiative and the *MetroMoves* Regional Rail Plan are known and will not be precluded by any alternatives developed as part of the Brent Spence Bridge Replacement/Rehabilitation project in this study corridor.

5.0 GEOTECHNICAL INFORMATION

A literature review consisting of compiling and reviewing existing geologic data within the study area was performed. Numerous documents and sources were reviewed for this effort, including:

- Historical topographic maps including 1912 maps and Hamilton County, Ohio CAGIS maps.
- Topographic and geologic maps published by the United States Geological Survey (USGS), the Geological Survey of Ohio, and the Kentucky Geological Survey, including website reviews of the same organizations.
- Soil Conservation Service Soil Surveys of Kenton County, Kentucky and Hamilton County, Ohio published by the United States Department of Transportation.
- Numerous geotechnical subsurface soils boring data in both Kentucky and Ohio in the project corridor study area.
- ODOT's Geotechnical Record in the applicable areas of Hamilton County, Ohio within the project corridor.
- History of notable landslides within the project corridor study area.
- Existing Brent Spence Bridge rehabilitation/reconstruction studies and feasibility studies performed by FHWA and others.
- Information obtained from project site visits conducted on August 3, 2005 and August 18, 2005.
- Original soil borings for projects in the study area, including the I-75 "Cut-in-the-Hill" project, original Brent Spence Bridge construction, Fort Washington Way and the Mill Creek Expressway project.

This information provided an overview of available project data within the study area. More detailed study will be required as specific corridors are chosen. Please refer to Exhibit 1 – Soils shows the soil types within the study area.

5.1 Site Topography

At the Kyles Lane interchange, grades along the proposed roadway corridor generally range between about 850 and 900 feet. The topography generally slopes downward farther north to about elevation 450 to 500 feet closer to the Ohio River.

The western portion of the study area shows several areas with steep slopes. The eastern side of the study area is relatively level in comparison to the existing terrain along the western side of the study area. Existing grades from the Ohio River, northward to the Western Hills Viaduct gradually slope upward from an approximate elevation of 450 to 500 feet adjacent to the Ohio River, to an approximate elevation of 550 feet near the Western Hills Viaduct. The study area is relatively flat beyond the existing roadway footprint.

5.2 Kentucky Corridor Area Geology

Northern Kentucky has been affected by major glaciations occurring during the Pleistocene Epoch time period. These glacial advances caused profound drainage changes and were responsible for the deposition of a variety of soils lying beneath the Covington/Cincinnati area and the study area.

In the area surrounding Covington, soils generally consist of a gravelly zone topped by granular outwash deposits. Near-surface soils contain alluvial sediments, deposited by the floodwaters of both the Ohio and Licking Rivers. Area soil conditions at the site have also been affected by placement of fill, construction of buildings, construction of marina and housing developments, demolition of structures, roadway grading, etc.

Soil conditions for the remaining portion of the study area within Kentucky include valley basin sediments, together with valley wall deposits, glacial and residual clays with limestone and shale remnants of the ancient Ordovician Sea. As the corridor elevation increases to the south nearer to Kyles Lane, soil types consist of Illinoian age glacial soils, capped with windblown loessian silts. Overlying residual clays provide a soil mantle of varying thickness atop native bedrock.

The Ordovician bedrock in the study area is composed of two major rock units. The Kope Formation is typically found from approximate elevations of 510 to 690 feet. It is principally shale with relatively thick and well-spaced limestone beds. The Maysville Formation, from approximate elevations of 690 to 800 feet, is composed of limestone and shale with thicker and more closely packed beds.

The rock beds are highly fossiliferous and calcareous. The limestone distribution within the Maysville Formation often provides a formidable resistance to excavation efforts due to hardness, thickness of layers, and close packing of layers at some elevations.

There are no mapped coal mines within the study area. In this region, solutioned limestone or karst, sometimes develops in upland areas where limestone is the predominant bedrock formation. The Northern Kentucky region is within an area with limited to moderate potential for karst. Based on local experience, the development of karst in the study area may occur in isolated areas, but is not anticipated to be a significant concern.

5.3 Ohio Corridor Area Geology

Geology in the Ohio portion of the study area includes a combination of alluvium and outwash soils, with minor amount of lacustrine (lakebed) and glacial till deposits. Based on review of the Ohio Department of Natural Resources Quaternary Geology Map of Ohio (1999), the western portion of the study from the Ohio River to Western Hills Viaduct consists of alluvial deposits such as silty clays, sands, gravels, and silty sands. These soils typically are encountered approximately between elevations of 460 and 530 feet.

Geology on the eastern side of the Ohio study area consists of Late Wisconsinian Age outwash soils. These soils generally consist of sands and gravels and are found between 400 to 460 feet above sea level. This area of downtown has been heavily disturbed. Cisterns, dry wells and privies, are to be expected. Silt pipes and anomalous loose granular zones have been noted. Remnant foundation walls of buildings which formerly occupied the site can also be anticipated. Lakebed deposits consisting of clays and silts are generally found on the northern part of the study area, near the Western Hills Viaduct.

Soils on the Ohio side are also underlain by Ordovician Age shale and limestone bedrock of the Eden Formation. Bedrock is generally encountered at elevations ranging from approximately 400 to 420 feet, and as high as elevation 460 feet at the Western Hills Viaduct. Based on review of published and existing subsurface information, the bedrock surface is highly variable with relatively drastic changes in depth over relatively short distances.

5.4 Landslide Issues

Areas of the greater Cincinnati and Northern Kentucky region are prone to slope movements and landslides. Several landslides have been reported and documented along the western side of the study area and near the southern limits, predominantly within the Kentucky portion of the study area. Due to the hilly terrain in these areas, slope instability was more common. Landslides typically occurred after heavy rain events or during extended periods of wet weather. The landslides generally occurred above bedrock, or along the soil/bedrock interface.

Of particular interest is a landslide event that occurred within a few years of the original I-71/I-75 construction between Interchanges 189 and 190 in Kentucky. The outside northbound lane began to show signs of settlement and cracking, initial evidence of a landslide. The lane was closed for some time and eventually a large buttress embankment was built to stabilize the slope in this area. In this case, the roadway embankment was constructed on a substantial depth of colluvium, which in turn overlaid a sloping bedrock surface.

Few landslides have been reported in other portions of the study area. In these relatively flat areas, the greatest potential for landslide or slope instability is adjacent to the Ohio River. Detailed slope stability analyses along the Ohio River should be performed once the bridge location has been selected.

Landslide concerns generally increase along the western side of the study area, and throughout the corridor near Kyles Lane to approximately 1.5 miles north of Kyles Lane in Kentucky. Therefore, shifting the I-71/I-75 roadway west of the current location increases potential for landslides and slope instability.

6.0 ENVIRONMENTAL RESOURCES

Environmental Red Flags represent specific community resources that could be affected by any transportation project within the study corridor. A literature and data base review of existing information was performed to identify specific ecological, historic, archaeological, and community resources as well as potential hazardous material locations.

Several agencies were contacted to acquire data pertaining to the human and natural environment of the study area. These data sources are listed below.

- United States Environmental Protection Agency (EPA)
- United States Fish and Wildlife Service (USFWS) Region 3
- United States Army Corps of Engineers (USACE)
- Ohio Environmental Protection Agency (OEPA)
- Ohio Department of Natural Resources (ODNR)
- Ohio Bureau of Underground Storage Tank Regulations (BUSTR)
- Kentucky Department of Fish and Wildlife Resources (KDFWR)
- Kentucky Natural Resources and Environmental Protection Cabinet (KNREPC)
- Kentucky Division of Waste Management (KDWM)

In addition, available environmental resource information from the North South Transportation Initiative and the Feasibility and Constructability Study for the Replacement/Rehabilitation of Brent Spence Bridge was reviewed.

This Red Flag Summary report provides an overview of this information as it specifically relates to Hazardous Materials, Ecological Resources, Architectural Resources, Archaeological Sites, Community Impacts, Environmental Justice, Noise Impacts and Air Quality.

6.1 Hazardous Materials

Federal and state agencies databases were reviewed to obtain hazardous materials information. A review of the US Environmental Protection Agency (EPA) Envirofacts Data Warehouse information resulted in the identification of 25 records for hazardous waste generators located within the study area. Underground Storage Tank (UST) data was obtained from two sources.

The Kentucky Division of Waste Management (KDWM) maintains the UST database for the Commonwealth of Kentucky. UST data for Ohio were obtained from the Ohio Bureau of Underground Storage Tank Regulations (BUSTR), which is housed in the State Fire Marshal's Office of the Ohio Department of Commerce. The data identified 121 USTs within the study area, 91 in Kentucky and 30 in Ohio.

There is a concentration of USTs in Kentucky, adjacent to the southern bridge landing area. One hazardous waste site specifically related to the Brent Spence Bridge is due to a previous painting operation. Sandblasting grit was not properly controlled and resulted in lead contamination in the soil below the bridge on the Kentucky side. The Kentucky Transportation Cabinet is currently taking actions to remediate this site.

Landfill locations were also researched during the environmental review process. The KDWM website was reviewed for the presence of any current or historically operated landfills in Kenton County. According to the list of Permitted Solid Waste Landfills, there are none present in Kenton County. The Ohio EPA Division of Solid and Infectious Waste Management website was accessed for information pertaining to possible landfills currently or historically operated landfills in the study area. According to several sources on the website, no landfills are located within the Ohio portion of the study area.

6.2 Ecological Resources

6.2.1 Wetlands

Potential wetland locations were obtained from the Kentucky Department of Fish and Wildlife Resources (KDFWR) and the Ohio Department of Natural Resources (ODNR) Geographic Information Systems (GIS). Potential wetlands were identified in both Ohio and Kentucky and are shown on Exhibit 3.

The majority of wetlands are scattered throughout the Ohio portion of the study area. The wetlands are classified as open water bodies (i.e. ponds) and palustrine emergent (i.e. shallow marsh wetlands).

6.2.2 Streams and Rivers

The Ohio River is the major water resource within the study area. Smaller streams that may exist within the study area tend to drain to storm sewers that discharge outside the project area to either the Ohio River or the Licking River. These streams are low quality streams which have been modified by development with in the study area and may be considered non-jurisdicitional with the absence of hydric soils and the presence of an ordinary high water mark. The locations of streams within the study area are also shown on Exhibit 3.

The Ohio River is approximately 1,300 feet wide at the existing Brent Spence Bridge location. The normal pool elevation of the Ohio River in the area of the bridge is about 455 feet and the ordinary high water mark is approximately 468.5 feet

In the Northern Kentucky/Greater Cincinnati area, the Ohio River is used as a source of drinking water for over one million people in two states and is the site of increasingly intensive recreational use. Within the region, the Ohio River receives discharges from over 100 square miles of urban watershed, and other non-point sources associated with a major metropolitan area. The river's water quality, and its suitability for contact recreation in particular, is subject to rapid changes, particularly during and after precipitation events. (Source: http://www.orsanco.org/empact, 2002).

There are no designated wild and scenic rivers, outstanding resource waters, high quality fishing streams or spawning areas in the study area.

6.2.3 Floodplains

Floodplains are located along the north and south banks of the Ohio River within the study area. The 100-year flood elevation is 498.5 feet. Approximately 168 acres of the 100-year floodplain are on the north side of the river and 12.5 acres of the 100-year floodplain are on the south side of the river.

6.2.4 Threatened and Endangered Species

State Listed Species

The ODNR Division of Parks and Natural Areas lists 13 plant and animal species listed state endangered (5), threatened or potentially threatened (6), and special interest (2) (Source: ODOT North/South Initiative). Three species are also receiving federal protection as well.

A preliminary literature search of the Kentucky State Nature Preserves Commission lists 32 plant and animal species listed state endangered (17), threatened (8), and special concern (7) (Source: website http://www.naturepreserves.ky.gov, 2004). Nine species are also receiving federal protection as well. Those species not listed but not receiving federal listing include two plants, one gastropod, 10 mussels, one insect, two fishes, three amphibians, one reptile, and three breeding birds These species are listed in Table 6-1.

Table 6-1: State Listed Threatened and Endangered Species Within the Study Area

County, State	Group	Common Name	Scientific Name	State Status
Kenton, KY	Plant	Stemless evening-primrose	*Oenothera triloba*	Threatened
Hamilton, OH	Plant	Riverbank Paspalum	*Paspalum fluitans*	Potentially Threatened
Hamilton, OH	Plant	Maypop	*Passiflora incarnate*	Threatened
Kenton, KY	Plant	Mock Orange	*Philadelphus inodorus*	Threatened
Hamilton, OH	Plant	Virginia Mallow	*Sida hermaphrodita*	Potentially Threatened
Hamilton, OH	Plant	Smooth Buttonweed	*Spermacoce glabra*	Potentially Threatened

Table 6-1: State Listed Threatened and Endangered Species Within the Study Area

County, State	Group	Common Name	Scientific Name	State Status
Kenton, KY	Gastropods	Onyx Rocksnail	*Leptoxis praerosa*	Special Concern
Kenton, KY	Mussel	Elktoe	*Alasmidonta marginata*	Threatened
Kenton, KY	Mussel	Spectaclecase	*Cumberlandia monodonta*	Endangered
Hamilton, OH	Mussel	Butterfly	*Ellipsaria lineolata*	Endangered
Hamilton, OH	Mussel	Elephant-ear	*Elliptio crassidens crassidens*	Endangered
Kenton, KY	Mussel	Snuffbox	*Epioblasma triquetra*	Endangered
Kenton, KY	Mussel	Longsolid	*Fusconaia subrotunda subrotunda*	Special Concern
Kenton, KY	Mussel	Pocketbook	*Lampsilis ovata*	Endangered
Kenton, KY	Mussel	Creek Heelsplitter	*Lasmigona compressa*	Endangered
Hamilton, OH	Mussel	Threehorn Wartyback	*Obliquaria reflexa*	Threatened
Kenton, KY	Mussel	Sheepnose	*Plethobasus cyphyus*	Endangered
Hamilton, OH	Mussel	Ohio Pigtoe	*Pleurobema cordatum*	Endangered
Kenton, KY	Mussel	Pyramid Pigtoe	*Pleurobema rubrum*	Endangered
Kenton, KY	Mussel	Rabbitsfoot	*Quadrula cylindrica cylindrica*	Threatened
Hamilton, OH	Mussel	Monkeyface	*Quadrula metanevra*	Endangered
Kenton, KY	Mussel	Salamander Mussel	*Simpsonaias ambigua*	Threatened
Kenton, KY	Insect	Sixbanded longhorn beetle	*Simpsonaias ambigua*	Threatened
Hamilton, OH; Kenton, KY	Fishes	Lake Sturgeon	*Acipenser fulvescens*	Endangered
Kenton, KY	Fishes	Alligator Gar	*Atractosteus spatula*	Endangered
Hamilton, OH	Fishes	Mooneye	*Hiodon tergisus*	Special Interest
Hamilton, OH	Fishes	Burbot	*Lota lota*	Special Interest
Kenton, KY	Amphibians	Eastern Hellbender	*Cryptobranchus alleganiensis alleganiensis*	Special Concern

Table 6-1: State Listed Threatened and Endangered Species Within the Study Area

County, State	Group	Common Name	Scientific Name	State Status
Kenton, KY	Amphibians	Redback Salamander	*Plethodon cinereus*	Special Concern
Kenton, KY	Amphibians	Northern Leopard Frog	*Rana pipiens*	Special Concern
Hamilton, OH; Kenton, KY	Reptiles	Kirtland's Snake	*Clonophis kirtlandii*	Threatened
Kenton, KY	Bird	Bachman's Sparrow	*Aimophila aestivalis*	Endangered
Kenton, KY	Bird	Bewick's Wren	*Thryomanes bewickii*	Special Concern
Kenton, KY	Bird	Barn Owl	*Tyto alba*	Special Concern

Federally listed Species

Ten federally endangered species, one federally threatened and one federal candidate species have ranges that include the study area as listed in Table 6-2. Nine of the federally endangered species are mussels whose ranges include the Ohio River and its tributaries in Kentucky. These mussel species have been extirpated from the Ohio study area, and are likely extirpated from the Kentucky study area (KSNPC 2001). Other federally endangered species whose ranges include the study area are the Indiana bat (Myotis sodalis) and running buffalo clover (Trifolium stoloniferum). The federally threatened bald eagle (Haliaeetus leucocephalus) has wintering sites in Hamilton County,

There are no documented populations of threatened and endangered species or critical habitat within the study area. However, potential habitat characteristics for the Indiana bat, running buffalo clover, and freshwater mussels may exist within the study area. The potential presence of endangered mussel species in the Ohio River will require further specific mussel surveys to determine impacts to any species.

Table 6-2: Federally Listed Threatened and Endangered Species

County	Group	Common Name	Scientific Name	Status
Hamilton Kenton	Mammal	Indiana Bat	*Myotis sodalis*	Endangered^
Hamilton Kenton	Plant	Running Buffalo Clover	*Trifolium Stoloniferum*	Endangered^*
Hamilton	Bird	Bald Eagle	*Haliaeetus leucocephalus*	Threatened^
Kenton	Mussel	Purple Catspaw Pearlymussel	*Epioblasma o. obliquata*	Endangered*
Kenton	Mussel	Clubshell	*Pleurobema clava*	Endangered*
Kenton	Mussel	Fanshell	*Cyprogenia stegaria*	Endangered*
Kenton	Mussel	Northern Riffleshell	*Epioblasma torulosa rangiana*	Endangered*

Table 6-2: Federally Listed Threatened and Endangered Species

County	Group	Common Name	Scientific Name	Status
Kenton	Mussel	Orange Pimpleback	*Plethobasus cooperianus*	Endangered*
Kenton	Mussel	Pink Mucket	*Lampsilis abrupta*	Endangered*
Kenton	Mussel	Ring Pink	*Obovaria retusa*	Endangered*
Kenton	Mussel	Rough Pigtoe	*Pleurobema plenum*	Endangered*
Kenton	Mussel	Sheepnose	*Plethobasus cyphyus*	Candidate

^ Also listed threatened or endangered by ODNR
* Also listed threatened or endangered by KYSNPC

6.2.5 Habitat

No unique terrestrial habitats were observed in the highly urbanized study area. The major terrestrial communities within the study area are small scattered scrub-shrub areas. These scrub-shrub habitats typically occurred in small, fragmented areas behind buildings, between buildings and road areas, or between urban areas and the Ohio River. The woody vegetation in these habitats generally consisted of honeysuckle (Lonicera sp.), amur honeysuckle (Lonicera maackii), tree-of-heaven (Ailanthus altissima), and other disturbance-tolerant species.

Aquatic habitat is limited within the study area to the Ohio River and is designated a warm water habitat by the Ohio Environmental Protection Agency (OEPA). Hamilton County, Ohio and Kenton County, Kentucky lie within the central lowlands physiographic province of the Ohio River (Source: www.fws.gov/orve/). This basin is the direct result of several glaciations, which covered most of the area depositing soils that are some of the richest agricultural land in the Ohio River watershed. The flat to slightly rolling topography has significantly altered the pre-glacial conditions and in some instances, buried pre-glacial streams that provide groundwater resources today (Source: www.fws.gov/orve/).

6.3 Historical Resources

Historic resources within the study area include individual residential, commercial, institutional, religious, and industrial buildings and districts. Exhibit 4 shows the specific location of historic properties and districts within the study area.

6.3.1 Kentucky

There are two NRHP individual properties property within the study area, the Bavarian Brewing Company and Kenny's Crossing (Table 6-3). Portions of six NRHP districts are also located within the study area (Table 6-4). These districts are located on both the east and west sides of I-75 and are dominated by residential buildings.

Table 6-3: NRHP Listed Resources Within the Study Area

Property	Address
Kentucky	
Bavarian Brewing Company	522 West 12th Street
Kenny's Crossing	1001 Highway Avenue
Ohio	
B & O Freight Terminal (Long Worth Hall)	700 Pete Rose Way
Carew Tower	West 5th Street and Fountain Square
Lombardy Apartment Building	318-326 West 4th Street
Derby, H.W. Building	300 West 4th Street
Hooper Building	139-151 West 4th Street
St Peter-in-Chains Cathedral	325 West 8th Street
Cincinnati City Hall	801 Plum Street
Plum Street Temple	726 Plum Street
Goodall Building	324 West 9th Street
Court Street Firehouse	311 West Court Street
Cincinnati Union Terminal	1301 Western Avenue
Our Lady of Mercy High School	1409 Western Avenue
Ohio National Guard Armory	1437-1439 Western Avenue
Police Station Number 5	1024-1026 York Street
John Church Company Building	14-16 East Fourth Street

Table 6-4: Kentucky Historic Districts Within the Study Area

District	NRHP Status	Local Historic District
Fort Mitchell Heights	Listed	N/A
Lewisburg	Listed	N/A
East Lewisburg	Eligible	N/A
Bavarian Brewing Company	Listed	N/A
West Side Neighborhood	Listed	N/A
West Side/ Mainstrasse	Listed	N/A
East Fourth Street	Listed	Yes
Lytle Park	Listed	Yes
Main and Third Street Cluster	Listed	Yes

6.3.2 Ohio

Fifteen individual properties are listed on the NRHP within the study area as listed in Table 6-3. Two properties, Union Terminal and Plum Street Temple are also designated as a National Historic Landmarks. The Court Street Firehouse, Saint Peter-in-Chains Cathedral, Plum Street Temple and Cincinnati City Hall are also listed as local landmarks.

Nine NRHP districts are entirely or partially within the study area as listed in table 6-5. These Nine districts and the Cincinnati Union Terminal are also identified as local historic districts. The districts are comprised of commercial buildings or buildings now undergoing conversion from commercial to residential uses. These districts are concentrated east of I-75 where they encompass large tracts within downtown Cincinnati.

Table 6-5: Ohio Historic Districts Within the Study Area

District	NRHP Status	Local Historic District
West Fourth Street	Listed	Yes
West Fourth Street Amended	Listed	Yes
Ninth Street	Listed	Yes
Betts-Longworth	Listed	Yes
Laurel Homes	Listed	Yes
Dayton Street	Listed	Yes

6.4 Archaeological Sites

There are six recorded archaeological sites within the study area. Five sites are listed in the Ohio Archaeological Inventory (OAI) and one site is listed in Kentucky's OSA files within the study area. These sites are listed on Table 6-6.

Table 6-6: Recorded Archaeological Sites Within the Study Area

Site	Description
15Ke122	Historic Scatter
33Ha1 (Cincinnati Tablet Mound)	Prehistoric Earthen Mound Early Woodland Period
33Ha113	Prehistoric Mound
33Ha311 (Seventh Street Mound)	Prehistoric Mound Middle Woodland Period
33Ha312 (Richmond Street Mound)	Prehistoric Mound Woodland Period
Cincinnati and Whitewater Canal	Historic Canal Early to Mid-19th Century

6.4.1 Kentucky

There is one recorded archaeological site (15Ke122) within the Kentucky portion of the study area. This site is historic scatter with associated features.

6.4.2 Ohio

Five of the archaeological sites recorded within the study area are located in Ohio. Four of the sites are prehistoric and were disturbed in the historic period. The sites are 33Ha1 Cincinnati Tablet Mound, 33Ha113, 33Ha311 Seventh Street Mound, and 33Ha312 Richmond Street Mound. All of the sites yielded lithics, ceramics, floral and faunal remains.

Several historic archaeological sites are known to exist within the Ohio portion of the study area. The most prominent of these is the Cincinnati & White Water Canal. The canal was already abandoned between Cincinnati and Valley Junction, Ohio, when it was purchased in 1863 by the Cincinnati & Indiana Railroad Company. The Cincinnati & Indiana Railroad used the existing canal bed to construct a new rail bed. Today, the canal tow path and bed are just north of Longworth Hall between Second and Third streets.

Historic maps illustrating the study area show increasingly dense commercial and industrial buildup of the areas northeast of existing I-75 and the Brent Spence Bridge approach lanes between 1815 and 1908. Buildings dating to 1840 and after still exist in this portion of the study area. Based on excavations conducted elsewhere in the urban core of Cincinnati and along its riverfront, it is likely that building remnants and intact features such as privies, cisterns, and wells remain. During recent construction of Paul Brown Stadium and Fort Washington Way, numerous foundations and shaft features were observed.

6.5 Community Resources

According to information provided by the Departments of Neighborhood Services in both the city of Cincinnati and the city of Covington, the study area includes several well established neighborhoods and commercial properties.

- Lewisburg is located just west of I-75 in the western part of Covington, Kentucky. It is also a National Register Historic District, which is characterized by beautiful views of downtown Cincinnati. It is a pedestrian scale neighborhood that has retained a unique character.

- Mainstrasse/West Side in Covington, Kentucky is a National Register Historic District (NR November 1983). It is considered to be an extensive, intact, and homogeneous late-nineteenth century urban residential neighborhood. The 800 buildings in the district, located on Covington's west side from 5th Street south to Pike Street, were built primarily between 1840 and 1877.

The City of Cincinnati has several well established neighborhoods located near the existing I-75/I-71 corridor in the study area. These neighborhoods include Queensgate and West End. The current configuration of Interstate 71 and Interstate 75 represent the largest physical boundary between these communities and the Central Business Districts within Cincinnati and Covington.

Issues associated with community cohesion and neighborhood cohesiveness were evaluated by reviewing demographic data such as density, as well as land use inventories such as commercial and residential distinctions. Many Cincinnati and Covington neighborhoods are cohesive communities with significant history and community infrastructure.

- The Queensgate neighborhood within the project area is the exception to this. It is important to note that the city of Cincinnati recognizes Queensgate as a neighborhood. However, this area does not represent a neighborhood in terms of a cohesive, residential community. The southern portion of Queensgate is sparsely populated, with a density less than 1,000 people per square mile. It is heavily dominated by commercial buildings. All other neighborhoods in the study area have a density greater than 1,000 people per square mile.

- The West End neighborhood of Cincinnati is an urban residential community characterized by a mix of older homes, newer residential developments and multi-family dwellings. This neighborhood includes the Dayton Street, Betts-Longworth and Laurel Homes Historic Districts.

The location of parks, recreational areas and other community resources can be found on Exhibit 5 – Land Uses and Exhibit 6 – Community Resources. In addition, a complete list of the community facilities within the study area is listed below (Table 6-6).

Table 6-7: Community Facilities and Services in Study Area

Kentucky		
Attraction	**Location**	**Description**
Garden of Hope	699 Edgecliff Road, Covington	Recreation of the Garden Tomb in Jerusalem
Churches/Religious	**Location**	**Description**
St. John's Catholic Church	627 Pike Street, Covington	Catholic Church
Nursing Home	**Location**	**Description**
Baptist Life Communities	800 Highland Avenue, Covington	Nursing Home
Recreation	**Location**	**Description**
Kenney Shields Park	West 9th & Philadelphia, Covington	Small neighborhood corner lot with playground equipement - Owned by the City of Covington
Neighborhood Pool	West 8th & Dalton, Covington	Neighborhood pool - Owned by the City of Covington
Devou Park/Golf Course/Overlook	1344 Audubon Road, Covington	700-acre park and golf course - Owned by the City of Covington
Goebel Park/Mainstrasse Village District	6th Street Area of Covington	Park area and surrounding retail & restaurants - Owned by City of Covington
Neighborhood Park	West 11th & Hermes Avenue, Covington	Owned by the City of Covington
School	**Location**	**Description**
Notre Dame Academy	1699 Hilton Drive, Park Hills	Parochial College Prep High School - 594 female students
Prince of Peace Catholic School	625 Pike Street, Covington	Parochial Grade School - Grades K - 8
Ohio		
Attraction	**Location**	**Description**
Paul Brown Stadium	One Paul Brown Stadium	Pro Football Facility – Home of NFL Cincinnati Bengals
National Underground Railroad Freedom Center	50 East Freedom Way, Cincinnati	Museum
Great American Ball Park	100 Main Street, Cincinnati	Pro Baseball Facility – Home of MLB Cincinnati Reds
US Bank Arena	100 Broadway, Cincinnati	
Cinergy Center	525 Elm Street, Cincinnati	Convention and Exhibition Facility
Cincinnati Fire Museum	315 West Court Street, Cincinnati	Museum

Table 6-7: Community Facilities and Services in Study Area

Ohio		
Geier Research & Collections Museum	760 West 5^{th} Street, Cincinnati	
Union Terminal *	1301 Western Avenue, Cincinnati	Omnimax Theatre, Museum Center, Children's Museum, Natural History Museum, Amtrak
Churches/Religious	**Location**	**Description**
York Street United Methodist	816 York Street, Cincinnati	Methodist Church
Plum Street Temple *	726 Plum Street, Cincinnati	Jewish Temple
St. Peter in Chains Cathedral *	325 West 8^{th} Street, Cincinnati	Catholic Church
Jarriel Baptist Church	Wesley & Court Street, Cincinnati	Baptist Church
Fire Station	**Location**	**Description**
Fire House - Company 14	5th and Central, Cincinnati	Fire House
Fire House - Company 29, Ladder 29	564 West Liberty @ Linn Street Cincinnati	Fire House
Government Building	**Location**	**Description**
City Hall *	801 Plum Street, Cincinnati	Offices of Mayor, City Mgr, City Council, etc.
Jail - Hamilton County Queensgate Facility	516 Linn Street, Cincinnati	Correctional Facility
Library	**Location**	**Description**
Public Library of Cincinnati and Hamilton County	805 Ezzard Charles Drive, Cincinnati	Public Library
Lloyd Library and Museum	917 Plum Street, Cincinnati	Botanical, Medical, Pharmaceutical & Scientific books
Utilities	**Location**	**Description**
CG&E Substation	West Pete Rose at Mehring Way, Cincinnati	
Public Agency	**Location**	**Description**
Cincinnati Job Corp Center	1409 Western Avenue, Cincinnati	Training Facility and Dorms
Post Office	**Location**	**Description**
Main Post Office - Dalton Avenue	1623 Dalton Avenue, Cincinnati	Post Office Facility
Post Office Branch	Dalton & Gest Streets, Cincinnati	Post Office Facility-Mid City Carrier Unit
Recreation	**Location**	
Lincoln Park - Union Terminal	Freeman Avenue & Ezzard Charles Drive, Cincinnati	Owned by the City of Cincinnati - Operated by Cincinnati Park Board - Greenspace
Park at Derrick Turnbow and Linn Street	1525 Linn Street, Cincinnati	Behind apartment buildings & a strip shopping center - Owned by the City of Cincinnati
Dyer Park	Baymiller & Bank Streets, Cincinnati	Ball Field, Pool and Playground -Owned by the City of Cincinnati - Operated by Cincinnati Recreation Commission
Lincoln Community Center	1027 Linn Street, Cincinnati	Pool, playground, tennis court, basketball courts -Owned by the City of Cincinnati - Operated by Cincinnati Recreation Commission
Queensgate Playground & Ballfields	707 West Court Street, Cincinnati	Playground and ballfields – Owned by the City of Cincinnati - Operated by Cincinnati Recreation Commission
School	**Location**	**Description**
St. Joseph's Catholic School	805 Ezzard Charles Dr., Cincinnati	Parochial Elementary School
Cincinnati Hamilton County Community Action Agency	880 West Court Street, Cincinnati	Theodore M. Berry Head Start Program
Lafayette Bloom B-O-T Accelerated Middle	1941 Baymiller Street, Cincinnati	Cincinnati Public School - Grades 6-8
Heberle Elementary	2015 Freeman Avenue, Cincinnati	Cincinnati Public School - Preschool - 8

Table 6-7: Community Facilities and Services in Study Area

Ohio		
TV/Radio Station	**Location**	**Description**
WXIX - TV	635 W. 7th St., Cincinnati	Network TV Station
Churches/Religious	**Location**	**Description**
York Street United Methodist	816 York Street, Cincinnati	Methodist Church
Plum Street Temple *	726 Plum Street, Cincinnati	Jewish Temple
St. Peter in Chains Cathedral *	325 W. Eighth St. Cincinnati	Catholic Church
Jarriel Baptist Church	Wesley & Court St., Cincinnati	Baptist Church
Fire Station	**Location**	**Description**
Fire House - Company 14	5th and Central, Cincinnati	Fire House
Fire House - Company 29, Ladder 29	564 W. Liberty @ Linn St. Cincinnati	Fire House
Government Building	**Location**	**Description**
City Hall *	801 Plum Street, Cincinnati	Offices of Mayor, City Mgr, City Council, DOTE, etc.
Jail - Hamilton County Queensgate Facility	516 Linn Street, Cincinnati	Correctional Facility
Library	**Location**	**Description**
Public Library of Cinti and Hamilton Co.	805 Ezzard Charles Dr., Cincinnati	Public Library
Lloyd Library and Museum	917 Plum Street, Cincinnati	Botanical, medical, pharm. & scientific books
Utilities	**Location**	**Description**
CG&E Substation	W. Pete Rose at Mehring Way, Cincinnati	
Public Agency	**Location**	**Description**
Cincinnati Job Corp Center	1409 Western Avenue, Cincinnati	Training Facility and Dorms
Post Office	**Location**	**Description**
Main Post Office - Dalton Avenue	1623 Dalton Ave. Cincinnati	Post Office Facility
Post Office Branch	Dalton & Gest Streets, Cincinnati	Post Office Facility-Mid City Carrier Unit
Recreation	**Location**	
Lincoln Park - Union Terminal	Freeman Ave & Ezzard Charles Dr., Cincinnati	Owned by City of Cinti - Operated by Cinti Park Board - Greenspace
Park at Derrick Turnbow and Linn St.	1525 Linn Street, Cincinnati	Behind apartment bldgs & a strip shopping center - Owned by City of Cincinnati
Dyer Park	Baymiller & Bank Streets, Cincinnati	Ball Field, Pool and Playground -Owned by City of Cinti - Operated by CRC
Lincoln Community Center	1027 Linn Street, Cincinnati	Pool, playground, tennis court, basketball courts - Owned by City of Cinti- Operated by CRC
Queensgate Playground & Ballfields	707 W. Court Street, Cincinnati	Playground and ballfields - Owned by City of Cinti - Operated by CRC
School	**Location**	**Description**
St. Joseph's Catholic School	805 Ezzard Charles Dr., Cincinnati	Parochial Elementary School
Cinti. Hamilton Co. Community Action Agency	880 W. Court St., Cincinnati	Theodore M. Berry Head Start Program
Lafayette Bloom B-O-T Accelerated Middle	1941 Baymiller St. Cincinnati	Cincinnati Public School - Grades 6-8
Heberle Elementary	2015 Freeman Ave, Cincinnati	Cincinnati Public School - Preschool - 8
TV/Radio Station	**Location**	**Description**
WXIX - TV	635 W. 7th St., Cincinnati	Network TV Station
***LISTED ON NATIONAL REGISTER OF HISTORIC PLACES**		

6.6 Environmental Justice

Secondary source data was assessed within the study area for potential Environmental Justice concerns. According to the Civil Right Act of 1964, Executive Order 12898 and the Federal Highway Administration's publication FHWA-EP-00-013, environmental justice has three fundamental principles:

1) "To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations."

2) "To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process."

3) "To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations."

The city of Cincinnati displays several census tracts of densely populated areas that include minority and low-income residents. The areas east of the existing interstate corridor in Cincinnati are diverse relative to both income and ethnicity.

A high number of census tracts report poverty levels higher than 40 percent within the study area. These tracts are primarily located within the Ohio portion of the study area. The southern part of the project area in Ohio and most of the project area in Kentucky report poverty levels below 40 percent. Please refer to Exhibit 7 – Population Below Poverty Level for more specific location information.

Census area tract data shows minority population levels more than 75 percent in the northeast part of the project area, located immediately adjacent to the existing I-75 corridor in the West End neighborhood of Cincinnati. The southern part of the project area in Cincinnati and the project area in Covington reports minority population of less than 25 percent. Please refer to Exhibit 8 – Minority Population Demographics for more specific location information.

Several significant HUD-assisted housing projects/developments exist in the study area, including large housing redevelopment projects from the federal HOPE VI program on both sides of the Ohio River.

6.7 Noise Impacts

Several traffic related factors as well as structural components can affect noise levels. Sensitive noise receivers located within the study area include residential and recreational properties, libraries, schools, hospitals, motels, and hotels along the existing and/or proposed alignments. These areas include, but are not limited to, residential properties along the northeast side of the corridor in Ohio (West End) and along the southwest and southeast side of the corridor in Kentucky (Lewisburg, Mainstrasse, and West Side). Recreational properties including Lincoln Park, Laurel Park, Lincoln Recreational Complex, Queensgate Ballfields, Albert B. Sabin Park, DeVou Park, and Goebel Park, as well as Our Lady of Mercy High School and the Stowe Adult Education Center, are also considered sensitive receivers.

A specific noise analysis was not conducted for this study. However, future studies will be required to model potential noise impacts based on FHWA's Highway Traffic Noise Prediction Model (Report No. FHWA-RD-77-108).

6.8 Air Quality

On April 15, 2004, the USEPA designated the Greater Cincinnati region (including all of Hamilton County, Ohio and Kenton County, Kentucky) as "Basic Non-attainment" for 8-hour ozone violations. This area is also designated as non-attainment for one-hour ozone violations.

The Metropolitan Planning Organization (Ohio, Kentucky, Indiana Regional Council of Governments) has received air conformity approval of their long range plan. This plan includes a placeholder for a replacement of the Brent Spence Bridge with a 10-lane facility.

No formal air quality analysis has been conducted for this project as yet. However, in order for the project to be incompliance with the Clean Air Act Amendment of 1990, future studies will need to include a micro-scale analysis of carbon monoxide (CO) using the latest USEPA approved computer models. This analysis is needed to determine whether the project would result in violations of the National Ambient Air Quality Standards (NAAQS) for CO.

7.0 GEOMETRIC DESIGN ISSUES

A number of geometric design issues were identified through a review of existing studies in the area Additional issues were also identified on field reviews conducted on August 3 and August 17, 2005. These issues include insufficient roadway lane, bridge and shoulder widths observed on some existing crossroads that will be tied into by this project. Potential roadway improvements in these areas will need to be considerate of these issues when designing tie-ins.

Several existing horizontal and vertical curves on mainline ramps do not meet current ODOT Location and Design Manual requirements. In addition, the presence of cultural resources and utility facilities, most notably the Cinergy Sub-station just west of the existing bridge and Longworth Hall, could impact these alignments and will be considered during the alternatives analysis phase of this project.

Grade and clearance issues on the existing facility could also be a limiting factor on the analysis of alternatives. The urban nature of this project will necessitate additional review activities in this area. For instance, the effect on bridge clearance at Elm Street over Fort Washington Way should be considered when analyzing potential alignments.

The Kentucky portion of the study area experiences a crash rate higher than the statewide average. Additionally, there are high concentrations of crashes at the 12th Street/Pike Street and 5th Street exits. Along I-75, more than half of the crashes are rear-end type accidents, which is an indicator of congestion already present along the corridor.

The high incidences of crashes within the study area lead to increased congestion along the corridor; as the congestion continues to increase, the likelihood of additional accidents also increases.

On the Ohio potion of the corridor, both I-75 and I-71 sections within the study area have been identified by ODOT as safety priorities. Both corridors in the study area (I-71 and I-75) appear on ODOT's Safety Hot Spot list. In addition, many segments on these corridors also appear on the High Crash Location Identification System (HCLIS) list. The segment on I-71 from state line mile 0.50 to 1.00 ranks as the fourth most accident prone section in the state. Most of the segment crash rates for individual years as well as overall years exceed the statewide average rates.

8.0 HYDRAULIC ISSUES

It is anticipated that some additional review and analysis of existing drainage structures will be required if any are to be re-used. At this time, it is anticipated that most of these structures will be replaced by the project. This includes overland flow, curb/gutter, under-drains and culvert structures both on the mainline and existing crossroads. In addition, the age of the current facility suggests that drainage problems could exist with under-drain outlets, though no specific locations were observed.

Curb heights on many side streets were observed to be inadequate. Construction of this project may require tying into local crossroads with inadequate curb heights. The selected alternative should be developed in consideration of this issue.

9.0 PAVEMENT ISSUES

For the most part, pavement on I-71/I-75 mainline and ramps is concrete with asphalt overlay. Crossroads within the study are largely paved with concrete.

Joint repairs, pavement repairs and new pressure relief joints would be anticipated for any sections of the existing pavement that might remain in the new project. It is anticipated that any maintenance of traffic plans will require temporary pavement in various sections in the study corridor. A subgrade study will be necessary in any new pavement areas.

10.0 STRUCTURAL ISSUES

Within the Ohio portion of the study area, it is likely that structures in Ohio will need super-structure replacement at a minimum. Any re-use of sub-structures should be evaluated on a site-specific basis.

Within the Kentucky portion of the study area, a fatigue analysis on the Brent Spence Bridge structure was conducted as part of the Engineering Feasibility Study. The results of this analysis were that primary truss members have an infinite fatigue life. A decision on the need for further analysis will be necessary if the selected alternative calls for keeping the current structure.

11.0 TRAFFIC CONTROL ISSUES/MAINTENANCE OF TRAFFIC

This project contains several sections with no shoulders or very narrow shoulders. Considering the potential for traffic impact during construction of this project, a detailed and thorough Maintenance of Traffic Plan will be necessary.

Alternate routes will need to be identified, temporary pavement will likely be needed to carry traffic, and creative solutions will need to be considered.

Road closures will be necessary for crossroads and mainline traffic. Short durations will need to be specified for any mainline activities. Considerations to maintain local access for business, pedestrians and commuters will need to be included in MOT plans. Similarly, accommodations for the high percentage of truck traffic will also need to be considered.

12.0 RIGHT-OF-WAY/SURVEY ISSUES

Due to the size, scope and urban setting of this project, a significant amount of work beyond the existing right-of-way limits is expected. This work may require the acquisition of additional property for the project.

The need for easements or acquisition of property from business and/or residential property will depend on the preliminary project design. Potential areas of consideration for acquisition activity include those directly adjacent to the structure and approaches on the western portions of downtown Covington, south of 12th Street and the southwestern portion of downtown Cincinnati, west of the Clay Wade Bailey Bridge and east of Gest Street.

Depending on the alternative selected, a number of properties in the Lewisburg and Devou Park areas of Covington, Kentucky and the Queensgate area in Cincinnati could be affected.

13.0 UTILITY ISSUES

The most visible utility issue in the Kentucky portion of the study area is the Willow Run Sewer line, which runs parallel to I-75 on the east between the Cut-in-the-Hill and Covington.

The Ohio portion of the study area contains major utility issues, the most visible of these is the Cinergy Sub-station. It is located south of Pete Rose Way and west of the existing Brent Spence Bridge structure. This sub-station is a large facility located less than 100 feet west of the existing Brent Spence Bridge structure. Cinergy also operates a high pressure gas main beneath the sub-station and an oil-jacketed high voltage electric main that serves both the Queensgate and Uptown areas of Cincinnati, via Central Avenue.

Other noteworthy utility issues include a Combined Sewer Interceptor facility directly beneath the bridge on the Ohio side. This facility is operated by the Metropolitan Sewer District of Greater Cincinnati. Also in the area is a distribution water main operated by Cincinnati Water Works. This main crosses the study area on the Ohio side, at a location near Mehring Way.

In addition, subway tunnels located just east of I-75 near the Western Hills Viaduct may also contain utilities. More investigation will be necessary to determine the impact of any alternatives developed in that specific location.

13.1 Railroad Coordination

Norfolk Southern, CSX and the Indiana & Ohio (I&O) have active mainline service lines and intermodal facilities in close proximity to the roadway corridor throughout this segment. However, there is only one location (just north of the Ohio River) where potential interaction exists.

In addition, several abandoned rail facilities are present, specifically near the Western Hills Viaduct, which were at one time operated by Norfolk & Western, B&O and C&O Railroads. Throughout the project area, NS and CSX own two tracks each along with numerous intermodal facilities, including a joint facility at Queensgate (just north and south of Western Hills Viaduct) and Gest Street (adjacent to the old Union Terminal). The Queensgate Rail Yard has the capacity for 4,000 train cars, and is one of the busiest freight rail yards in the Midwest. All SB rail traffic is operated by CSX and all NB traffic is operated by NS under a unique joint operating agreement through this area. From the Gest Street Yard, CSX has two tracks that parallel the Ohio River and US 50 and pass underneath I-75/I-71 just north of the River. Once crossing under I-75/I-71, the tracks turn south just west of Paul Brown Stadium and continue across the Ohio River on a railroad-only bridge adjacent to the Clay Wade Bailey Bridge into Kentucky.

Upon initial contact with railroad companies operating within the study area, the following clearance information was obtained:

- 23 feet is the required minimum overhead clearance.
- 25 feet is the required minimum lateral clearance (from centerline of track), less would require crash walls.

On curved tracks, the lateral clearances on each side of track centerline shall be increased 1.5 inches per degree of curvature. When the fixed obstruction is on tangent track but the track is curved within 80 feet of the obstruction, the lateral clearances each side of track centerline shall be increased as shown in Table 13-1:

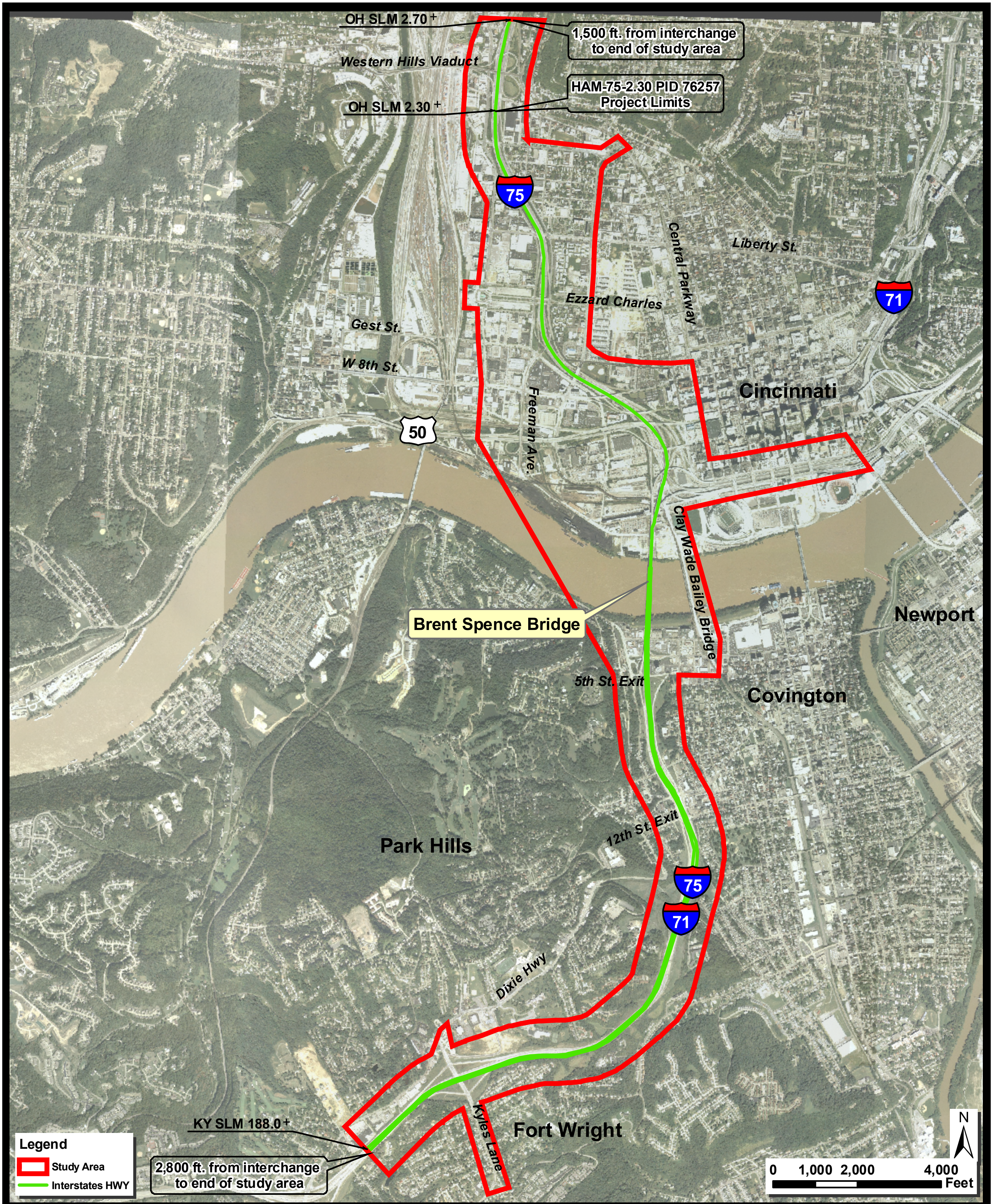
Table 13-1: Lateral Clearances for Active Rail Lines

Distance from Obstruction to Curved Track	Increase Per Degree of Curvature
20 feet	1 ½ inches
40 feet	1 1/8 inches
60 feet	¾ inch
80 feet	3/8 inch

14.0 PERMIT ISSUES

Preliminary contact with the Unites States Coast Guard (USCG) was made for purposes early coordination. USCG indicated that greater horizontal clearance may be needed for skewed crossings as associated with any Queensgate alignments.

The U.S. Army Corps of Engineers (USACE) Section 404 Permit process would likely be required as the Ohio River and its associated tributaries (including wetlands) are considered “waters of the United States.” Similarly, a state level 401 Water Quality Certification and associated permit(s) will also likely be required by Ohio and Kentucky. Such permits can not be sought and reviewed until an alternative has been selected, wetlands have been delineated and verified by USACE, and the construction limits established.



BRENT SPENCE BRIDGE PROJECT STUDY AREA

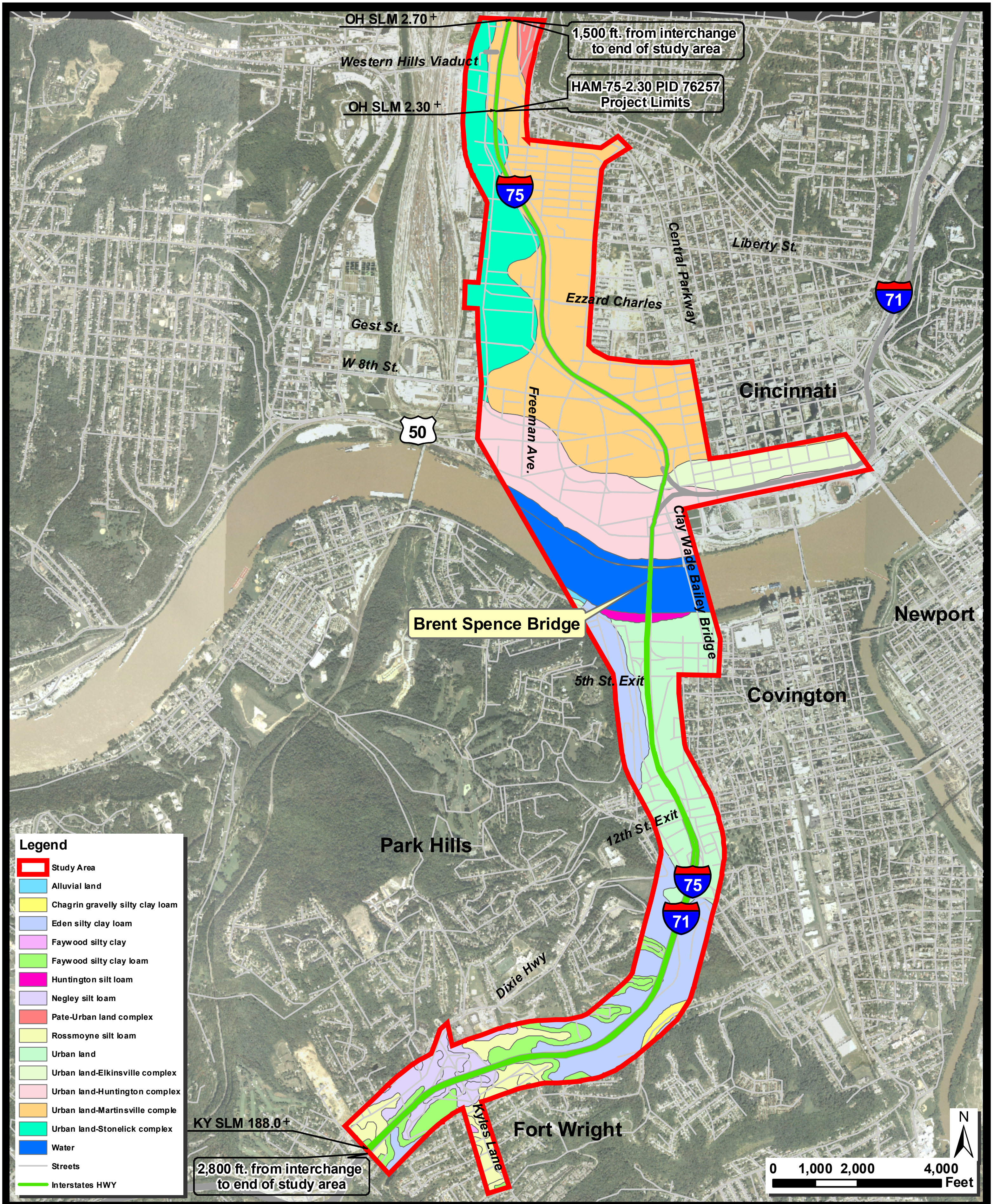
HAM 71/75-0.00/0.22 PID No. 75119

2005.10

PB 100 YEARS

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

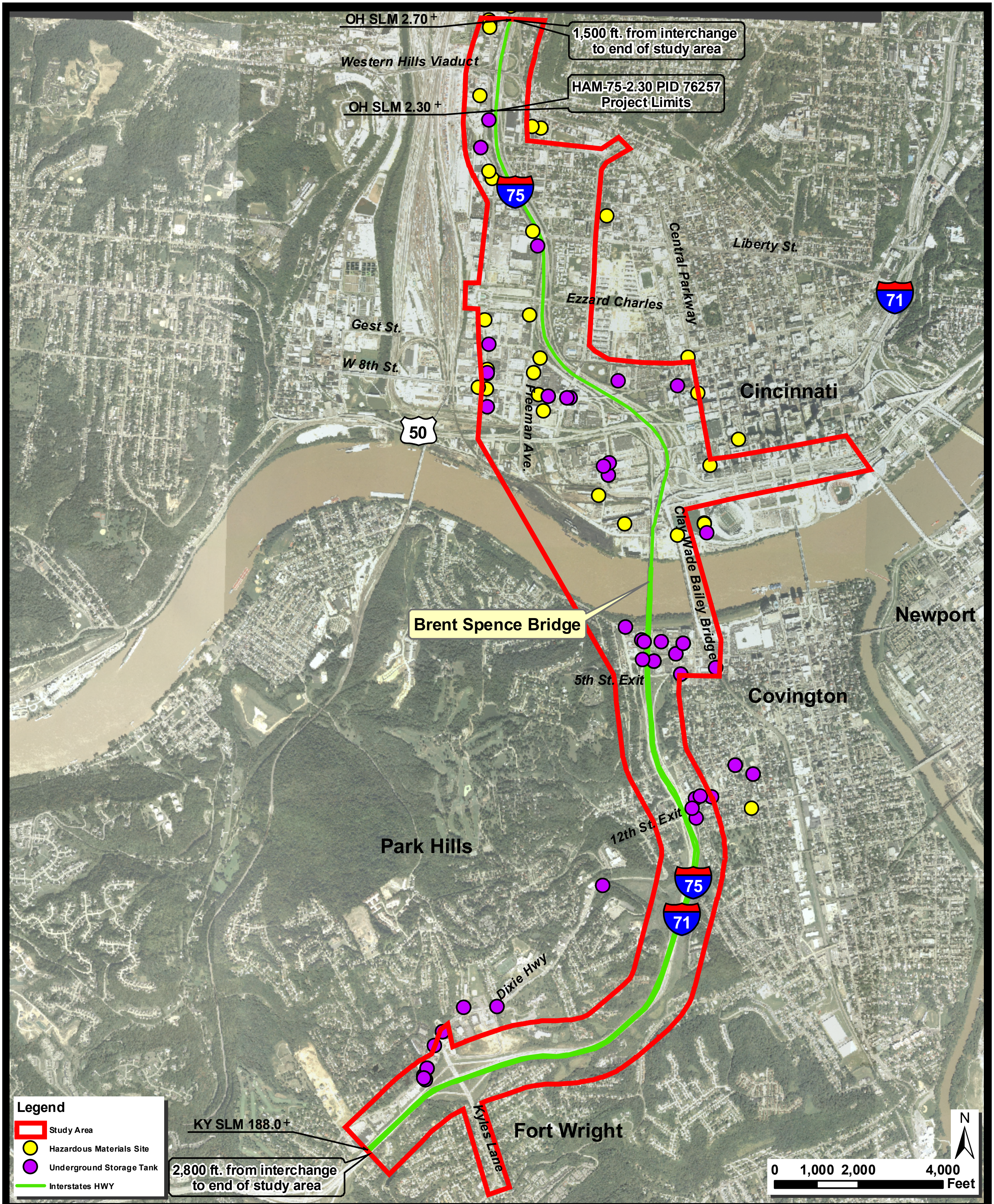
KENTUCKY TRANSPORTATION CABINET



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 1 - Soils

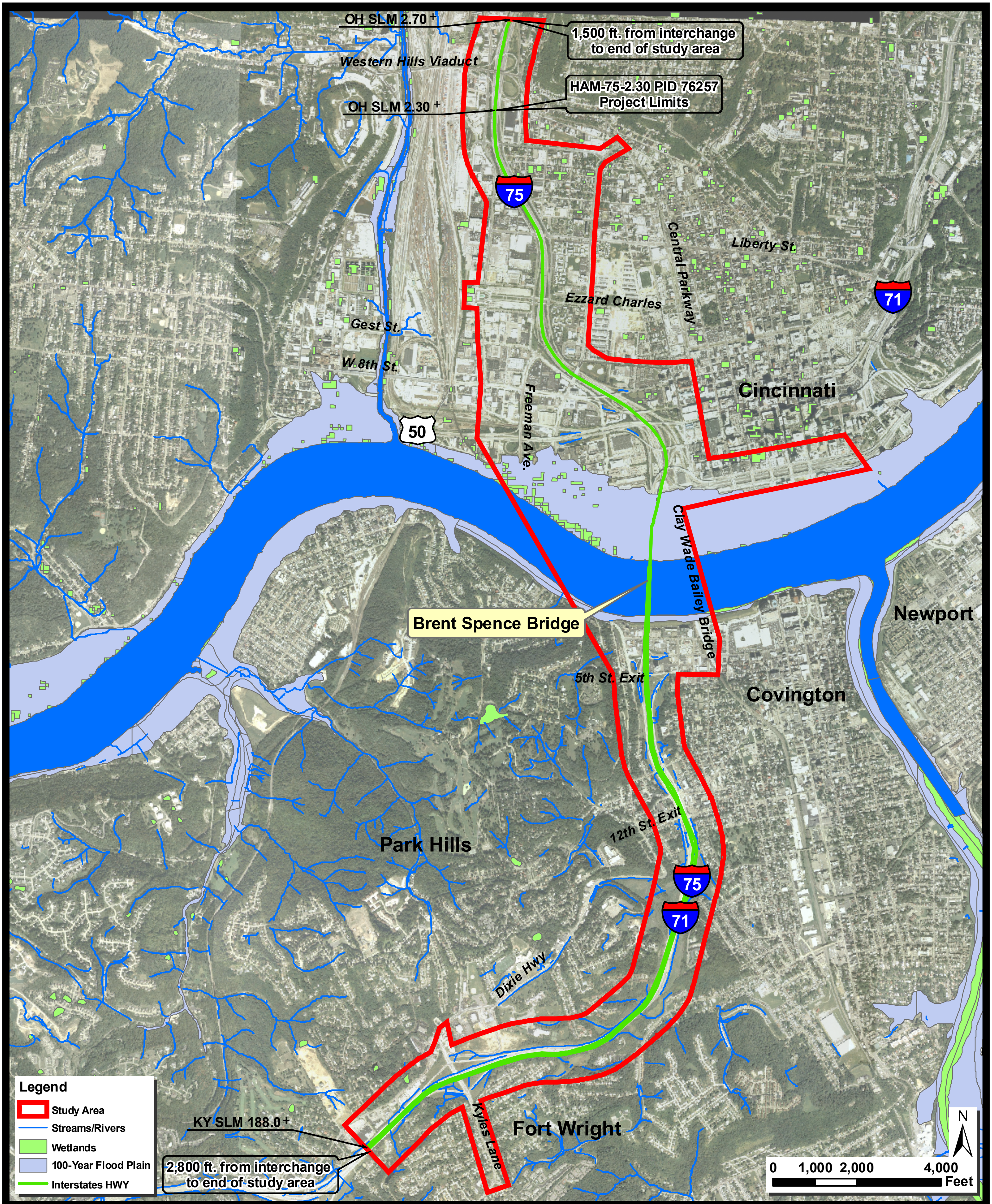
HAM 71/75-0.00/0.22 PID No. 75119 2005.10



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 2 - Hazardous Materials Sites

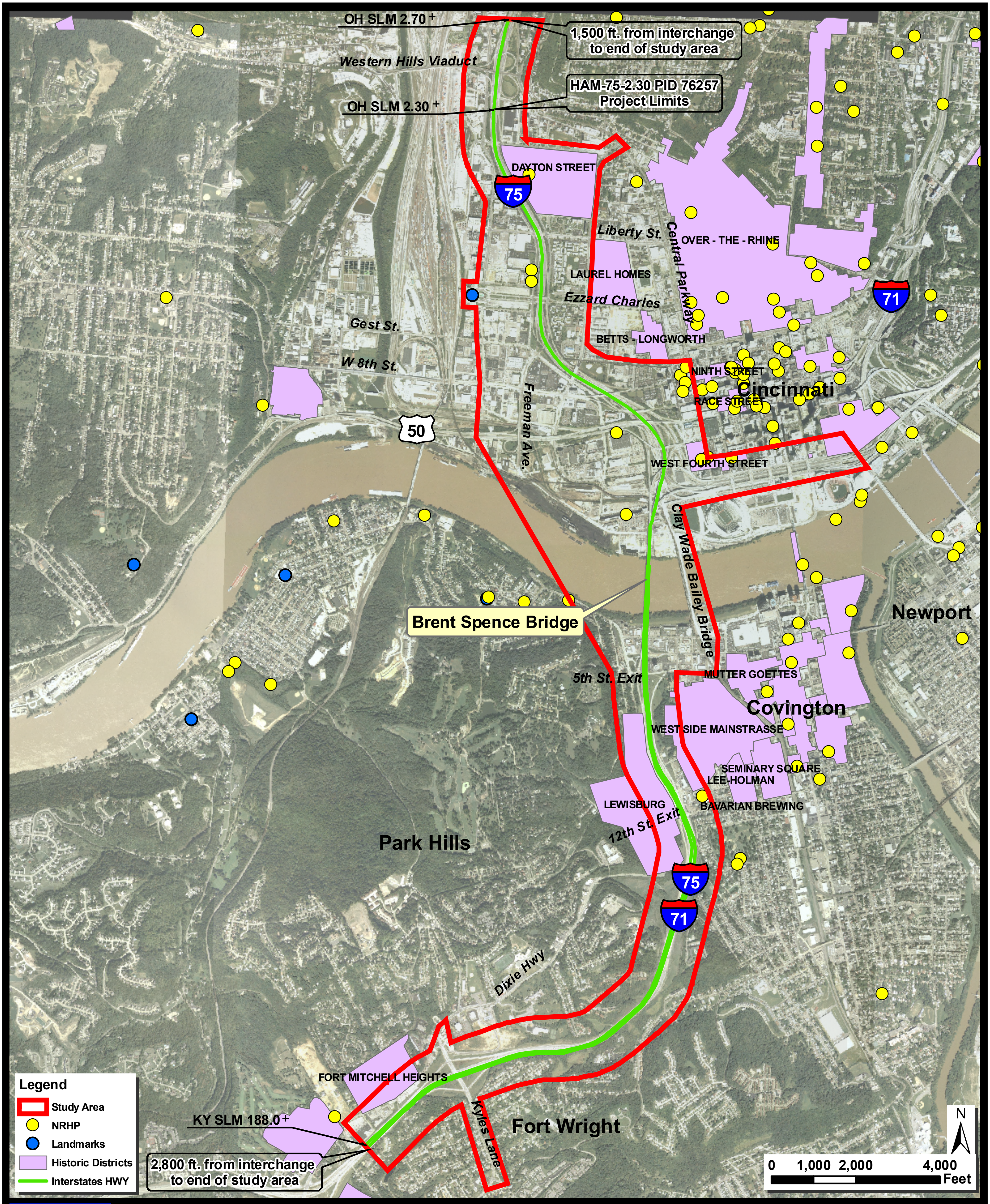
HAM 71/75-0.00/0.22 PID No. 75119 2005.10



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 3 - Streams, Wetlands and 100-Year Flood Plain

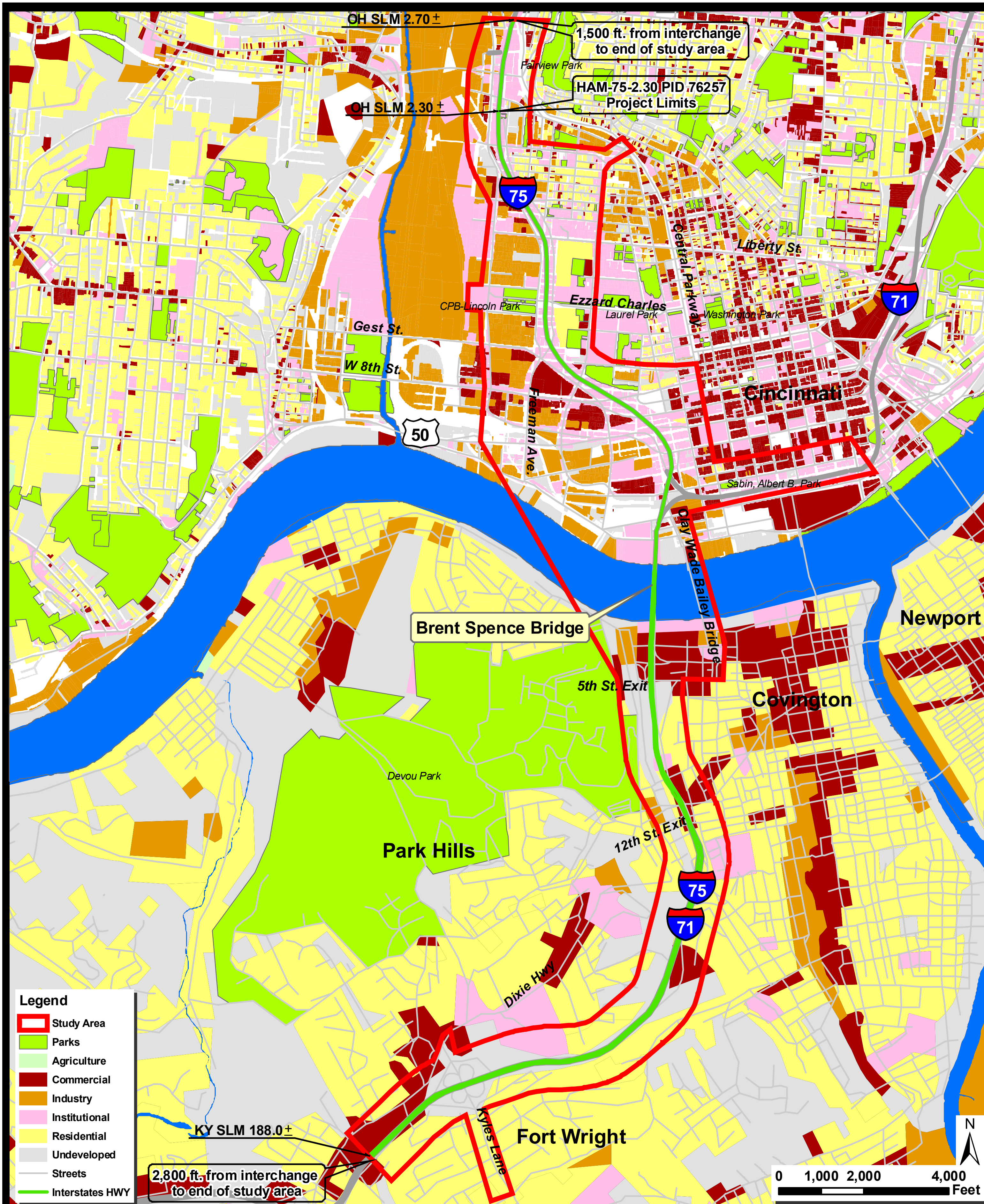
HAM 71/75-0.00/0.22 PID No. 75119 2005.10



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 4 - NRHP, Landmarks and Historic Districts

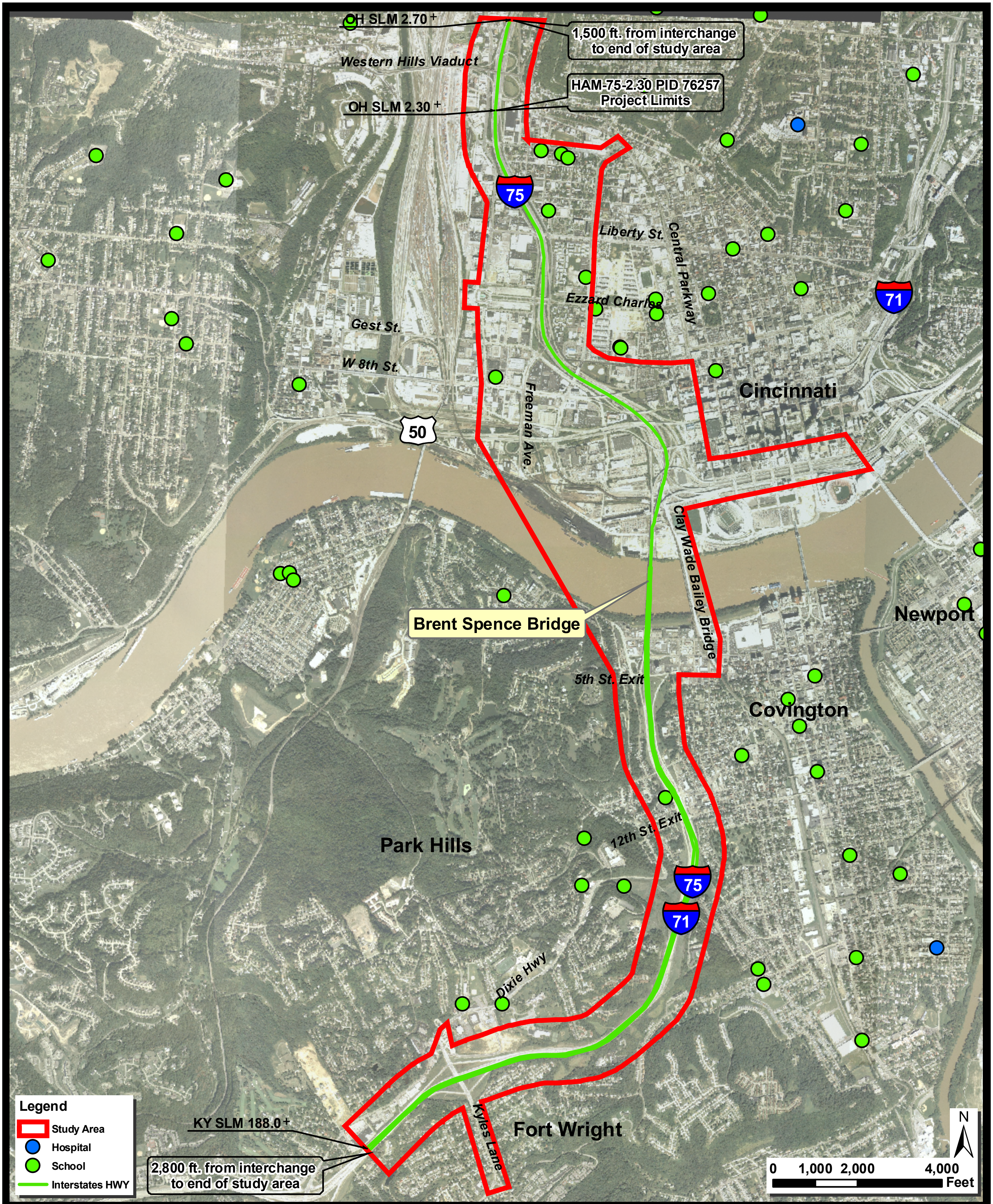
HAM 71/75-0.00/0.22 PID No. 75119 2005.10



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 5 - Parks and Land Use

HAM 71/75-0.00/0.22 PID No. 75119 2005.10



PB 100 YEARS

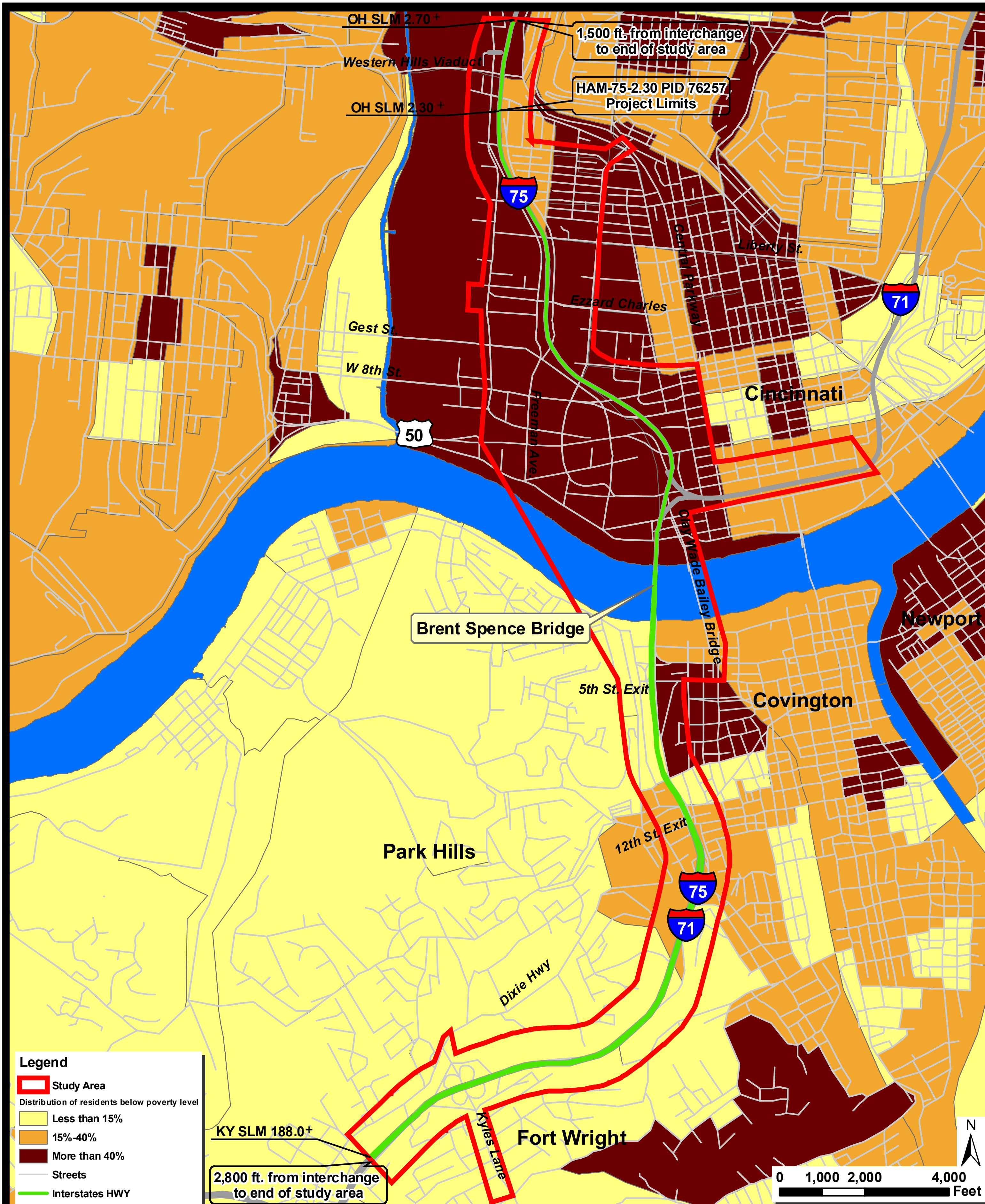
BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 6 - Community Resources

HAM 71/75-0.00/0.22 PID No. 75119 2005.10

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

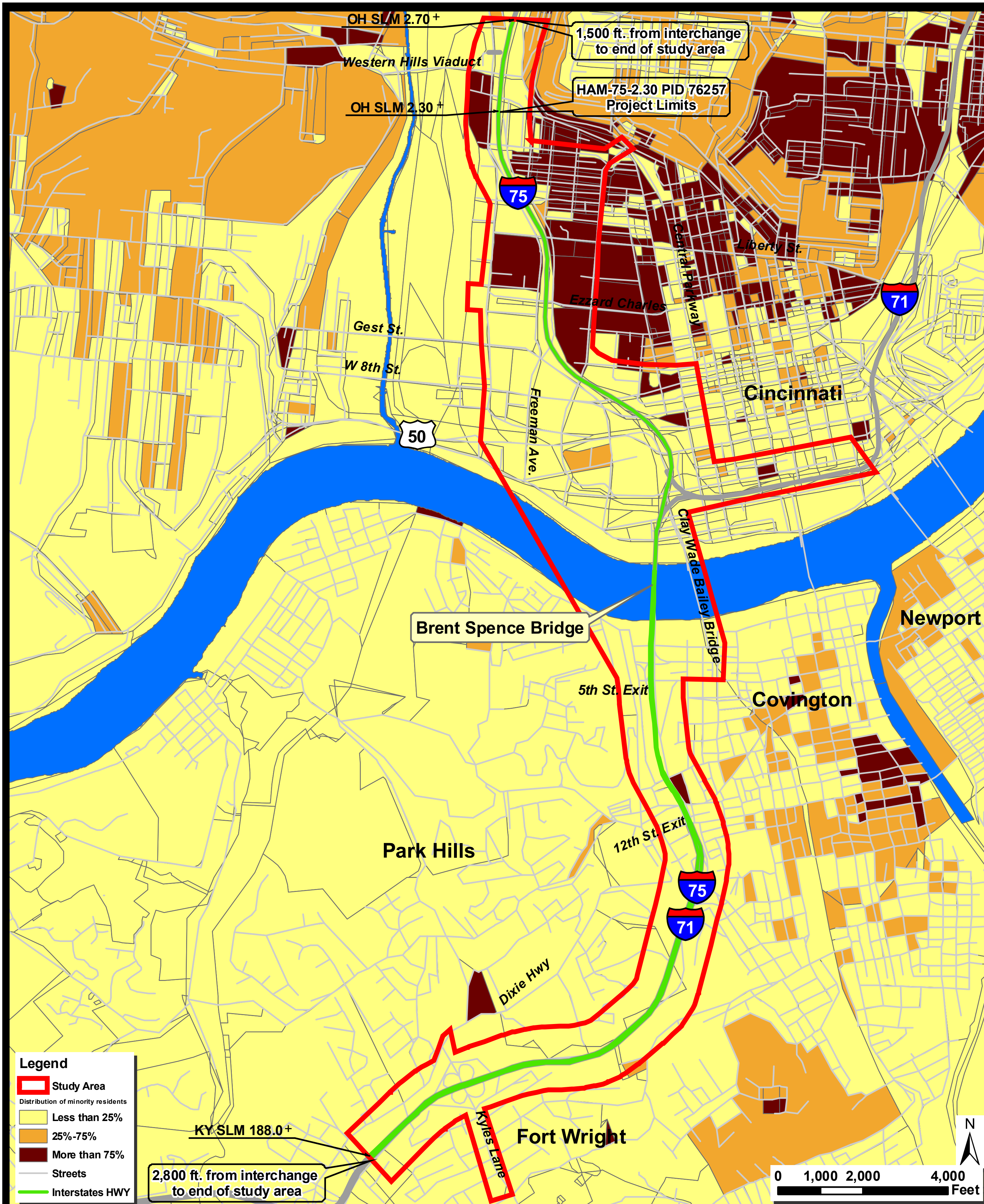
KENTUCKY TRANSPORTATION CABINET



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 7 - Population Below Poverty Level

HAM 71/75-0.00/0.22 PID No. 75119 2005.10



BRENT SPENCE BRIDGE PROJECT STUDY AREA

Exhibit 8 - Minority Population Demographics

HAM 71/75-0.00/0.22 PID No. 75119 2005.10

RED FLAG SUMMARY

Red Flag Summary Completed: October 2005

The purpose of this Red Flag summary is to identify concerns that could cause revisions to the anticipated design and construction scope of work, the purposed project development schedule, the estimated project budget, or the potential impacts of the project on the surrounding area.

Date Red Flag Summary Completed:	October 14, 2005
District	8
Project Name (County, Route, Section):	HAM-71/75-0.00/0.22 - KYTC Project Number 6-17
City, Township or Village Name(s):	Cities of Cincinnati, Ohio and Covington, Kentucky
PID	75119
Prepared By:	Parsons Brinckerhoff
ODOT Project Manager:	Stefan Spinosa

GENERAL PROJECT PLANNING INFORMATION

Project Description:

The Brent Spence Bridge and its approaches are key elements of the Interstate Highway System in the nation, carrying both I-71 and I-75 traffic in the Greater Cincinnati/Northern Kentucky region. This important river crossing is vital to long-distance, state and national commerce, as well as being a major thoroughfare for local and regional mobility.

I-75 connects the region northward to Detroit and southward to destinations such as Atlanta and Miami. Locally, it connects to I-71, I-471 and US Route 50. I-75 and the railroads that run parallel are among the nations busiest. It is the backbone of commerce and travel in this region. I-75 is also among the busiest routes for truck traffic in the country as well, with as many as 6 billion miles of truck travel annually. Each day, more that 250 freight trains pass though this area. Significant safety, congestion and geometric problems exist on the structure and its approaches.

Project Limits / General Location:

The Brent Spence Bridge study area is approximately 4,000 feet wide, extending from the Harrison Avenue interchange on the north, to just south of the Kyles Lane interchange on the south. In Ohio, the study area is bounded by the Mill Creek on the west and parallels the existing I-75 mainline at 2,000 feet to the east. In Kentucky, the study area is bounded by Kenton Hills/Park Hills on the west and the Covington rail yards on the east.

The study area is approximately 6.47 miles in length.

List Structures: **Note: Only Mainline Structures are noted on this form.**

Bridge No.:	HAM-00071-0000 L (ODOT)	Structure File #:	3105946 (ODOT)
Bridge No.:	HAM-00071-0000 R (ODOT)	Structure File #:	3105970 (ODOT)
Bridge No.:	HAM-00075-0022 L (ODOT)	Structure File #:	3108791 (ODOT)
Bridge No.:	HAM-00075-0022 R (ODOT)	Structure File #:	3108805 (ODOT)
Bridge No.:	HAM-00075-0024 R (ODOT)	Structure File #:	3108821 (ODOT)
Bridge No.:	HAM-00075-0030 (ODOT)	Structure File #:	3108872 (ODOT)
Bridge No.:	MP 059 0075 B00043 (KYTC)	Bridge No.:	MP 059 0075 B00090 (KYTC)
Bridge No.:	MP 059 0075 B00043P (KYTC)	Bridge No.:	MP 059 0075 B00039 (KYTC)
Bridge No.:	MP 059 1072 B00047 (KYTC)	Bridge No.:	MP 059 0075 B00040 (KYTC)
Bridge No.:	MP 059 0075 B00044 (KYTC)	Bridge No.:	MP 059 0075 B00041 (KYTC)
Bridge No.:	MP 059 0075 B00044P (KYTC)	Bridge No.:	MP 059 0075 B00046 (KYTC)
Bridge No.:	MP 059 0075 B00038 (KYTC)	Bridge No.:	MP 059 0075 B00089 (KYTC)
Bridge No.:	MP 059 0075 B00038P (KYTC)	Bridge No.:	MP 059 0025 B00049 (KYTC)
Bridge No.:	MP 059 0075 B00087 (KYTC)	Bridge No.:	RR 059 2374 RR 0602 (KYTC)
Bridge No.:	MP 059 0075 B00088 (KYTC)	Bridge No.:	RR 059 0025 RR0610 (KYTC)

Estimated Project Cost: $750 M - 1.5 B

Funding Source(s):

- [x] Federal
- [x] State
- [x] Local — City of Cincinnati, Ohio/City of Covington, Kentucky
- [ ] Private

Are Funding Splits Required?

- [x] Yes
- [ ] No

Specify Splits: Major New, Major Bridge, District Allocation, Local

Anticipated Quarter and Fiscal Year of Project Awarded: Second Quarter - Fiscal Year 2015

Project Sponsor, if any: Ohio Department of Transportation/Kentuckty Transportation Cabinet

Is Local Legislation Required?

- [x] Yes
- [ ] No

Is FHWA Oversight Required?

- [x] Yes
- [ ] No

Is the project located on the congestion / safety list?

- [x] Yes
- [ ] No

Problem identified by (indicated document date):

- [ ] District Work Plan
- [ ] Congestion Study
- [ ] Safety Study
- [ ] Major New
- [x] MPO TIP — April 14, 2005
- [x] MPO LRP — June 10, 2004
- [x] Access Ohio — Corridor 16 (May 2004)
- [x] Other — North South Transportation Initiative (February 2004), KyTC Engineering Feasibility Study (March 2005)

Are there any projects in the area (ODOT, Local, Utility) that might conflict with the project (e.g. a local project on the proposed detour route, a resurfacing project a year after the pavement marking project)?

[X] Yes

[ ] No

Specify: Possible Mill Creek Expressway Project (HAM-75 2.30), Thru the Valley (HAM-75-10.10), Eighth Street Viaduct (City of Cincinnati), Waldvogel Viaduct (City of Cincinnati), Western Hills Viaduct (City of Cincinnati). Local street resurfacing program in Cincinnati and Covington.

Are there growth or land use changes in the area surrounding the project that could have an impact on the project scope?

[X] Yes

[ ] No

Specify: The City of Cincinnati has existing plans for re-development in areas near the project study area, particularly in the Queesngate area and an existing project north of Mehring Way and west of Gest Street. Further coordination with thtese efforts will be required. Development contracts are in process which would preclude aerial easements on Queensgate alignments.

Are there known public involvement issues?

[X] Yes

[ ] No

Specify: Public involvement will be required. Major issues identified in preliminary efforts include bridge aesthetics, maintenance of traffic, capacity and the consideration of transit modes.

Purpose and Need Statement (Must be a separate document for Major Projects):

Draft Purpose and Need Statement will be submitted seperately

Other Information / Notes:

In 2000, the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) and the Miami Valley Regional Planning Commission (MVRPC) cooperated on a regional multi-modal transportation plan named the North South Transportation Initiative (NSTI). The NSTI's focus was to determine ways to improve safety, efficiency and reliability of the transportation networks within Southwest Ohio, Northern Kentucky and Southeast Indiana. Following analysis of the existing and future travel corridors combined with public concerns and thoughts, several projects were established to address the original focus of the NSTI. One of the most important corridors established by the public and stakeholders was Interstate 75, which is the only major north-south connector through the NSTI project area. The Brent Spence Bridge carries both Interstate 71 and Interstate 75 (I-71 and I-75)over the Ohio River and is a vital link of the interstate, regional, and local transportation system. It opened to traffic in 1963 and was designed to carry three 12-foot travel lanes on two decks in each direction. The northbound traffic is carried on the lower deck and the southbound traffic is carried on the upper deck. To accommodate increasing traffic levels, the lane configur

EXISTING INFORMATION:

Check all information that was reviewed for the Red Flag Summary. Not all information is available or necessary for every project. The scope of the Red Flag Summary should be commensurate with the nature of the proposed project.

[X] Legal Speed: 55 mph

[X] Design Speed: 55 mph

[X] Traffic Data:

- Opening Year ADT: 83,000
- Design Year ADT: 80,000
- Design Hourly Volume:
- Directional Distribution:
- Trucks (24 Hr. B&C): 18,430 at the highest location

(Traffic data does not need to be certified for the Red Flag Summary.)

[ ] Turning Movement Traffic Counts

[X] Functional Classification:

- [X] Interstate, Freeway
- [ ] Arterial
- [ ] Collector
- [ ] Local

[X] Locale:

- [ ] Rural
- [X] Urban

[X] National Highway System (NHS):

- [X] NHS Routes: Interstate Routes 71 and 75
- [ ] Non-NHS Routes:

- [ ] (3R) Project?
  - [ ] Yes
  - [x] No

- [x] Aerial Mapping
- [ ] Ohio Utility Protection Service (OUPS) Markings
- [x] United States Geologic Survey (USGS) topographic mapping
- [x] Federal Emergency Management Agency (FEMA) flood plain study mapping
- [ ] Natural Resources Conservation Services (NRCS) mapping
- [x] County Map(s)
- [ ] Airport locations within 4 miles of project
- [x] Tax maps
- [ ] Property deeds
- [ ] Pavement marking log
- [x] Original construction plans:
- [x] Existing Right-of-Way plans:
- [x] Bridge Inspection Reports
- [ ] Bridge Load Ratings
- [ ] Pile Driving Logs
- [ ] Recorded vertical clearances for overpasses and underpasses
- [x] Old soil borings
- [x] Old Geologic reports
- [ ] Pavement Cores
- [ ] Dynaflec Testing
- [ ] Deck Cores
- [ ] Ground Penetrating Radar (GPR Data)
- [ ] Maintenance history
- [ ] Pavement Condition Ratings (PCRs)
- [ ] County manager concerns
- [x] Traffic studies, Highway Safety Program (HSP) studies
- [x] Previous Maintenance of Traffic concerns on roadway
- [x] Accident history / Accident reports
- [ ] Past Project Construction Diaries
- [ ] Permitted Lane Closure Map
- [ ] Property owner contacts
- [x] National Register of Historic Places
- [x] Other: Ohio and Kentucky Resource Agency Databases

EXISTING GEOTECHNICAL INFORMATION:
Identify all geotechnical references found. It is assumed , based on the project type, that not all reference materials listed herein will be applicable for use during the Red Flag Study. This study should provide a comprehensive review of all existing information available for the project area and should be supplemented with a complete field reconnaissance

Review of Information From ODOT:

- [x] Original Construction Plans including plan views, profiles, and cross-sections
- [ ] Construction diaries and inspection reports for original construction
- [ ] Compile information on changes to the plans during construction activities (e.g., slope, spring drains)
- [x] Interview people knowledgeable with the previous projects
- [ ] Maintenance records
- [x] Boring log on file with the Office of Geotechnical Engineering
- [x] History and occurrence of landslides
- [x] History and occurrence of rockfalls
- [x] Other Similar records and documentation from the Kentucky Transportation Cabinet

Review of information from ODNR:

From the Division of Geological Survey

- [x] Boring logs on file
- [ ] Measured geological sections
- [x] Bedrock Geological Maps
- [x] Bedrock Topography Maps
- [x] Bedrock Structure Maps
- [x] Geologic Map of Ohio

- [x] Quaternary Geology of Ohio
- [x] Known and Probable Karst in Ohio
- [x] Bulletins
- [x] Information Circulars
- [x] Report of Investigations
- [x] Locations and Information on underground mines
- [x] Location and characteristics of karst features
- [x] Landslide Maps
- [x] Other: Kentucky Transportation Cabinet Data

From the Division of Mineral Resource Management

- [x] Applications and permits files for surface mines (coal & industrial mineral)
- [x] Active, reclaimed or abandoned surface mines
- [x] Abandoned Mine Land (AML) sites
- [ ] Emergency Projects
- [ ] Other:

From the Division of Soil & Water

- [x] Water well Logs
- [x] Soil Survey
- [x] Ohio Wetland Inventory Maps
- [x] National Wetland Inventory Maps
- [x] Presence of lake bed sediments, organic soils or peat deposits
- [x] Other: Groundwater Resources of Hamilton County (1986)

Other Sources:

- [x] Aerial photography
- [ ] Satellite imagery
- [x] USGS quadrangles
- [x] USGS publications and files
- [x] City and County Engineers
- [ ] Academia with engineering or geology programs
- [x] USGS open File Map Series #78-1057 "Landslide and Related Features"
- [x] Other: City of Cincinnati Landslide Susceptibility Map and Report

SITE VISIT:
A site visit is required for ALL projects. The site visit shall consist of visual inspection of the entire project area including the ditch lines, cut slopes, stream banks, bridge foundations, pavement, rock / soil slopes, etc.

Date(s) of Site Visit: 8/3/2005 ODOT, KyTC, Covington* | 8/18/2005 ODOT, KyTC, Cincinnati*

* The attendence list thes evisits is attached to the end of this document

ODOT DISCIPLINE INVOLVEMENT:

List name and phone number of individual(s) representing each discipline during the site visit and preparation of the Red Flag Summary. One individual may represent multiple disciplines. Check box if individual attended the site visit.

Attended	Discipline	Name	Phone
x	District Project Manager	Stefan Spinosa, P.E.	513.933.6639
x	Geometrics	Stefan Spinosa, P.E.	513.933.6639
x	Hydraulics	Stefan Spinosa, P.E.	513.933.6639
x	Pavements	Stefan Spinosa, P.E.	513.933.6639
x	Geotechnical	Swmainathan Srinivasan (HC Nutting)	513.321.5816
x	General Roadway	Stefan Spinosa, P.E.	513.933.6639
x	Structures	Stefan Spinosa, P.E.	513.933.6639
x	Traffic Control	Jay Hamilton	513.933.6584
x	Signals	Jay Hamilton	513.933.6584
x	Maintenance of Traffic	Jay Hamilton	513.933.6584
	Right-of-Way / Real Estate		
	Utilities		
	Survey		
x	Environmental	Diana Martin	513.933.6597
	Highway Management		
	CO Program Manager		
x	County Manager(s)**	Keith Smith	513.933.6590
	Production Administrator**	Stefan Spinosa, P.E.	513.933.6639
x	Planning Administrator**	Diana Martin	513.933.6597

** The County Manager, District Production Administrator, and District Planning Administrator (or qualified representative) must attend the site visit.

EXTERNAL AGENCY INVOLVEMENT:

Indicate external agency involvement during identification of red flags. List the name and phone number of individual(s) representing each agency during the site visit. Check box if individual attended the field review.

Attended	Agency	Name	Phone
	Federal Highway Administration (FHWA)		Phone:
	County Engineer		Phone:
X	City Engineer	Tom Logan (Cov); Bonnie Phillips (Cin)	Phone: 859.292.2112/513.352.5310
	Other Local Public Agency		Phone:
	Federal Emergency Management Agency (FEMA)		Phone:
	US Army Corps of Engineers (USACE)		Phone:
	U.S. Coast Guard		Phone:
	Ohio Department of Natural Resources (ODNR)		Phone:
	Ohio Environmental Protection Agency (OEPA)		Phone:
	Railroad Railway Company		Phone:
	State Historical Preservation Office (SHPO)		Phone:
X	Metropolitan Planning Organization (MPO)	Bob Koehler, (OKI)	Phone:
	Utilities Company list:		
	Electric		Phone:
	Telephone		Phone:
	Water		Phone:
	Gas		Phone:
	Sanitary		Phone:
	Cable		Phone:
	Other		Phone:
	Other		Phone:
X	Other	Dave Harmon, Kevin Rust, Mike Bezold, David Waldner (KYTC)	Phone: 859.341.3661

ODOT COUNTY MANAGER CONCERNS:
List any comments / requests from the ODOT County Manager

ACCIDENT DATA:

Summarize accident history. Indicate and design features that should be revised to increase safety

In the Kentucky portion of the study area, crash rates are higher that the state average. A high concentration of crashes occurs at the 12th Street/Pike Street and 5th Street exits. Along this portion of the corridor, more than half of the crashes are rear-end type accidents, which is an indicator of congestion already present along the corridor. The high incidences of crashes within the study area lead to increasing congestion along the corridor, as the congestion continues to increase; the likelihood of additional accidents also increases. Both the I-75 and I-71 corridors have been identified by ODOT as safety priorities. The segment of I-71 between State Line Mile 0.50 and 1.00 ranks as the fourth most accident prone section in the state. Most of the segment crash rates for individual years as well as overall crashes exceed the statewide average rates. There are high concentrations of crashes near the I-75/I-71 split, which only serve to increase congestion and delay in the study area.

ENVIRONMENTAL ISSUES:
Make a preliminary determination on whether the following resources will be affected by the proposed project.

Involvement:	Resource	Comments	References*
[X] Yes [ ] No [ ] Possible	Parkland, nature preserves and wildlife areas (Name)	Goebel, Devou, Laurel and Lincoln parks	
[X] Yes [ ] No [ ] Possible	Cemetery (Name)	St. John's and Highland Cemeteries	
[ ] Yes [X] No [ ] Possible	Scenic River (Name)	Mill Creek Conservancy District boundaries coincide with study area limits, but it is not a state scenic river.	EPM: 104.2, 104.2.4
[X] Yes [ ] No [ ] Possible	Public Facilities (Name)	Schools, churches and mediacal facilties	
[ ] Yes [ ] No [X] Possible	Threatened and Endangered Species and/or habitat (e.g., Indiana bat trees, etc.)	Indiana Bat habitat on either side of Ohio River. Potential for mussels in Ohio River	EPM: 104.2, 104.2.6

[X] Yes [ ] No [ ] Possible	Existing cat tails (Location)	Along river bank and associate with highway drains	
[X] Yes [ ] No [ ] Possible	Existing wet areas (Location)	Along river bank and associate with highway drains	EPM: 104.2, 104.2.3
[X] Yes [ ] No [ ] Possible	Streams, rivers and watercourses (Use Designation)	Ohio River is within study area limits. The Mill Creek in Ohio and the Licking River in Kentucky are nearby, but not within the studay area.	EPM: 104.2, 104.2.4
[X] Yes [ ] No [ ] Possible	Historic Building(s) (Location)	The Ohio Historical Preservation Office Database lists 231 buildings, 17 of which are deemed eligible for the National Register of Historic Places (NRHP). This includes Longworth Hall at 700 West Pete Rose Way. The Kentucky Heritage Counil database lists 879 buildingd or features, 174 of which are deemed NHRP eligible.	EPM: 104.3
[X] Yes [ ] No [ ] Possible	Historic Bridge(s) (Location)	Western Hills Viaduct (SFN 310545).	EPM: 104.3
[ ] Yes [X] No [ ] Possible	Farmland (Location)		
[ ] Yes [X] No [ ] Possible	Landfill(s) (Location)		
[ ] Yes [X] No [ ] Possible	Total Maximum Daily Load (TDML) Streams		
[ ] Yes [X] No [ ] Possible	ODOT MS4 Phase 2 Regulated Areas		
[X] Yes [ ] No [ ] Possible	Evidence of hazardous materials (Location)	Electric sub-station, dry cleaners, body shops, gas stations, printing and sign companies all operate within the study area at various locations. This is a long developed industrial zone with probability for soil contamination.	EPM: 104.7
[ ] Yes [ ] No [X] Possible	Sensitive environmental justice areas	Subsidized housing units located on the West End of Cincinnati in the areas of Linn Street, Dayton Street, Dalton Street and Ezzard Charles Avenue.	
[X] Yes [ ] No [ ] Possible	Federal Emergency Management Agency (FEMA) floodplains	Special flood hazard zone along the Ohio River (FEMA online)	EPM: 104.2, 104.2.5
[ ] Yes [X] No [ ] Possible	Lake Erie Coastal Management Area		EMP: 104.2
[ ] Yes [X] No [ ] Possible	Sole Source Aquifers (Location)		
[ ] Yes [X] No [ ] Possible	Wellhead Protection Areas (Specify)		
[X] Yes [ ] No [ ] Possible	Does it appear that noise abatement will be an issue for the project?	Possibly for residential areas as noted above	
[ ] Yes [ ] No [X] Possible	Other Environmental Issues	Coal yards, roofing companies, scrap yards and homes with asbestos siding are all present within the project area.	

GEOMETRIC ISSUES:
Use the design speed, design functional classification and available traffic data to make a preliminary determination as to the geometric standards for the project. Compare these requirements to accident data and impacts if deviations are being considered

Design Exception Required?	Design Feature	Preliminary Comments Regarding Justification	References*
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Lane Width (including curve widening)	Lane widths on some existing crossroads do not meet LDV1 design requirements. Construction of this project will likely involve tying in to existing crossroads with inadequate lane widths.	LDV1: 301.1.1
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Graded Shoulder Width	Graded shoulder widths on some existing crossroads do not meet LDV1 design requirements. Construction of this project will likely involve tying in to existing crossroads with inadequate shoulder widths.	LDV1: 301.2.3
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Bridge Width	Bridge widths on some existing crossroads do not meet LDV1 design requirements. Construction of this project will likely involve tying in to existing crossroads with bridges of inadequate width.	LDV1: 302.1
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Structural Capacity	Existing bridges on crossroads may not meet current design loading criteria. Additional review of existing bridges will be required upon final determination to reuse any existing bridges.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Horizontal Alignment (including Excessive Deflections, Degree of Curve, Lack of Spirals, Transition/Taper Rates and Intersection Angles)	Several horizontal curves on mainline ramps and crossroads do not meet LDV1 design requirements. Construction of this project may involve tying to existing roadway alignments with inadequate horizontal alignment. Horizontal alignment may also be restricted to avoid existing cultural resources.	LDV1: 202, 401.2
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Vertical Alignment (including grade breaks)	Several vertical curves on mainline ramps and crossroads do not meet LDV1 design requirements. Construction of this project may involve tying to existing roadway alignments with inadequate vertical alignment. Vertical alignment may also be restricted to avoid existing cultural resources.	LDV1: 203
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Grades	Due to the surrounding urban environment, ties to existing ramps, crossroads, and mainline will require additional review dependent on final design configuration. Final grades may also be restricted to avoid existing cultural resources.	LDV1: 203.2
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Stopping Sight Distance	Several vertical curves on mainline and crossroads do not meet LDV1 design requirements. Construction of this project may involve tying to existing roadway alignments with inadequate vertical alignment including inadequate stopping sight distance. Stopping sight distance may also be restricted to avoid existing cultural resources.	LDV1: 201.2
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Pavement Cross Slopes	Due to the surrounding urban environment, ties to existing ramps, crossroads, and mainline will require additional review dependent on final design configuration.	LDV1: 301.1.5

[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Superelevation (Maximum rate, transition, position)	Due to the surrounding urban environment, ties to existing ramps, crossroads, and mainline will require additional review dependent on final design configuration.	LDV1: 202.4
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Horizontal Clearance	Changes in horizontal alignment due to the final design configuration would have a direct impact on existing horizontal clearances and will require additional review. Avoidance of existing cultural resources may require guardrail and/or concrete barrier wall.	LDV1: 301.2.5
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Vertical Clearance	Changes in horizontal and vertical alignment due to the final design configuration would have a direct impact on existing vertical clearances and will require additional review.	LDV1: 302.1

Indicate if the following geometric issues are present or should be considered during project development. Consider work on the mainline as well as any side roads or service roads. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does the existing horizontal alignment need to be modified?	Dependent on final design configuration, it is anticipated that portions of the existing horizontal alignments of mainline, ramps, and crossroads will need to be modified.	LDV1:202
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does the existing vertical alignment need to be modified?	Dependent on final design configuration, it is anticipated that portions of the existing vertical alignments of mainline, ramps, and crossroads will need to be modified.	LDV1:203
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does stopping sight distance need to be increased?	Dependent on final design configuration, it is anticipated that stopping sight distance at various locations will need to be upgraded.	LDV:201.2
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does intersection sight distance need to be increased?	Dependent on final design configuration, it is anticipated that some of the local intersections will need sight distance modifications.	LDV1: 201.3
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any hazards in the clear zone? Specify treatment.	Due to the urban environment, many of the existing bridge abutments and other surrounding features are within the clear zone area. Dependent on final design, it is anticipated guardrail and concrete barrier wall will be required to protect hazards within the clear zone or removal of the hazard at a cost.	LDV1: 600.2, 601
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does existing guardrail need to be replaced (e.g., too low, poor condition)?	Dependent on final design, it is anticipated that portions of existing guardrail will be replaced due to the final design configuration.	LDV1: 602, 603
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is there sufficient area for guardrail anchor assemblies (E-98 or B-98)?	Dependent on final design configuration, it is anticipated that sufficient area will be available for anchor assemblies.	LDV1: 602, 603
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does the number of turn lanes appear to be adequate?	Dependent on final design configuration, it is anticipated that upgrades to existing intersections will be required.	LDV1: 401.7, 402
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does the number of through lanes appear to be adequate?	Dependent on final design configuration, it is anticipated that upgrades to the number of lanes on mainline, ramps, and crossroads will be required.	LDV1: 401.7
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are changes to access control required?	Dependent on final design configuration, it is anticipated that changes to access control will be required.	LDV1: 800, 801, 802
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any drive locations that will require special attention during design (e.g., very steep grades, high volume commercial drives, drives close to bridges or intersections)?	Dependent on final design configuration, it is anticipated that drive locations and alignments on the crossroads will need to be reviewed for possible relocation and/or modification.	LDV1: 803, 804, 805
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are new mailbox turnouts required?		LDV1: 803.1
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is there any evidence of accidents due to substandard vertical clearance on overpass structures?	A more detailed analysis will be available in the Existing and Future Conditions Report.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will an interchange be added or modified?	Dependent on final design configuration, it is anticipated that existing interchanges will need to be modified and additional access points may be provided.	LDV1: 403, 404
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Do the existing intersection radius returns need to be modified to accommodate larger truck turning movements?	Dependent on final design configuration, it is anticipated that some intersection radii along the crossroads will need to be improved to accommodate traffic.	LDV1: 401.5
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does grading need to be upgraded? To what criteria (e.g., clear zone, safety, standard)?	Dependent on final design configuration, it is anticipated that grading will be required to address both existing and final conditions.	LDV1: 307
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any other geometric issues? Describe	Due to the urban environment, the close proximity of residences and businesses to the mainline, ramps, and crossroads, and the existence of cultural resources and other environmental features will affect geometric design decisions. Tight geometry exists currently on most mainline ramps.	

HYDRAULIC ISSUES:

Indicate if the following drainage issues are present or should be considered during project development. Side road and service road work should be considered in this assessment. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Based on visual evidence (height of debris, erosion or other markings left from high water) and approximate drainage areas, does the existing drainage system (culverts, storm sewers and/or ditches) appear to be appropriately sized and functioning properly? Describe deficiencies.	Dependent on final design configuration, it is anticipated that additional review and analysis of existing drainage structures to be reused will be required. It is anticipated that many existing structures will be replaced.	LDV2: 1003 - 1006
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is there evidence of alignment or flow velocity problems (e.g., scour, bank erosions, silting) at culvert entrances or exits?	Dependent on final design configuration, it is anticipated that additional review and analysis of existing drainage structures to be reused will be required. Evaluation of bridge scour has not been conducted.	LDV2: 1107
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there sinkholes or other deterioration in the pavement that would indicate separations in the existing pipes?		
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Should guardrail over culverts be eliminated with clear zone grading?		LDV1: 307.2

[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Should the existing culverts be replaced?	Dependent on final design configuration, additional review and analysis will be required to determine if existing culverts to be reused should be replaced. It is anticipated that many existing structures will be replaced.	LDV2: 1105
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Should the existing culverts be extended?	Dependent on final design configuration, additional review and analysis will be required to determine if existing culverts to be reused can be extended if possible or should be replaced.	LDV2: 1105
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will a new alignment concentrate flow (in culverts) that is currently overland flow?	Dependent on final design configuration, additional review and analysis will be required to determine if additional runoff is being directed to existing drainage structures that are to be reused.	LDV2: 1105
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Will the maximum height of cover (100') be exceeded for any culvert?		LDV2: 1008
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Will bankfull design be used for any culverts?		LDV2: 1105.3.3
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Could materials with long lead times (e.g., large boxes) have an impact on construction schedule?	Long steel or concrete boxes or structures may require long lead times.	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does the existing drainage system have an odor that might indicate that it includes septic connections?	Possible due to the urban environment.	LDV2: LD-30 Form 1111.1
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is the exposed curb height in existing gutters adequate to contain flow (include height of proposed resurfacing)?	Curb heights on many side roads are likely inadequate. Construction of this project may involve tying to existing crossroads with inadequate curb heights.	LDV2: 1103
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Do the existing inlets or catch basins need to be raised to meet proposed grade?	Dependent on final design configuration, it is anticipated that most existing drainage structures will be replaced with new structures.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the project in a FEMA flood zone?	The project involves a major crossing of I-75 over the Ohio River and the Ohio side may flood at elevations closer to the Ohio River.	LDV2: 1005
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does the project affect a wetland or waterway (e.g., stream, river, jurisdictional ditch)?	The project involves a major crossing of I-75 over the Ohio River. Wetlands may exist along the fringe of the river.	LDV2: 1001.2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the existing and/or proposed channel alignment compatible with the existing/proposed structure?		
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Will channel relocation be required?		LDV2: 1102.2.4
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will Municipal Separate Storm Sewer System (MS4) requirements apply?		
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will post construction flow requirements be required?		LDV2: 1115.1 LDV2: 1115.2
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is there evidence of existing field tiles?		LDV2: 1002.3.6, 1108
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are underdrain outlets functioning properly?	Age of the system would indicate that some problems likely exist.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will a new storm sewer outfall be required?	Dependent on final design configuration, storm sewer outfalls may be modified to some extent.	LDV2: 1104
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is ditch cleanout required?		
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does the drainage work warrant any special maintenance of traffic considerations?		TEM: PART 6
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there any other hydraulic issues? Describe.		

GEOTECH ISSUES:

“Geotechnical Red Flag” features may include, but are not limited to, known or suspected geologic hazards (e.g., organic soils, karst, rockfalls, landslides, surface and underground mines, poor subgrade conditions, or difficulty in correcting existing surface or subsurface drainage problems).

GEOLOGY

Soils noted in the study area consist of a gravelly zone topped by granular outwash deposits, alluvial sediments, valley basin sediments, valley wall deposits, silty sands glacial and residual clays with limestone and shale, Illinoian age glacial soils, capped with windblown loessian silts and overlying residual clays that provide a soil mantle of varying thickness atop native bedrock. The predominately shale and limestone bedrock surface is highly variable, with relatively drastic changes in depth over relatively short distances. Area soil conditions at the site have also been affected by placement of fill, construction of buildings, construction of marina and housing developments, demolition of structures and roadway grading. Rock beds are highly fossiliferous and calcareous. The present limestone often provides a formidable resistance to excavation efforts due to hardness, thickness of layers and close packing of layers. Based on local project experience, the development of karst in the study area could occur in isolated areas, but is not anticipated to be a significant concern.

ORIGINAL CONSTRUCTION PLAN OBSERVATIONS

Test borings performed along the Ohio River banks for the existing Brent Spence Bridge indicated approximately 45 feet of sandy and clay-like fill underlain by medium stiff silty clay to a depth of about 66 feet below existing grade. The cohesive alluvium was underlain by a medium dense layer of sandy outwash deposits with varying amounts of gravel down to about 115 feet below existing grade. Test borings performed within the Ohio River encountered more granular soils with varying consistency and gravel content to the top of a bedrock surface encountered at approximately 75 feet below the existing water surface. Foundations for main span of bridge are built on driven piles and 90 - 120 feet below water level. Bearing strata and bedrock, predominantly limestone, are variable in depth.

DISTRICT NOTATIONS

None provided

FIELD REVIEW

In Ohio, a number of historic structures were noted south of Pete Rose Way and throughout Queesngate. Railroad activity in the form for active lines and spurs was also noted east of Gest Street and south of Third. The Cinergy sub-station just west of the existing bridge was also noted. In Kentucky, a lead contamination side was identified along the Ohio River bank as well as residual metal contamination in the area of the existing floodwall. Drainage into the Ohio River from the Kentucky side was also discussed as well as the number of historic properties in the Covington area, on both sides of I-71/I-75.

SUMMARY OF GEOTECHNICAL ISSUES

Based on the information compiled during this study indicate whether or not the following geotechnical issues are present or should be further considered during project development. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there evidence of soil drainage problems (e.g., wet or pumping subgrade, standing water, the presence of seeps, wetlands, swamps, bogs)?	There are some areas in the lower elevations where drainage and wet pumping subgrade in alluvial soils may be an issue. The shale and top soils in Kentucky are also prone to moderate-to-severe erosion in steeper embankment areas or when exposed to air and water.	SSI: 2.1, 2.2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there evidence of any embankment or foundation problems (e.g., differential settlement, sag, foundation failures, slope failures, scours, evidence of channel migrations)?	Deep alluvial, lakebed deposits are possible in the river valley and settlement issues need to be addressed. Scour in the river channel will be an issue, particularly in the Kentucky portion of the study area. There have been historical slides in Kentucky and north of the Western Hills Viaduct.	SSI: 2.1, 2.2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there evidence of any landslides?	Certain areas in the valley (river) and uplands have weak alluvium and colluvial soils prone to landslide.	SSI: 2.1, 2.2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there evidence of unsuitable materials (e.g., presence of debris or man-made fills or waste pits containing these materials, indications from old soil borings)?	Majority of the urban developed areas have variable thickness of till and even buried foundations. Debris from I-75 construction can be found in the road bed.	SSI: 2.1, 2.2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there evidence of rock strata (e.g., presence of exposed bedrock, rock on the old borings)?	The upland areas in the Kentucky side have shallow shale bedrock in evidence at the road cut slopes.	SSI: 2.1
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is there evidence of active, reclaimed or abandoned surface mines?	No evidence based on this level review	SSI: 2.1, 2.2, AUM
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is there information pertaining to the existence of underground mines?	None located	SSI: 2.1, 2.2, AUM
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are soil borings needed for pavement design, foundations (bridge, headwall, retaining wall, noise wall) or slopes?	Geology is very complex and variable. Structure-specific boring will be needed.	SSI: 2.1, 2.2
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does an undercut appear to be needed?	Undercut of existing fill and upper alluvium may be needed.	SSI: 5.3.2.1
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Should the Office of Geotechnical Engineering be contacted to evaluate the project site?	Not deemed necessary at this time.	SSI: 1.3
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are There any other geotechnical issues? Describe.	Bridge will likely require deep foundations and detailed study since bedrock was located at depths in excess of 100 feet. Regional seismology should be considered in design. Localized areas of landslide and karst (KY) side may be present. Numerous wells may be needed. Rock cuts and stability/erosion issues. Old foundations and existing till may be present requiring attention. A more detailed report will be provided as a part of further study efforts.	

Provide a list of bulleted items referencing additional areas of concern or special notation.

- Historical topographic maps including 1912 maps and Hamilton County, Ohio CAGIS maps.
- Topographic and geologic maps published by the United States Geological Survey (USGS), the Geological Survey of Ohio, and the Kentucky Geological Survey, including website reviews of the same organizations.
- Soil Conservation Service Soil Surveys of Kenton County, Kentucky and Hamilton County, Ohio published by the United States Department of Transportation.
- Numerous geotechnical subsurface soils boring data in both Kentucky and Ohio in the project corridor study area.
- ODOT's Geotechnical Record in the applicable areas of Hamilton County, Ohio within the project corridor.
- History of notable landslides within the project corridor study area.
- Existing Brent Spence Bridge rehabilitation/reconstruction studies and feasibility studies performed by FHWA and others.
- Information obtained from project site visits conducted on August 3, 2005 and August 18, 2005.
- Original soil borings for projects in the study area, including the I-75 "Cut-in-the-Hill" project, original Brent Spence Bridge construction, Fort Washington Way and the Mill Creek Expressway project.

PAVEMENT ISSUES:

Indicate if the following pavement issues are present or should be considered during project development. Side road and service road work should be considered in this assessment. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are pavement cores needed to determine the existing pavement buildup and/or condition?		
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is the proposed pavement buildup known? (For pavement preservation projects, pavement treatment, including pavement type & thickness should be specified in the design scope of services)		
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the existing pavement concrete or asphalt?	Concrete with asphalt overlay on mainline and ramps. Crossroads are mostly asphalt.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are dynaflect tests available to assess existing pavement condition?		
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does the proposed pavement buildup need to be approved by the Pavement Selection Committee?		

[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are joint repairs needed?	Dependent on final design configuration, existing pavement to remain may require joint repairs or full replacement. Interim maintenance is required.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are pressure relief joints needed?	Dependent on final design configuration, existing pavement to remain may require pressure relief joints.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are pavement repairs needed?	Dependent on final design configuration, existing pavement to remain may repair. Interim maintenance is required.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does the maintenance of traffic scheme require additional permanent or temporary pavement?	It is anticipated that maintenance of traffic will require temporary pavement. Additional review will be required dependent on final design configuration.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does curb need to be replaced due to deteriorated condition or lack of curb reveal?	On side roads	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does sidewalk need to be replaced or installed?	On side roads	LDV1: 306.2
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are new curb ramps needed?	At ramp intersections	LDV1: 306.3
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Do truncated domes need to be installed?		LDV1: 306.3.5
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there any work on side roads, service roads or ramps?	Dependent on final design configuration, the project will affect significantly many crossroads and mainline interchanges and ramps.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any special drive treatments or preferences (e.g., concrete for all drive aprons, curved aprons, etc.)?	On side roads.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Has the site received repeated resurfacings in recent years?	Maintenance information will be presented in the Existing and Future Conditions Report. Overlays applied in 2000.	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does pavement deterioration appear to be caused by drainage or geotechnical problems?	Not observed	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there any other pavement issues? Specify.		

STRUCTURAL ISSUES:
Indicate if the following structure issues are present or should be considered during project development. Provide additional comments as needed.
Provide a separate table for each structure.

Structure:	Design Issue	Comments	References*
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Can the structure be replaced with a prefabricated box culvert or 3-sided box?		BDM: 201
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does the bridge (including foundation) meet current design live loading?		BDM: 301.4, 301.4.1, 301.4.2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Was the existing structure built according to plan?	Existing design plans have been obtained and reviewed	BDM: 206, 401.1, 610.1
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is deck coring needed?		BDM: 412
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is the deck delaminated? Specify.	Not specifically observed. Deck was re-surfaced in 1998.	BDM: 412
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is non-destructive testing needed to determine the amount of delamination?		BDM: 412
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the bridge deck in good condition?	Bridge deck appears to be in good condition.	BDM: 412
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Has a deck condition survey (Bridge Design Manual, Section 412) been performed?	Unknown	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there areas to be patched or repaired on the deck?		BDM: 403.1, 404.3
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the bridge a good candidate for an overlay? Specify type of overlay if known.	Interim overlays may occur until main span is replaced.	BDM: 404.1, 404.2
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does the bridge rail meet current standards?		BDM: 209.2, 304, 410
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is a fatigue analysis required?	Previous analyses conducted. A decision on the need for further analysis will be needed if the selected alternative calls for keeping the current structure.	BDM: 402.2, 402.3
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Should all fatigue prone details be retrofitted or replaced? Specify.	None in evidence from prior study.	BDM: 402.2, 402.3
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is the abutment (including backwall, beam seats, breatwall, wingwall, etc.)) in good condition? Specify location and level of deterioration.	Appear to be in good condition.	BDM: 403.1

[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is there any evidence of substructure movement (e.g., settlement, rotation)?		
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Should the piers be replaced or reused? Specify.	Will depend on the alternative selected. The current bridge is built on driven piles.	BDM: 303.3
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there any evidence of existing beam deterioration/section loss, strands exposed, shear joints leaking or longitudinal cracks?	Some of the existing overpasses should be repainted to extend life to 2020 replacement.	BDM: 402.1
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are the bearings in good condition?		BDM: 411
[ ] Yes [ ] No [ ] Possible [X] Not Applicable	Can the deck joint be eliminated? If not, specify what modifications are necessary.		BDM: 205.8, 205.9, 406
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are new approach slabs needed?		BDM: 209.5
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Can hinges be removed to make the members continuous?		BDM: 402.8
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does existing vertical and horizontal clearance meet design standards?		BDM: 207.1, 207.3, 209.8
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the bridge on a curve, skew or superelevation transition?	The main span is prependicular to the river. Several overpasses are on a skew.	BDM: 207.5, 209.1
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is there any evidence that the bridge does not meet hydraulic capacity?		BDM: 202.5, 203
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there existing sidewalks on or adjacent to the bridge?	Present on adjancent structures.	BDM: 209.11
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will the structure work require any special maintenance of traffic (e.g., closing of roadway for erection of beams, special location of cut line, etc.)? Specify.		BDM: 208, 409, 304.3.5
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the structure in a Federal Emergency Management Agency (FEMA) flood plain?	This is a major structure crossing the Ohio River.	BDM: 203
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is there any erosion in the existing channel?		BDM: 203.3
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is the foundation exposed due to scour?		BDM: 203.3, 409.3
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Will there be more than 25' of channel relocation?		
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any opportunities to construct the bridge faster (e.g., precast walls, segmental construction)?	This is a candidate for Constructibility Review and advanced construction technology.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is there any railroad involvement?	Several operating rail lines in the project area. The bridge crosses two active railroads.	BDM: 209.8
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does the bridge need to accommodate future additional roadway lanes or railroad tracks?	Additional lanes are likely to be needed. The need for additional rail lines is not determined at this time.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will temporary shoring be required next to the roadway?		BDM: 208.3
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Could materials with long lead times for delivery (e.g., steel beams) have an impact on the construction schedule?	The volume of materials necessary could also be an issue.	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there any problems with existing retaining walls?	Not observed	BDM: 204.9
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any other structures issues? Specify	Ohio bridges most likely will have superstructure replacement at a minimum. Substructures will need to be investigated for salvage if geometrics will permit.	

TRAFFIC CONTROL ISSUES:

Indicate if the following traffic control (signals, signing, pavement markings, etc.) issues are present or should be considered during project development. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Do the existing signs need to be replaced due to poor condition?	Little sign work is needed at this time. Poor visibility for signs on the northbound section of the Bnrent Spence Bridge is a more pressing issue	TEM: 260
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there any obvious deviations from requirements of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD)?		
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is a particular type of pavement marking desired (e.g., paint, epoxy, thermoplastic)?	Not determined at this time.	TEM: 320
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will pavement planning affect loop detectors?	Possibly on local roads.	TEM: 450-10.7, 420-5

[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will pavement widening affect pole locations?	Possibly on local roads.	TEM: 450-6
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will resurfacing effect signal height?	Possibly on local roads.	TEM: 450-7
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does it appear that any traffic control items will fall outside the existing right of way limits (e.g., large signs, strain poles)?	Not known at this time.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any special pedestrian considerations?	The project is in an urban setting and pedestrian access should be maintained wherever possible.	TEM: 404
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any accidents that can be related to existing signal deficiencies (e.g., timing, lack of turn lanes)?	A more detailed trafffic and accident ananlysis is being performed and will be presented as part of the Existing and Future Conditions Report.	TEM: 402-3.5
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Do turn lane lengths appear to have sufficient storage capacity?	An issue for local roads within the study area.	LDV1: 401.7
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does the controller need to be upgraded?	Not known at this time.	TEM: 460
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Do proprietary materials need to be specified?	Not known at this time.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Should signs or signal installations be supplemented with lighting?	Not known at this time.	TEM: 408
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are any TODS signs present?	Several TODS style signs present on local roads and other urban areas within the corridor.	TEM: 207-3
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Could material with long lead times for delivery have an impact on the construction schedule (e.g., strain poles)?	Depending on the alternative selected.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	If traffic control at an intersection is being changed from stop control to signalization, does the stop condition road need to be upgraded to accommodate faster traffic?	Possibly on local roads within the corridor.	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Are there any other traffic control issues? Specify.		

MAINTENANCE OF TRAFFIC ISSUES:

Indicate if the following maintenance of traffic issues are present or should be considered during project development. Provide additional comments as needed.

	Design Issue	Comments	References*
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Can traffic be detoured?	Project will significantly impact mainline and local crossroad traffic. The MOT plan will need to utilize alternate detour routes, traffic detours, and traffic shifts to maintain traffic during construction on ramps and crossroads. Maintenance of traffic on mainline will be critical factor. Additional review will be required dependent on final design configuration.	TEM: 602-6
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is the local alternate detour route in good condition? Are there any load limits or bridge width restrictions?	Detour routes for local crossroad traffic should be in good condition. Additional review will be required dependent on final design configuration.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will the detour route have a detrimental impact on emergency vehicles, school buses or other sensitive traffic?	The project is located within an urban area. Dependent on final design configuration, construction may likely have a detrimental impact to all local traffic.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any load limits on the proposed detour route?	Proposed detour routes for local crossroad traffic will have to be coordinated with restrictions.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does the project fall within the permitted lane closure map?	As part of the MOT for final design and dependent on final design configuration, it is possible that lane closures will be required beyond what is normally allowed.	TEM: 630-4
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is existing bridge width sufficient to maintain traffic? Number of beam lines sufficient?	Dependent on final design configuration.	TEM: 640-2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will temporary pavement be required?	Due to the scope of the anticipated project, temporary pavement will likely be required.	TEM: 640-2, 640-11
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Should temporary pavement be retained after project completion?	To be determined dependent on final design configuration.	TEM: 640-11
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will the speed limit be lowered by more than 10 mph during construction?	It is not anticipated that traffic speed limit will be reduced by more than 10 mph. Additional review will be required dependent on final design configuration and MOT plan development.	TEM: 640-18
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is the existing shoulder in good enough condition to support traffic during construction?	Shoulder reconstruction will likely be required as part of this project to support MOT.	TEM: 640-5
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Does pedestrian traffic need to be maintained?	Due to the urban environment, local pedestrian traffic on the crossroads will need to be maintained.	TEM: 64-25
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will additional width be required on culverts or bridges to maintain traffic?	To be determined dependent on final design configuration.	TEM: 640-2
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will a temporary structure / run-around be required?		TEM: 640-11

Yes / No / **X** Possible / Not Applicable	Will a cross over be utilized?	Will depend on the alternative selected and subsequent review of MOT options.	TEM: 640-11
X Yes / No / Possible / Not Applicable	Will the road need to be closed for short durations (e.g., 15 minutes for beam erection)?	Likely for crossroads during demolition and construction of bridges.	TEM: 640-8
Yes / No / **X** Possible / Not Applicable	Can drive access be maintained at all times?	Drive access will be maintained at all times as much as possible.	TEM: 640-10
X Yes / No / Possible / Not Applicable	Can trucks make turning movements during construction?	Will need to be incorporated in development of MOT plans.	
Yes / No / **X** Possible / Not Applicable	Will portable concrete barrier wall obstruct stopping sight distance?	Due to existing tight geometry, it is possible that stopping sight distance may be obstructed by temporary barrier wall.	LDV1-201.2
Yes / No / **X** Possible / Not Applicable	Will additional signal heads be needed for drives and/or side roads?	It is possible that temporary and/or relocated signal heads may be required. Will need to be incorporated in development of MOT plans.	TEM: 605-13
X Yes / No / Possible / Not Applicable	Are there any issues regarding access to the work site?	Due to the urban environment, there are a large number of access points to the project which will be both beneficial and a hindrance to the construction of the anticipated project.	TEM: 640-9
X Yes / No / Possible / Not Applicable	Are there any issues regarding construction timeframes (e.g., time of day, time limits)?	Due to the urban environment, local residences and businesses will be located immediately adjacent to construction areas.	TEM: 606-3, 640-14
Yes / No / Possible / **X** Not Applicable	Have innovative contracting ideas been considered? Specify.	None have been contemplated to date.	
X Yes / No / Possible / Not Applicable	Are there specific requirements for maintaining railroad traffic?	Grade separated crossings exist within the project area. Railroad traffic will need to be maintained at all times.	TEM: 606-19
Yes / No / **X** Possible / Not Applicable	Does it appear that the maintenance of traffic will require additional right of way?	Dependent on final design configuration.	
Yes / No / **X** Possible / Not Applicable	Are there any other maintenance of traffic issues? Specify.	Dependent on final design configuration.	

RIGHT OF WAY / SURVEY ISSUES:
Indicate if right of way or survey issues are present or should be considered during project development. Provide additional comments as needed.

	Design Issue	Comments	References*
X Yes / No / Possible / Not Applicable	Will there be any work beyond the existing right of way limits?	Due to the size, scope and setting of this project, work beyond the existing right-of-way limits is expected.	
X Yes / No / Possible / Not Applicable	Will major real estate relocation acquisition be involved?	Due to the size, scope and setting of this project, acquisition of properties is expected. The scope of this effort will be determined by the alternative selected.	
Yes / No / **X** Possible / Not Applicable	Will relocation of residences be involved?	Due to the size, scope and setting of this project, acquisition of properties is expected. The scope of this effort will be determined by the alternative selected.	
X Yes / No / Possible / Not Applicable	Will relocation of businesses be involved?	Due to the size, scope and setting of this project, acquisition of properties is expected. The scope of this effort will be determined by the alternative selected.	
X Yes / No / Possible / Not Applicable	Does access control need to be revised?		
Yes / No / **X** Possible / Not Applicable	Are there any obvious encroachments?	None specifically observed, but the size and scope of this project makes the presence of encroachments likely.	
Yes / No / **X** Possible / Not Applicable	Can the number of involved property owners be determined? If so, how many?	To be determined, based on the alternative selected.	
Yes / No / **X** Possible / Not Applicable	Will temporary parcels be needed (e.g., for drive work)?	To be determined, based on the alternative selected.	
Yes / No / **X** Possible / Not Applicable	Will right of way need to be acquired for an agency other than ODOT (e.g., county, city)? Specify.	The Kentucky Transportation Cabinet may also acquire right-of-way if necessary.	
Yes / No / **X** Possible / Not Applicable	Will additional right of way be needed for utility relocations?	Likely, based on the size and scope of this project and depending on the alternative selected.	
Yes / No / **X** Possible / Not Applicable	Will right of way need to be acquired for storm sewer outfalls?	To be determined, based on the alternative selected.	
X Yes / No / Possible / Not Applicable	Do property owners need to be contacted for the locations of underground items such as leach fields, septic systems or field tiles that might be effected by the proposed take?	This will become necessary when more specifics are known.	
Yes / **X** No / Possible / Not Applicable	Are there any mineral rights considerations?		
X Yes / No / Possible / Not Applicable	Are there any specific property owner concerns?	Long lead times are required for some business relocations (~2 years).	
Yes / No / **X** Possible / Not Applicable	Will right of way acquisition from a railroad/railway be involved?	To be determined, based on the alternative selected.	

[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Can work agreements be used?		
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Does the centerline of construction match the centerline of right of way?	To be determined, based on the alternative selected.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will right of way be acquired for wetland or stream mitigation?	Possible considering the project setting and size.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any other right of way or survey issues? Specify.	Low income replacement housing, community/neighborhood impact analysis, business impacts	

UTILITY ISSUES:
Indicate if the following utility issues are present or should be considered during project development. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Do existing utilities need to be relocated?	Size and scope of these efforts are to be determined based on the alternative selected. Major utilities within the study area include a major Cinergy sub-station, ARTIMIS, Tele-communication ducts as well as water and sewer lines.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Can utility conflicts be minimized (e.g., by careful placement of storm sewer and underdrains)?	More will be known later in project development.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Would the project benefit from subsurface utility engineering (SUE)?	The size, scope and setting of this project makes SUE necessary.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there existing utilities on an existing structure that need to be relocated?	ARTIMIS connections and Tele-communication ducts are known relocations at this time. More may depend on the alternative selected. A complete utility survey is required.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any specific utility requirements or concerns? Specify.	Cinergy substation adjacent (west) to existing bridge is a major facility.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there facilities that require a large lead time to relocate?	Most notably, the Cinergy substation, if any alternatives affect it..	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is additional right of way needed to accommodate utility relocations?	Very likely, but this will be specifically determined based on the alternative selected.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there water or sanitary lines that will be relocated as part of the ODOT contract?	To be determined based on the alternative selected.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any other utility issues? Specify	Utilities present in subway tunnels, east of the I-75 near the Western Hills Viaduct.	

PERMIT ISSUES:
Indicate if the following permit issues are present or should be considered during project development. Provide additional comments as needed.

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will an individual Corps of Engineers/Environmental Protection Agency 404/401 permit be required?	Due to the size, scope and setting of this project as an Ohio River crossing, the requirement of 404/401 permit is likely. The scope of this effort will be determined by the alternative selected.	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Does it appear that the project can be constructed under a nationwide 404/401 permit? If so, which permit and what specific requirements apply?	Unknown at this time. The scope of this effort will be determined by the alternative selected.This project's scope suggests an individual permit.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will a Coast Guard Permit be Required	The project involves the construction of a new bridge structure over the Ohio River, a heavily traveled commercial route.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is review by a local public agency or project sponsor required? Specify.	The City of Cincinnati, City of Covington and the Northern Kentucky Planning Commission will all be involved.	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Is Airway/Highway clearance analysis required?		
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is Federal Emergency Management Agency (FEMA) approval required?	Possible given the project setting as an Ohio River crossing.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is railroad/railway coordination required?	A number of active rail lines within the project study area. Specific level of coordination activities will be determined by the alternative selected.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is State Historic Preservation Office (SHPO) coordination for work involving historic bridges or historic properties required?	OHPO database lists 231 buildings in the study area, with 17 deemed as eligible. KHC database lists 879 buildings and features, with 174 being deemed as eligible. Project area also includes 17 Historic Districts (8 in Ohio and 9 in Kentucky).	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Is coordination with ODNR for work involving State Scenic Rivers, State Wildlife Areas or State Recreational Areas required?	Possible given the project setting as an Ohio River crossing.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Is coordination with any other agency required? (See Location and Design Manual, Figures 1402-2 through Figure 1402-7.)	FHWA, OKI, NKAPC, USACE, USFW, OEPA, US Department of Interior, USFWS, USEPA, ODNR, OSHPO, KDFWR, KNREPC, KDWM, KSNPC, Kentucky OSA and possibly others.	

MISCELLANEOUS ISSUES:
Indicate if the following issues are present or should be considered during project development. Provide additional comments as needed

	Design Issue	Comments	References*
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Will a value engineering study be required due to project cost (total cost greater than $20 million) or project complexity?	Project cost is expected to exceed $20 million. Value Engineering and a Continous Constructibility Review is recommended. The use of advanced and accelerated construction techniques should be considered.	

[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Will warranties be used?	Not known at this time.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there aesthetic concerns? Specify.	Many local community leaders see the Brent Spence Bridge as a signature structure, or gateway to the region.Significant local interest exists.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there any concerns relating to noise walls?	None have been specifically expressed as of yet. However, a number of residential communities are adjacent to the project limits on both sides of the Ohio River.	
[ ] Yes [ ] No [X] Possible [ ] Not Applicable	Are there areas available within the existing right of way for portable plans or waste and borrow sites?	Possible considering the size and scope of this project.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there specific concerns related to pedestrian access?	Necessary to maintain existing pedestrian access wherever possible.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Any concerns related to landscaping?	Specifics will be determined based on alternative selected. Several local officials consider this project as a gateway to the region.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any concerns related to existing or proposed lighting (e.g., light trespass, river navigation, airway clearance)?	Specifics will be determined based on alternative selected. Several local officials consider this project as a gateway to the region.	
[X] Yes [ ] No [ ] Possible [ ] Not Applicable	Are there any other concerns? Specify.	Access concerns for businesses, emergency vehicles and other services withint he project area.	

RED FLAG MAPPING:
Is a map showing locations of red flag areas attached?
[X] Yes [ ] No **(A map showing locations of red flag areas is mandatory for Major Projects.)**

GEOTECHNICAL DELIVERABLES:
Include copies of plan views, geologic cross-sections, existing boring logs, and soil and rock testing data. This information should be augmented with data from ODOT's archived files of previous projects in the area. Additional information on soil survey data, glacial deposits, bedrock topography, bedrock structure, and aquifer mapping, etc. should be compiled as a GIS workspace. Both digital ortho-quarter quadrangles and U.S.G.S. quadrangles should be available for base mapping. Copies of the reference maps and ArcView files should be provided.

SCOPE, SCHEDULE AND BUDGET CONSIDERATIONS:
Based on the responses to the red flag questions, do any of the following need to be modified?

	Design Issue	Comments	References*
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Conceptual (draft) scope?	NONE	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Work limits?	NONE	LDV3: 1307.7
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Probable environmental document type?	NONE	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Major / minor / minimal classification?	NONE	LDV3: 1400
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Schedule?	NONE	
[ ] Yes [X] No [ ] Possible [ ] Not Applicable	Budget?	NONE	

*Abbreviations:
AUM = Manual for Abandoned Underground Mine Inventory and Risk Assessment
BDM = Bridge Design Manual
LDV1 = Location and Design Manual, Volume 1
LDV2 = Location and Design Manual, Volume 2
LDV3 = Location and Design Manual, Volume 3
SSI = Specifications for Subsurface Investigations
TEM = Traffic Engineering Manual
EPM = Environmental Process Manual

Appendix

Geotechnical Red Flag Summary and Overview

REPORT OF
GEOTECHNICAL RED FLAG SUMMARY AND OVERVIEW

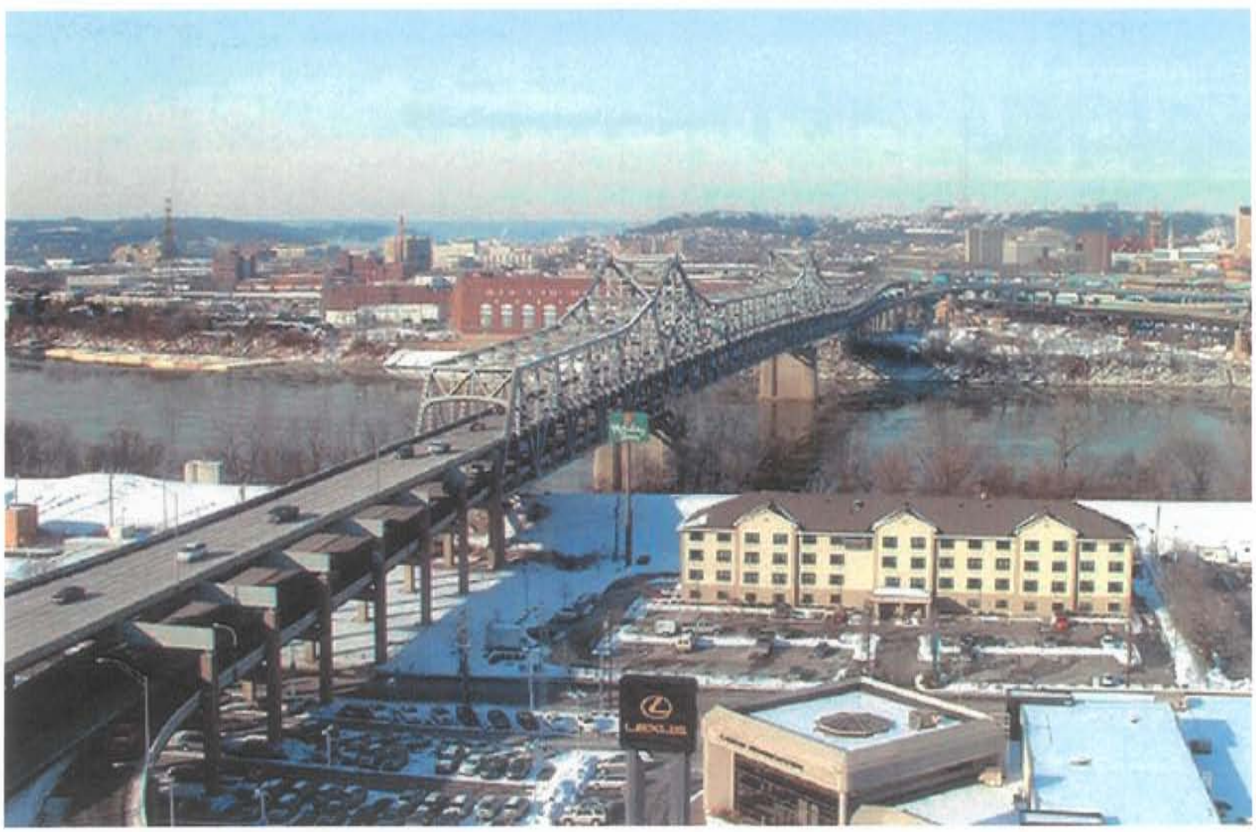
PROPOSED ROADWAY IMPROVEMENTS AND
BRIDGE (BRENT SPENCE) REPLACEMENT
CARRYING I-71/I-75 OVER THE OHIO RIVER
COVINGTON, KENTON COUNTY, KENTUCKY TO
CINCINNATI, HAMILTON COUNTY, OHIO

OHIO DEPARTMENT OF TRANSPORTATION
HAM-71-0.00 (BRENT SPENCE BRIDGE) PID NO. 75119

PREPARED FOR

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
CINCINNATI, OHIO

SEPTEMBER 2005



HCN H. C. NUTTING COMPANY
EMPLOYEE OWNED

H. C. NUTTING COMPANY
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS
SINCE 1921

CORPORATE CENTER
611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
FAX (513) 321-0294

September 30, 2005

W.O. # 10974.049

Mr. Alfred B. Craig, Jr.
Parsons Brinckerhoff Quade & Douglas, Inc.
312 Elm Street, Suite 2500
Cincinnati, Ohio 45202

Re: Report of Geotechnical Red Flag Summary and Overview
Proposed Roadway Improvements and
Bridge (Brent Spence) Replacement
Carrying I-71/I-75 Over the Ohio River
ODOT Project HAM-71-0.00, PID No. 75119
Covington, Kenton County, Kentucky to
Cincinnati, Hamilton County, Ohio

Dear Mr. Craig:

The H.C. Nutting Company (HCN) is pleased to present our report of geotechnical overview for the proposed roadway improvements and bridge (Brent Spence) replacement project carrying I-71/I-75 over the Ohio River. The proposed project generally extends from the intersection of Kyles Lane and I-71/I-75 in Covington, Kenton County, Kentucky to the intersection of Western Hills Viaduct and I-75 in Cincinnati, Hamilton County, Ohio (south to north). The overview is based on our field reconnaissance performed on August 3, 2005, review of both Ohio and Kentucky geologic publications, review of numerous subsurface investigations performed along the proposed construction corridor (in Kentucky and Ohio), available Ohio Department of Transportation (ODOT) data, and various pertinent sources.

This report includes an overview of our understanding of the proposed project, a summary of the work performed during this study, and a discussion of our findings, observations, and conclusions. Following this report is an Appendix containing a general project site location plan, various figures, and an ODOT Red Flag Summary.

The H.C. Nutting Company appreciates the opportunity of providing our professional and technical geotechnical engineering services for this project. HCN is available to answer any questions that may arise following review of this report. If you would like to meet to discuss our findings and/or conclusions, please do not hesitate to contact us at (513) 321-5816.

Thank you for your consideration.

Respectfully submitted,

H. C. NUTTING COMPANY

Aaron J. Muck

Aaron J. Muck, P.E.
Project Geotechnical Engineer

Swaminathan Srinivasan

Swaminathan Srinivasan, P.E.
Chief Geotechnical Engineer

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APPENDIX

1.0 INTRODUCTION

The H.C. Nutting Company (HCN) was retained by Parsons Brinckerhoff Quade & Douglas, Inc. (PB) to perform a project overview and red flag summary for the proposed roadway improvement and bridge (Brent Spence) replacement project carrying I-71/I-75 over the Ohio River. The proposed project generally extends along I-71/I-71 from Kyles Lane in Covington, Kenton County, Kentucky to Western Hills Viaduct in Cincinnati, Hamilton County, Ohio. The general site location is shown on Figure 1, Regional Site Vicinity Map in the Appendix.

1.1 Purpose

The purpose of this "Red Flag Summary - Geotechnical Overview" was to review available geologic information, and conceptually characterize the subsurface conditions and summarize the geotechnical considerations within the proposed study corridor (about 1,000 feet east to 1,000 feet west of the existing I-71/I-75 roadway). This report summarizes our findings and provides an overview of the general geotechnical aspects with respect to the proposed roadway improvements and bridge replacement project.

1.2 Scope of Study and Report Format

This study included attendance at a project bus tour by the design team, site reconnaissance, and discussions with design team personnel, review of available published and experience-based geologic information, and preparation of this report. The report includes a brief history and our understanding of the proposed roadway improvement and bridge replacement project, a summary of the anticipated geotechnical conditions in the project area based on review of available data, a geotechnical overview of the anticipated subsurface conditions and geotechnical expectations along the corridor and bridge replacement study area, and any geotechnical aspects that may be considered "red flags" during the design phase of the proposed development. In addition to the geotechnical overview, the pertinent sections of ODOT's "Red Flag Summary" have been completed and are included in the Appendix of this report.

Following the text of this report is an Appendix, which contains a general site vicinity map and numerous supplemental figures. The figures include geotechnical subsurface cross-sections, general geologic information, approximate locations of previous selected geotechnical studies in the vicinity of the project area, known areas of geotechnical concerns (i.e. landslides, deep fills, surface mines), and other pertinent geotechnical overview information. The pertinent portions of the ODOT Red Flag Summary are also included in the Appendix.

2.0 PROJECT OVERVIEW

2.1 Project Background

The existing Brent Spence Bridge carrying I-71/I-75 over the Ohio River from northern Kentucky to Cincinnati opened in November of 1963. The roadway was developed to complete the I-75 link between Lexington, Kentucky and Dayton, Ohio. Not until 1970 was I-71 traffic routed over the bridge. The existing bridge is located at the approximate Ohio River mile point 471, connecting Covington, Kentucky to the south with Cincinnati, Ohio to the north.

The truss design bridge was originally constructed as a three-span, double-deck bridge, with three (3) traffic lanes per level. Northbound traffic is carried on the lower deck, while southbound traffic is carried on the upper deck. The main bridge span is about 830 feet long, with approach spans each measuring about 453 feet. The original design was based on a traffic volume of about 85,000 vehicles per day. In 1985, the decks were reconfigured, with the removal of the emergency pull-off lanes. The reconfiguration resulted in four (4) lanes in each direction and an increased capacity to about 130,000 vehicles per day. However, the reconfiguration provides safety concerns with only minimal shoulder widths and congested areas for merging on/off ramp traffic.

The construction of the bridge related directly to increased development in the Northern Kentucky area, thus resulting in a substantial increase in commuter and local traffic. Recent studies (2003) indicate current traffic loads between about 150,000 to 160,000 vehicles per day. The current traffic load includes nearly 30,000 trucks. Projected traffic loadings suggest approximately 200,000 vehicles per day in 20 years. A 1996 study suggested a fatigue life of less than about 12 years. However, a 2003 study completed jointly by the Ohio Department of Transportation (ODOT) and Federal Highway Administration (FHWA) concluded that the primary truss members have an infinite fatigue life.

In addition to the structural fatigue concerns surrounding the bridge, traffic safety is also an issue. The current lane widths do not meet desired standards and there is no space for disabled vehicles to pull off. Based on FHWA criteria for the National Bridge Inventory, the existing Brent Spence Bridge is classified as functionally obsolete.

2.2 Project Description

Numerous conceptual alternatives have been developed, including various reconstruction alternatives at the current location and at new locations. Currently, this report of geotechnical overview is being performed as part of the project development process (PDP) in consideration of feasible alternatives for the possible replacement of the Brent Spence Bridge. Based on the feasible conceptual alternatives developed, a corridor study area for this geotechnical overview was selected. The corridor geotechnical overview area generally extends 1,000 feet to the west and 1,000 feet to the east of the existing I-71/I-75 mainline roadway (2,000 feet total width). The overview study area is generally bounded by Kyles Lane in Covington, Kenton County, Kentucky to the south and Western Hills Viaduct in Cincinnati, Hamilton County, Ohio to the north, a total length of about 5½ miles. The corridor study area is shown on Figure 2, Corridor Study Area in the Appendix of this report.

Outside of the existing I-71/I-75 roadway and associated on/off ramps, the corridor study area is primarily developed with numerous commercial and residential structures, in both the public and private sectors. Some undeveloped areas occur primarily in Kentucky due to limitations caused by the existing hilly terrain. The existing topography south of the Ohio River in Kentucky is generally characterized by a severely to moderately undulating terrain. Heading north near the Ohio River and north of the Ohio River in Ohio, the terrain is generally characterized by a more gentle topography.

2.3 Project Scope

The scope of work for this project generally consists of compiling existing geologic data into a geotechnical overview within the corridor study area for the proposed bridge replacement and roadway improvement project. Our evaluation was based on review of published geologic data, review of projects and information from the Ohio Department of Transportation (ODOT) and Kentucky Transportation Cabinet (KTC), and H.C. Nutting's geotechnical experience in both the Ohio and Kentucky regions. Our scope of work also included attendance at various project meetings, site reconnaissance, and preparation of this report. Our geotechnical overview was based on information compiled from review of numerous documents, including:

- Various topographic and geologic maps within the project area published by the United States Geological Survey (USGS), the Geological Survey of Ohio, and the Kentucky Geological Survey, including website reviews of the same organizations.
- Soil Conservation Service Soil Surveys of Kenton County, Kentucky and Hamilton County, Ohio published by the United States Department of Transportation.
- Numerous geotechnical subsurface soils boring data in both Kentucky and Ohio in the project corridor study area.
- Results of ODOT's Geotechnical Records Request in the applicable areas of Hamilton County, Ohio within the project corridor.
- History of notable landslides within the project corridor study area.
- Existing Brent Spence Bridge rehabilitation/reconstruction studies and feasibility studies performed by FHWA and others.
- Information obtained from our site reconnaissance.
- Historical topographic maps including 1912 maps and Hamilton County, Ohio CAGIS maps.

The geotechnical overview presented in this report is based on the available project information, the limits of the corridor study area, and review of the available geological/geotechnical data listed above. Based on the review of the above data sources, this report generally summarizes the typical site geology in the corridor study area. The following sections provide a geological/geotechnical overview of the study area and address aspects that may influence the proposed project or raise a "red flag". In the event of changes in location or concept of the project, the overview should be reviewed and applicable changes, if required, should be made.

Following the text of the geotechnical overview is an Appendix, which contains figures and subsurface cross-section data along the alignment. The completed applicable portions of the Red Flag Summary are also attached in the Appendix of this report. A listing of the figures contained in the Appendix is shown on the front page of the Appendix.

3.0 SITE CONDITIONS

3.1 Site Description

The corridor study area generally passes through urban areas of Covington, Kentucky and Cincinnati, Ohio. Beyond the area currently occupied by the I-71/I-75 roadway alignment and associated interchanges/ramps, the corridor area is predominantly occupied by residential communities; however, portions remain undeveloped generally due to geographic limitations caused by the sloping topography. As the alignment approaches the Ohio River, the study area currently consists of residential developments along with an increasing number of commercial businesses, such as shopping centers, office parks, light industry, restaurants, hotels, and car dealerships.

Immediately north of the Ohio River in Cincinnati, Ohio, a sand/gravel quarry and a major Cinergy power distribution facility lie within the existing corridor study area. A local historic site, the B&O Warehouse structure, also falls within the corridor. Continuing northward, the Fort Washington Way interchange, along with the split of I-75/I-71 and several downtown Cincinnati exits occupy the majority of the study area. North of the Fort Washington Way interchange, the majority of the corridor study area generally consists of business developments. Near the northern limits of the project area (Western Hills Viaduct), the area is currently developed with a combination of commercial businesses and residential housing.

3.2 Site Topography

Beginning at Kyles Lane, existing site grades along the proposed roadway corridor generally range between about 850 and 900 feet. Continuing northward along the corridor, the existing topography generally slopes downward to about elevation 450 to 500 feet at the Ohio River. From the interchange at Kyles Lane (Interchange 189) to Interchange 190, the topography within the corridor area is relatively level along the existing I-75/I-71 roadway, with moderately to steeply sloping hillsides and ridges outside the roadway footprint. From Interchange 190 to the Ohio River, the west side of the corridor area exhibits similar moderately to steeply sloping hillsides. The eastern side of the corridor is relatively level in comparison to the existing terrain along the western side of the corridor.

The existing grades from the Ohio River, northward to Western Hills Viaduct gradually slope upward from about elevation 450 to 500 adjacent to the Ohio River, to about elevation 550 feet near Western Hills Viaduct. The corridor area is relatively flat beyond the existing roadway footprint.

The Ohio River, forming the border between Ohio and Kentucky, is about 1,300 feet wide at the existing Brent Spence Bridge location. The normal pool elevation of the Ohio River in the area of the bridge is about 455 feet. On the Kentucky side of the Ohio River, the nearest body of water is the Licking River, which is located about 1 mile to the east of the existing I-71/I-75 roadway. In Ohio, the nearest body of water is the Mill

Creek, which is located about ½ to ¾ of a mile to the west of the existing roadway. The USGS map indicates several smaller water features, including lakes, ponds, and manmade ponds/reservoirs.

Water drainage in the corridor study area is generally achieved by diverting water towards the Ohio River and/or adjacent connecting streams. Due to the relatively large watershed that the Ohio River covers upstream to the north and east, periodic flooding is generally common in low-lying areas along the Ohio River in the Cincinnati/Covington area. The following flood information was obtained from the Louisville District U.S. Army Corp of Engineers near the corridor study area:

Normal pool – Elevation 455 feet

Ordinary High Water Mark – Elevation 468.5 feet

100 Year Flood – Elevation 498.5 feet

500 Year Flood – Elevation 512 feet

3.3 Geologic Site Conditions

Northern Kentucky has been affected by major glaciations occurring during the Pleistocene Epoch. These glacial advances caused profound drainage changes and were responsible for the deposition of a variety of soils lying beneath the Covington/Cincinnati area and the project site. To understand the depositional sequence at the site, we have generally described the Pleistocene history of the Covington area and Cincinnati area in the following paragraphs.

3.3.1 General Northern Kentucky/Southwest Ohio Geology

A highly estimated, two million years before present time, the first major ice sheet arrived in Southwest Ohio and Northern Kentucky. At the time, the northwesterly-flowing Teays River flowed across West Virginia and entered Ohio near Portsmouth.

This ancestral river occurred along with several tributaries, including the Licking River. The valleys at that time were only about 150 feet deep, compared with 400 feet deep today.

Between an estimated 1.2 and 2 million years ago, the Kansan and Nebraskan glaciers advanced into Cincinnati and the Northern Kentucky area. At that time, the north-flowing Teays Age Licking River was dammed by the snout of the glacial ice, resulting in deposition of lake clays within the valleys. The basal elevation of the lake-filled valley was about elevation 650 feet.

In time, the lake waters rose and eventually overflowed a divide near Madison, Indiana. The glacial meltwaters caused elevated water flow through the new drainage system westward, near Hamilton, Ohio and southwesterly toward Ross and Harrison, Ohio, Lawrenceburg, Indiana, and on to Louisville, Kentucky. The water flow eroded a deep and wide channel, termed the Deep Stage Ohio. The valley bottom was deepened well below today's Ohio, Little Miami, and Great Miami Rivers to about elevation 380 feet.

The Teays Age Licking River abandoned its former course and shifted somewhat westerly, cutting its Deep Stage valley where the present day Licking River occurs. However, in Deep Stage time, the Licking River did not terminate at its present day mouth location. Instead, it continued northerly across the basin of present day downtown Cincinnati, west of Great American Ball Park and northward to what is now called the Mill Creek Valley to join the Deep Stage Ohio River near Norwood, Ohio.

The Illinoian Age glacier then advanced into southwest Ohio about 400,000 years ago. This glacier did not reach Northern Kentucky. The ice dammed the north flowing Deep Stage Ohio River, forming a lake, which extended towards Portsmouth and well into the Deep Stage Licking valley to the south. The resulting deposition above the valley bottom consisted of Deep Stage gravels topped by Illinoian lakebed silts and clays. The lake filled and eventually spilled over directly west from Cincinnati. A new valley was now cut through Anderson Ferry, Saylor Park, and on to North Bend, Ohio. This process created the present day course of the Ohio River. Also occurring at this time, the Illinoian glacier continued to creep southwesterly and deposited till on top of the lake clays.

Over the next 300,000 years, well after the Illinoian glacier retreated, extensive weathering and erosion took place. New valleys were carved by streams, within the partially filled former valleys.

The last glacial advance began about 70,000 years ago. This glacier, called the Wisconsin glacier, retreated slightly and then readvanced into Northern Hamilton County, Ohio about 18,000 years ago. This glacier left till and then granular outwash from its meltwaters. Subsequent stream erosion has cut terraces into this outwash along many of the valleys.

3.3.2 Kentucky Corridor Area Geology

Near the Covington, Kentucky corridor area, the sediments begin at the base of the Deep Stage Licking Valley, which was eroded prior to the Illinoian glacial advance. Soils consist of a gravelly zone topped by granular outwash deposits. Near-surface soils contain alluvial sediments, deposited by the floodwaters of both the Ohio and Licking Rivers. Man has also affected soil conditions at the site by placement of fill, construction of buildings, construction of marina and housing developments, demolition of structures, roadway grading, etc.

Heading southward from the existing Brent Spence Bridge into Covington, Kentucky, the first mile or so of the corridor area experiences valley basin sediments (already discussed), together with valley wall deposits on the western perimeter consisting of glacial and residual clays underlain by limestone and shale, remnants of the extremely ancient Ordovician Sea. Elevations on the basin of this trend are on the order of about elevation 510 to 540 feet, moving north to south, while the west valley wall will ascend from an approximate elevation of 510 feet upslope to an approximate elevation of 800 feet (±).

The remaining mile and a half (±) of the corridor study area ascends into an upland environment to Kyles Lane. Within the upland, Illinoian age glacial soils, sometimes capped with windblown loessian silts, overlying residual clays provide a soil mantle of varying thickness atop native bedrock.

The Ordovician bedrock in the corridor area that ascends from the basin to the upland is composed of two major rock units. The Kope Formation is typically found from approximate elevations 510 to 690 feet (±) being principally shale with relatively thin (4-inch to 8-inch) thick and well-spaced limestone interbeds. The overlying Maysville Formation, from approximate elevations 690 to 800 feet (±), is composed of limestone and shale, at times of equal proportions, but with limestone often predominating, with thicker (8-inch to 22-inch) and more closely packed beds.

The rock beds are highly fossiliferous and calcareous. The limestone distribution within the Maysville often provides a formidable resistance to excavation efforts due to hardness, thickness of layers, and close packing of layers at some elevations.

There are no mapped coal mines within the corridor area. In this region, solutioned limestone, or karst, sometimes develops in upland areas where limestone is the predominant bedrock formation. The Northern Kentucky region is within an area with limited to moderate potential for karst. Based on local experience, the development of karst in the project corridor area may occur in isolated areas, but is not anticipated to be a significant concern.

Figures 3A to 3D, in the Appendix of this report, include physiographic, geologic, and karst maps for the Kentucky region.

3.3.3 Ohio Corridor Area Geology

Heading northward from the Ohio River, the local geology generally consists predominantly of a combination of alluvium and outwash soils, with minor amount of lacustrine (lakebed) and glacial till deposits. Based on review of the published Quaternary Geology Map of Ohio (dated 1999), the western portion of the corridor area from the Ohio River to Western Hills Viaduct consists of recent alluvium and alluvial terraces deposited in present and former floodplains. The alluvial deposits ranged from silty clays, sands, gravels, and silty sands. The alluvium soils typically are encountered between about elevation 460 and 530 feet.

Along the eastern side of the corridor, the predominant geology consists of Late Wisconsinian Age outwash soils from the Ohio River to about 1½ miles (±) north of the Ohio River. The outwash materials were deposited by meltwater in front of glacial ice in valley terraces or low plains. The outwash soils are generally granular, consisting predominantly of sands or sands and gravels. The approximate elevation of the outwash deposits range from about elevation 400 to 460

It should be noted that this area of downtown has been heavily worked by man. Thus, cisterns, dry wells, privies, etc., should be expected. Silt pipes and anomalous loose granular zones have also been noted. Remnant foundation walls of buildings, which formerly occupied the site, can also be anticipated.

A zone of lacustrine (lakebed) deposits is generally positioned along the eastern side of the corridor from about 1½ miles (±) north of the Ohio River to Western Hills Viaduct. The water-deposited Illinoian Age soils are lake-bottom sediments consisting of clays and silts, and are often distinguished by their laminar depositional appearance. Occasionally, the lakebed deposits contain organics.

At approximately 1½ miles (±) north of the Ohio River, minor amounts of Illinoian glacial till deposits border the eastern boundary of the corridor area. Till soils are typically comprised of an unsorted, unstratified conglomeration of silts, clays, sands, and gravels. The till profile often contains intermediate sand/silt seams and/or layers. The outwash and till deposits are often covered by a relatively thin loess layer.

The overburden soils are generally underlain by Ordovician Age interlayered shale and limestone bedrock of the Eden Formation. Bedrock is generally encountered at elevations ranging from about 400 to 420 feet, and as high as about elevation 460 feet at Western Hills Viaduct. Based on review of published and existing subsurface information, the bedrock surface is highly variable, with relatively drastic changes in depth over relatively short distances.

Figures 4A to 4D, in the Appendix of this report, include physiographic, geologic, and karst maps for the Ohio region.

3.3.4 USDA Soil Survey Review

Based on review of the USDA Soil Survey for Hamilton County, Ohio, the soils within the study area on the Ohio side of the bridge generally belong to the Pate-Urban land (PhD) and urban land series of the Huntington (Uh), Elkinsville (UgB), Stonelick (Ux), and Martinsville (UmB) complexes. Other soil types within the vicinity of the project limits consist of urban land series of the Rossomoyne (RtB, RtC) complex. Based on review of the USDA Soil Survey for Boone, Campbell, and Kenton County, Kentucky, the soil types on the Kentucky side of the project belonged to urban land (Ur) along the east side of the corridor, and Eden (EdE2), Faywood (FcD), and Rossmoyne (RsB) series on the west side of the corridor.

The Pate soil and Urban land (Phd) are intricately mixed and are located on the colluvial positions on the lower part of the hillsides in Ohio. The Pate soil has very slow permeability and moderate organic content. It has a high shrink-swell potential and is also considered highly corrosive to untreated steel. The Pate soils often make up parks, open space, lawns, and gardens, and are generally unsuited to use as a site for buildings and is subject to slippage.

The Urban land series soils in Ohio, are generally dark brown silty loams with moderate permeability and make up parks, open space, lawns, and gardens. The Elkinsville (UgB) and Martinsville (UmB) series soils have low strength and high frost action susceptibility, and are considered suitable for buildings and recreation areas. However, the Huntington (Uh), and Stonelick (Ux), soils are not generally suited for buildings. Closer to the Ohio River, the Huntington soils have a high water table and frost susceptibility. The Rossomoyne series (Rtb, Rtc) soils are silt to clay loams and are covered by streets, parking lots, buildings and other structures with moderate permeability above the fragipan. These soils are moderately well suited to use as a site for buildings and have high frost action susceptibility. Moreover, these soils are highly corrosive to uncoated steel and concrete.

The urban land (Ur) on the Kentucky side of the project limits is disturbed by cuts and fills and is underlain by alluvium and outwash deposits. The Eden (EdE2), Faywood (FcD) series soils are formed of residual material weathered from calcareous shale and limestone and are generally silty clays with slow to moderately slow permeability. The Rossomoyne (RsB) series soils are silty loam and silty clays formed in loess and in glacial till. The permeability is slow in the fragipan. The shrink/swell potential of these soils varies from moderate to high with increasing depths.

The applicable USDA Soil Survey Maps have been reproduced as Figures 5 (Kentucky) and 6 (Ohio), and are included in the Appendix of this report.

3.3.5 Review of Soil Test Borings

Test borings performed along the riverbanks for the existing Brent Spence Bridge in 1958 indicated up to about 45 feet, or to about elevation 450 feet, of sandy and clayey fill. The existing fill was underlain by medium stiff silty clay to a depth of about 66 feet below existing grade, or about elevation 430 feet. The cohesive alluvium was typically underlain by medium dense to very dense sandy outwash deposits with varying amounts of gravel to about 115 feet below existing grade, or about elevation 380 feet. Although no rock coring was performed, the casing refusal was encountered during drilling below the outwash at about elevation 380 feet, which was considered the top of bedrock.

Test borings performed within the Ohio River at the bridge location encountered granular soils, with varying consistency and gravel content to the top of the bedrock surface, which was encountered at about 70 to 75 feet below the existing water surface, or at about elevation 370 feet. Rock coring was performed below the depth of auger refusal at the test boring locations. The bedrock consisted of interbedded gray shale and limestone, with the limestone occurring in 1 to 9-inch thick layers. Limestone made up about 15 to 70 percent of the bedrock profile. Rock cores were generally extended about 10 to 30 feet below the auger refusal depths.

Various cross-sections along the I-71/I-75 mainline and perpendicular to the mainline have been developed based on test boring information. Figure 7, Selected Subsurface Investigations, identifies several projects in the corridor study area that were reviewed in preparation of this report. Figures 8 and 8A through 8E, show subsurface cross-section data in the corridor study area within Ohio. Likewise, Figures 9A to 9E show the generalized subsurface profile along the I-71/I-75 roadway along the corridor area. Figures 10A to 10E show subsurface cross-sections (perpendicular to the I-71/I-75 roadway) at various locations along the existing alignment.

4.0 GEOTECHNICAL DESIGN AND CONSTRUCTION CONSIDERATIONS

This section focuses on the geotechnical aspects that will likely impact the design and construction of the new bridge and roadway improvements within the corridor study area. The section is divided into three (3) main categories, including 1)

Geological/Geotechnical Considerations, 2) Preliminary Seismic Hazard Analysis, and 3) Landslide Issues.

4.1 Geological/Geotechnical Considerations

4.1.1 Bridge Structure Foundations

We anticipate that the bridge structure will need to be supported on deep foundations since bedrock was generally encountered at depths in excess of 100 feet in the area of the existing bridge. Deep foundations bearing on/in the existing bedrock may include driven steel piles or large diameter drilled shafts. Axial loads, seismic loads, and lateral loads, and constructability need to be considered in determining if pile groups or large diameter shafts socketed into the underlying shale and limestone bedrock would be the foundation of choice. The deep foundations would need to be designed to provide not only adequate axial support, but also resistance to uplift and lateral forces. Deep foundations would also provide protection from vessel impact loads and scour associated with erodible soils along the Ohio River riverbed.

Support of a new bridge with a deep foundation system will be required regardless of the location that the bridge crosses the Ohio River. End bent support on both the Kentucky and Ohio sides will also likely be supported on deep foundations. Since the general subsurface profile (type of overburden and depth to bedrock) will be similar along the riverbank, construction of the new bridge to optimize geotechnical support capabilities will not play a major role in bridge location selection. A very detailed exploration of overburden soils and bedrock characteristics is expected to determine the appropriate foundation type and its optimal performance.

4.1.2 Roadway Considerations

At-grade roadways can generally be constructed on suitable natural soils or new structural fill. We anticipate that minimal cut/fill will be required if the I-71/I-75 roadway generally follows the current alignment. If the mainline is shifted significantly to the west in Kentucky, deeper cuts, including rock excavation should be anticipated. It has been our experience that the Ordovician Age shale and limestone bedrock in the greater Cincinnati region can generally be excavated with heavy-duty equipment. Blasting, though not commonly used, may be needed in areas of deep rock cuts.

Due to the corridor area generally being developed, the use of typical embankment fills for roadway construction will likely be limited. Mechanically Stabilized Earth (MSE) walls and/or cut walls may be considered to reduce the roadway impact area. In urban areas, due to space limitations, use of soil nail walls, cantilevered, and tieback walls may also be needed. We would anticipate several opportunities to use innovative geotechnical technologies to meet project schedules and budgets. Raised roadway sections or “flyovers” may also be considered. Due to relatively large lateral loads associated with raised roadways, deep foundations are often required to provide adequate resistance to axial, lateral, and uplift forces.

In Kentucky, the biggest impact to realignment of the existing roadway is the amount of cut (soil and rock) and fill that would be required if the alignment is shifted significantly to the west of its' current location. Significant rock cuts should be anticipated if the alignment crosses through the hilly terrain to the west. Near the Ohio River in Kentucky, and on the Cincinnati side of the river, significant realignment of the I-71/I-75 mainline is limited due to existing interchange/tie-ins. Slight modifications to the alignment to either the west or the east will likely not have a significant impact on roadway construction. The presence of random fill, old structures, and moderately compressible overburden soils in some portions of the project area may warrant the need for ground modification. Various techniques for ground modification and/or improvement can be used and are anticipated.

4.1.3 Excavations

Excavations into soil and bedrock should be performed in accordance with applicable OSHA requirements. Permanent slopes in soil should be 3H:1V or flatter. Steeper slopes can generally be attained in rock formations; however, the local rock formations are highly degradable and prone to erosion and/or raveling of surficial material. Vegetation should be established on soil slopes as soon as possible and rock faces should be protected where required. As a minimum, permanent slopes would need to be evaluated periodically to monitor the integrity of the slope face and look for any destabilizing aspects caused by erosion or movement.

Stability of excavated slopes will be an important consideration. Portions of the corridor may have colluvial soils (especially in the upland areas), which are prone to movement. The presence of groundwater and its impact on cut excavations and overall long-term stability of slopes is also an important consideration. The Ohio Riverbank has a history of shallow sloughing and flood events have an impact on their overall short-term and long-term stability. Rapid drawdown and its impact, especially on the riverbanks and where loess is exposed, is an important stability issue needing detailed investigation and analyses.

Excavation through the underlying unweathered gray shale and limestone bedrock, will involve additional effort. The presence of limestone layers, its thickness, and its distribution will impact the level of difficulty. Proper equipment (heavy-duty) to deal with rock breaking and removal will likely be required. Rock excavation methods may include the use of a large hydraulic trackhoe or dozer with a ripper tooth, hydraulic rock hammers or rock splitters, and/or pneumatic rock drills (air drills) or percussion machines. If deep rock cuts are necessary and/or thick limestone layers are encountered in the bedrock, rock removal by blasting techniques may be required.

4.2 Seismic Considerations

4.2.1 General Seismic Characteristics of the Corridor Area

Hamilton County (Ohio) and Kenton County (Kentucky) is located within a relatively "quiet" seismic area with regard to local seismic activity. Figure 11, in the Appendix, shows the locations and intensities of notable earthquakes in Southwestern Ohio and

Northern Kentucky. As discussed in greater detail in the following section, the seismicity of the area is strongly controlled by the New Madrid fault zone in southeastern Missouri. The Ohio Geological Survey has prepared a map of basement structures in Ohio, indicating fault lines and tectonic zones. The map is reproduced as Figure 12 in the Appendix. There are no mapped faults in the project corridor area.

Recent maps published by the USGS (October 2002) for recommended peak acceleration values for 2 percent and 10 percent probability of exceedance in 50 years for the eastern United States are shown as Figures 13A and 13B, respectively, in the Appendix. A preliminary seismic hazard analysis is presented in the following section.

4.2.2 Preliminary Seismic Hazard Analysis

A preliminary seismic hazard analysis was performed for the proposed bridge corridor. The steps for the analysis generally include the identification of the seismic sources capable of strong motions at the project site, evaluation of the seismic potential for each capable source and evaluation of the intensity of the design ground motions at the project site.

Plate tectonic theories do not adequately explain the mechanisms associated with intra-plate earthquakes such as those which occur in this area. To our knowledge, there are no mapped faults within the project site area. Further, there are no mapped faults which have experienced surface displacement due to seismic activity during the Holocene Epoch (past 11,000 years) within 100 miles of the project site. The closest mapped fault with such movement is the New Madrid Seismic Zone, which is about 200 miles southwest of the site.

For this preliminary analysis, the evaluation of the intensity of ground motions was accomplished using U.S. Geological Survey (USGS) published information regarding the seismic hazard for the Central and Eastern United States. This information for the project site is strongly influenced by the New Madrid Seismic Zone in southeastern

Missouri. To a lesser degree, historical local seismicity of Ohio, Kentucky and Indiana contribute to the seismic hazard as well. The USGS Internet website seismic hazard mapping tools were used to estimate the potential ground motions for the project site corridor. For the purposes of this analysis, the design event evaluated was an earthquake whose ground motions have a 2 percent probability of exceedance in 50 yrs (equivalent to a 10 probability in 250 years, or a recurrence interval of 2475 years).

The USGS mapping evaluation uses a database that considers the contribution of all recorded earthquakes that may influence the project site area. The coordinates at three locations along the center of the project corridor (north end, Ohio River south bank, and south end) were entered to obtain peak ground accelerations and spectral accelerations. Maps which depict the relative contribution of historical earthquakes, their distance from the project site and the earthquake magnitude were produced. Figures 14A to 14H in the Appendix show these maps for the Ohio River south bank location. The following tables summarize the information obtained for each of the three locations for the design event:

Table A: Preliminary Seismic Hazard Data – North End of Project Corridor

		Site-Source Mean Event		Site-Source Modal Event		Relative Contribution		CEUS Source Mean Event	
Criteria	Accel. (g)	M	D (km)	M	D (km)	NMSZ (%)	CEUS (%)	M	D (km)
PGA	0.079	6.20	152	7.7	456	14	86	5.95	101
0.2 sec SA	0.178	6.42	185	7.7	456	18	82	6.13	126
0.3 sec SA	0.155	6.73	239	7.7	456	29	71	6.37	151
1.0 sec SA	0.076	7.25	358	7.7	456	51	47	6.73	241

Notes: Accel.=acceleration value, M=earthquake magnitude, D=distance, NMSZ= New Madrid Seismic Zone, CEUS=Central and Eastern US Seismic Zone, PGA = peak ground accelerations, SA = spectral accelerations

Table B: Preliminary Seismic Hazard Data – Ohio River South Bank

		Site-Source Mean Event		Site-Source Modal Event		Relative Contribution		CEUS Source Mean Event	
Criteria	Accel. (g)	M	D (km)	M	D (km)	NMSZ (%)	CEUS (%)	M	D (km)
PGA	0.080	6.21	150	7.7	455	14	86	5.94	100
0.2 sec SA	0.179	6.42	183	7.7	455	18	82	6.13	125
0.3 sec SA	0.156	6.73	237	7.7	455	28	72	6.33	150
1.0 sec SA	0.076	7.25	357	7.7	455	51	48	6.74	240

Notes: Accel.=acceleration value, M=earthquake magnitude, D=distance, NMSZ= New Madrid Seismic Zone, CEUS=Central and Eastern US Seismic Zone, PGA = peak ground accelerations, SA = spectral accelerations

Table C Preliminary Seismic Hazard Data – South End of Project Corridor

		Site-Source Mean Event		Site-Source Modal Event		Relative Contribution		CEUS Source Mean Event	
Criteria	Accel. (g)	M	D (km)	M	D (km)	NMSZ (%)	CEUS (%)	M	D (km)
PGA	0.080	6.20	150	7.7	452	14	86	5.94	100
0.2 sec SA	0.179	6.42	185	7.7	449	18	82	6.13	125
0.3 sec SA	0.157	6.73	237	7.7	452	28	71	6.33	150
1.0 sec SA	0.076	7.25	355	7.7	452	51	48	6.74	240

Notes: Accel.=acceleration value, M=earthquake magnitude, D=distance, NMSZ= New Madrid Seismic Zone, CEUS=Central and Eastern US Seismic Zone, PGA = peak ground accelerations, SA = spectral accelerations

The primary conclusions that may be derived from the information presented above are:

1. The acceleration values predicted (for the soil-bedrock interface) do not vary significantly for peak ground acceleration and spectral accelerations at the selected periods across the range of the corridor. For conservatism, we recommend using the values observed at the south end of the corridor.
2. The relative contribution of the New Madrid Seismic Zone is limited except for the spectral accelerations predicted at a period of 1.0 second.
3. The relative contribution of the random seismicity of the Central and Eastern U.S. Seismic Zone (CEUS) appear to be higher for spectral accelerations at the other selected periods and for the peak ground acceleration.

These observations suggest that seismic site response analyses should be performed using a series of several time histories that represent the smaller magnitude earthquakes of the CEUS and at least one time history that represent the New Madrid Zone event.

4.3 Landslide Issues

Areas of the greater Cincinnati and Northern Kentucky region are prone to slope movements and landslides. On the Kentucky side of the Ohio River, within the corridor area and nearby, many landslides have been reported and documented. The landslides were typically observed to occur along the western side of the corridor area and near the southern limits. Due to the hilly terrain in these areas, slope instability was more common. Landslides typically occurred after heavy rain events or during extended periods of wet weather. The landslides generally occurred above the bedrock within the overburden soils, or along the soil/bedrock interface. The approximate locations of the landslides are shown on Figure 15 in the Appendix of this report.

Of particular interest, within a few years after the original construction of the I-71/I-75 in Kentucky (between Interchanges 189 and 190), the outside northbound lane started to show signs of settlement and cracking. The distress was initial evidence of a landslide. The lane was closed for some time and eventually a large buttress embankment was built to stabilize the slope in this area. In this case, the roadway embankment was constructed on a substantial depth of colluvium, which in turn overlaid a sloping bedrock surface. The approximate location of the landslide within the I-71/I-75 roadway is shown on Figure 15 in the Appendix.

Few, if any, landslides have been reported along the eastern side of the corridor (nearer the Ohio River) on the Kentucky side, and in the entire corridor area on the Ohio side of the river. In these relatively flat areas, the greatest potential for landslide or slope instability is adjacent to the Ohio River. Detailed slope stability analyses along the Ohio River should be performed once the bridge location has been selected.

Landslide concerns generally increase along the western side of the corridor area, and throughout the corridor from about Kyles Lane to about 1½ miles north of Kyles Lane in Kentucky. Therefore, shifting of the I-71/I-75 roadway west of its' current location increases the potential for landslides and slope instability.

5.0 RED FLAG SUMMARY

Per ODOT, the purpose of a Red Flag summary is to "identify concerns that could cause revisions to the anticipated design and construction scope of work, the purposed project development schedule, the estimated project budget, or the potential impacts of the project on the surrounding area". Based on the geotechnical overview described in this report, the Red Flag Summary is used to highlight geotechnical issues that are present and that should be considered during project development. The applicable geotechnical portions of the Red Flag Summary were completed and are attached to this report. The Red Flag Summary should not be reviewed independently of the information contained in this report. This geotechnical overview of the corridor study area should be used to supplement the Red Flag Summary.

6.0 CLOSING

The purpose of this report was to provide a geotechnical overview for the proposed Brent Spence Bridge replacement and I-71/I-75 roadway improvements from Kyles Lane in Covington, Kentucky to Western Hills Viaduct in Cincinnati, Ohio. The corridor study area extended 1,000 feet to the east and 1,000 feet to the west of the existing I-71/I-75 mainline. Based on review of available data, the overview includes general subsurface and geologic conditions in the project corridor area, and an overview of existing geotechnical features that have an impact on the final bridge/roadway location, and design and construction. The overview also included the completion of the applicable sections of ODOT's Red Flag Summary, which is attached to this report.

The information contained in this report is considered general in nature. No field exploration, laboratory testing, or analyses were performed for this overview. The information contained in this report is based on published data and previous experience across the corridor study area. A more detailed geotechnical study, including soil test borings, in-situ field testing, soils laboratory testing, and geotechnical engineering analyses should be performed once the bridge location/roadway alignment is more defined to identify areas of geotechnical concerns. The study should also be performed to assist the project team during design and construction of the Brent Spence Bridge and I-71/I-75 roadway improvement.

H.C. Nutting appreciates the opportunity of providing our geotechnical services for this overview. We would be pleased to assist the project team through attendance at future project meetings and/or by providing additional consultation as the need arises. Please do not hesitate to contact us if you have any questions and/or comments regarding this overview. We request the opportunity to provide future geotechnical engineering services for this premier project as it progresses into the design and construction phases.

APPENDIX

FIGURE 1: REGIONAL SITE VICINITY MAP

FIGURE 2: CORRIDOR STUDY AREA

FIGURES 3A TO 3D: GEOLOGY OF KENTUCKY

FIGURES 4A TO 4D: GEOLOGY OF OHIO

FIGURE 5: USDA SOIL SURVEY – KENTUCKY

FIGURE 6: USDA SOIL SURVEY – OHIO

FIGURE 7: SUMMARY OF SELECTED SUBSURFACE INVESTIGATIONS

FIGURE 8: SUMMARY OF SUBSURFACE CROSS-SECTIONS A-A' TO F-F'

FIGURES 8A TO 8E: SUBSURFACE CROSS-SECTIONS A-A' TO E-E'

FIGURES 9A TO 9E: GENERALIZED SUBSURFACE PROFILE ALONG I-71/I-75 PROJECT CORRIDOR

FIGURES 10A TO 10E: GENERALIZED SUBSURFACE CROSS-SECTIONS WITHIN THE PROJECT CORRIDOR

FIGURE 11: LOCATIONS AND INTENSITIES OF HISTORIC EARTHQUAKES IN SOUTHWESTERN OHIO

FIGURE 12: BASEMENT STRUCTURES IN OHIO

FIGURES 13A AND 13B: USGS PEAK ACCELERATION MAPS

FIGURE 14A TO 14H: EARTHQUAKE HAZARD ANALYSIS MAPS

FIGURE 15: LANDSLIDES IN PROJECT AREA

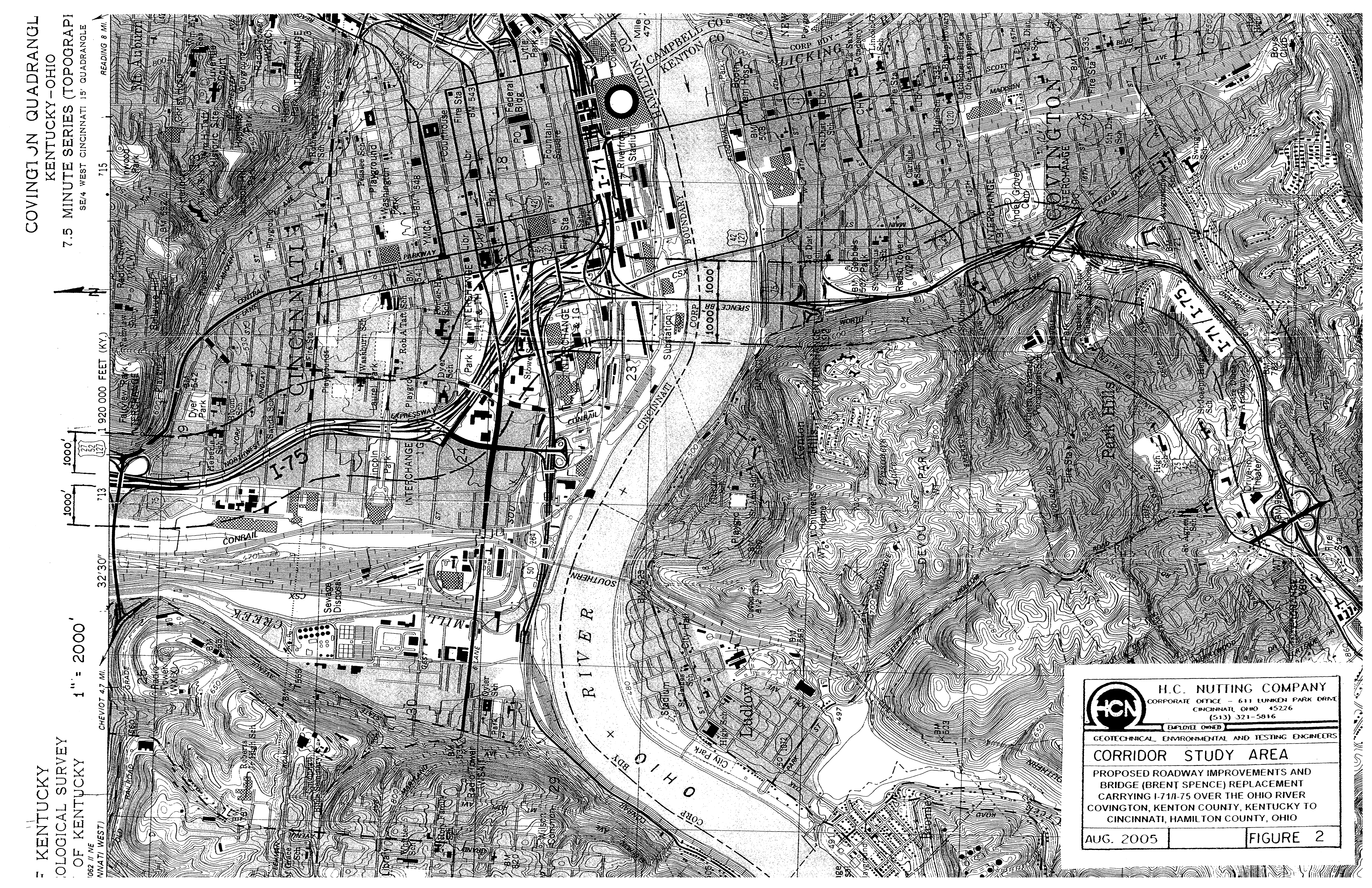
ODOT RED FLAG SUMMARY

Not to Scale

Base map was copied from Microsoft Corp. NAVTEQ, and/or GDT, Inc. online mapping.

N

W.O. 10974.049	H. C. Nutting Company EMPLOYEE OWNED *Geotechnical, Environmental and Testing Engineers Since 1921*	**Regional Site Vicinity Map** Parsons Brinckerhoff Geotechnical Overview Brent Spence Bridge and I-71/I-75 Roadway Improvements Covington, Kentucky Cincinnati, Ohio	**Figure 1**

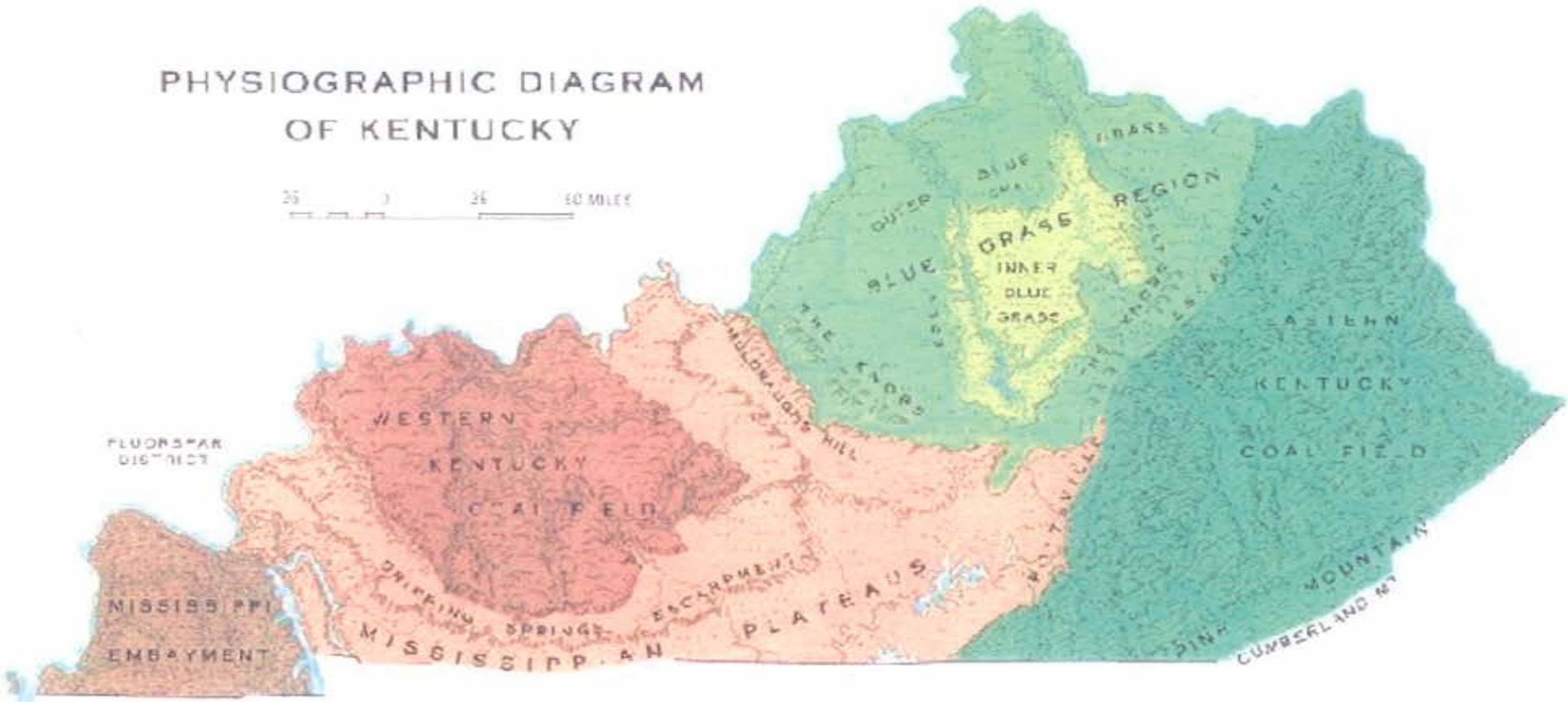


H.C. NUTTING COMPANY
CORPORATE OFFICE - 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

CORRIDOR STUDY AREA

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005 | FIGURE 2



Source: Kentucky Geological Survey, University of Kentucky Website (http://www.uky.edu/KGS/coal/webgeoky/pages/physiographic.html)

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FIGURE 3A – PHYSIOGRAPHIC MAP OF KENTUCKY

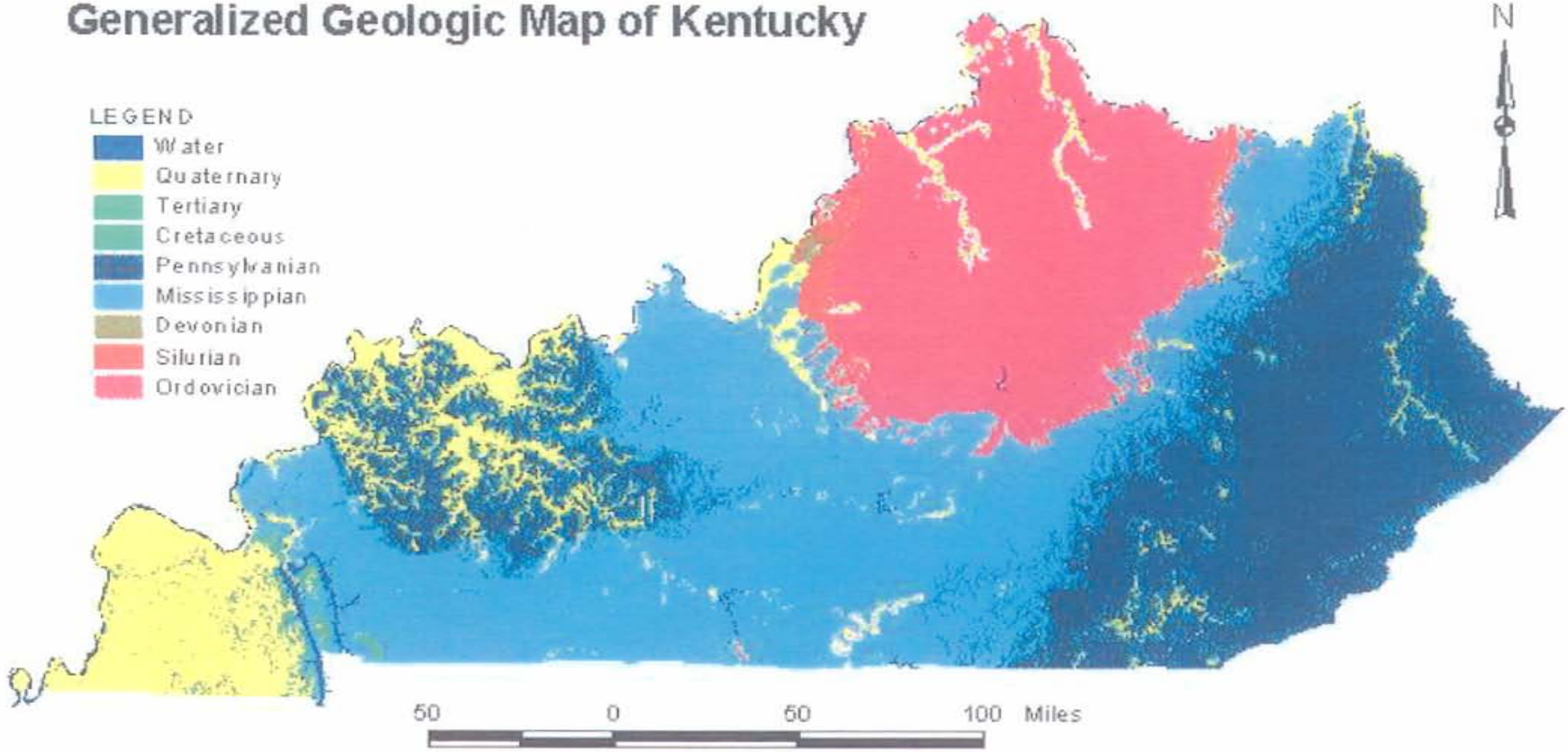
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

Generalized Geologic Map of Kentucky



Source: Kentucky Geological Survey, University of Kentucky Website
(http://www.uky.edu/KGS/coal/webgeoky/pages/quaternary.html)

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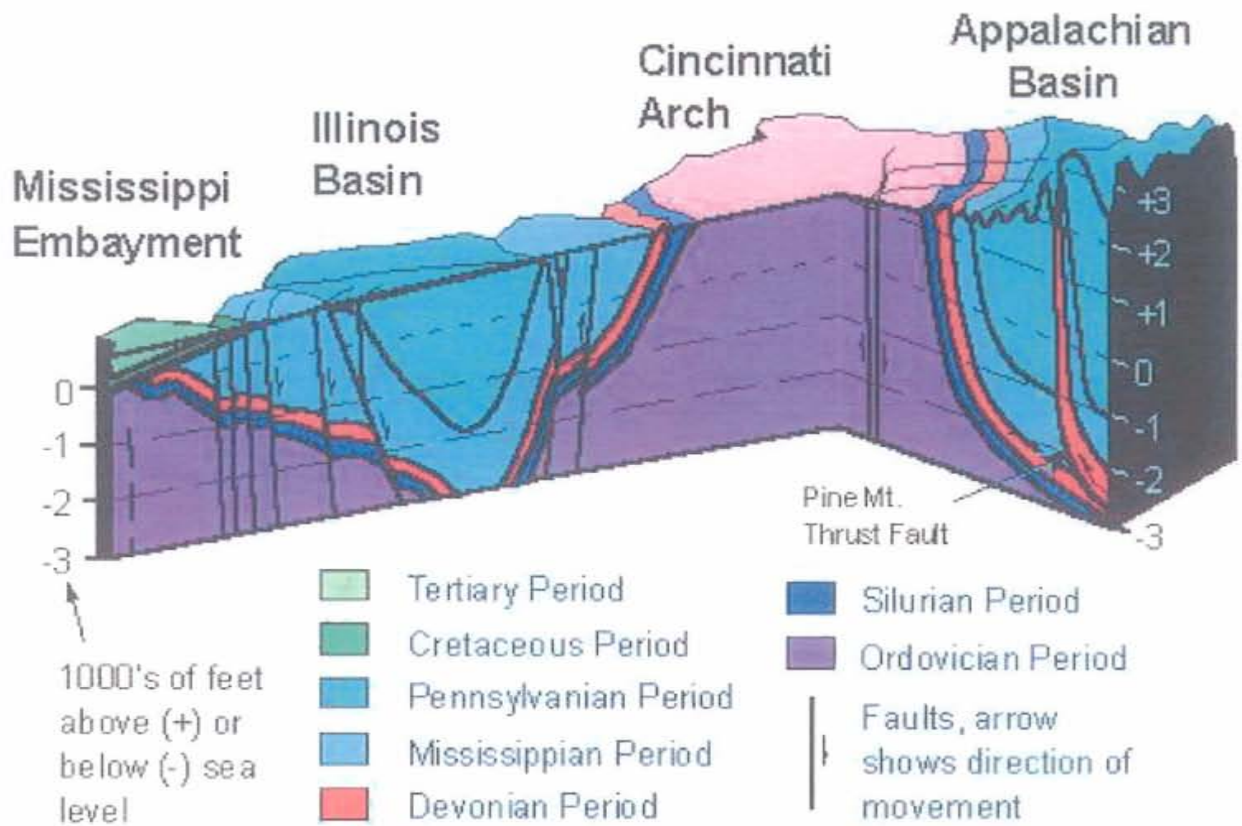
FIGURE 3B – GENERALIZED GEOLOGIC MAP OF KENTUCKY

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE
REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO
CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005



Source: Kentucky Geological Survey, University of Kentucky Website
(http://www.uky.edu/KGS/coal/webgeoky/pages/beneath.html)

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FIGURE 3C – GEOLOGIC CROSS-SECTION OF KENTUCKY

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

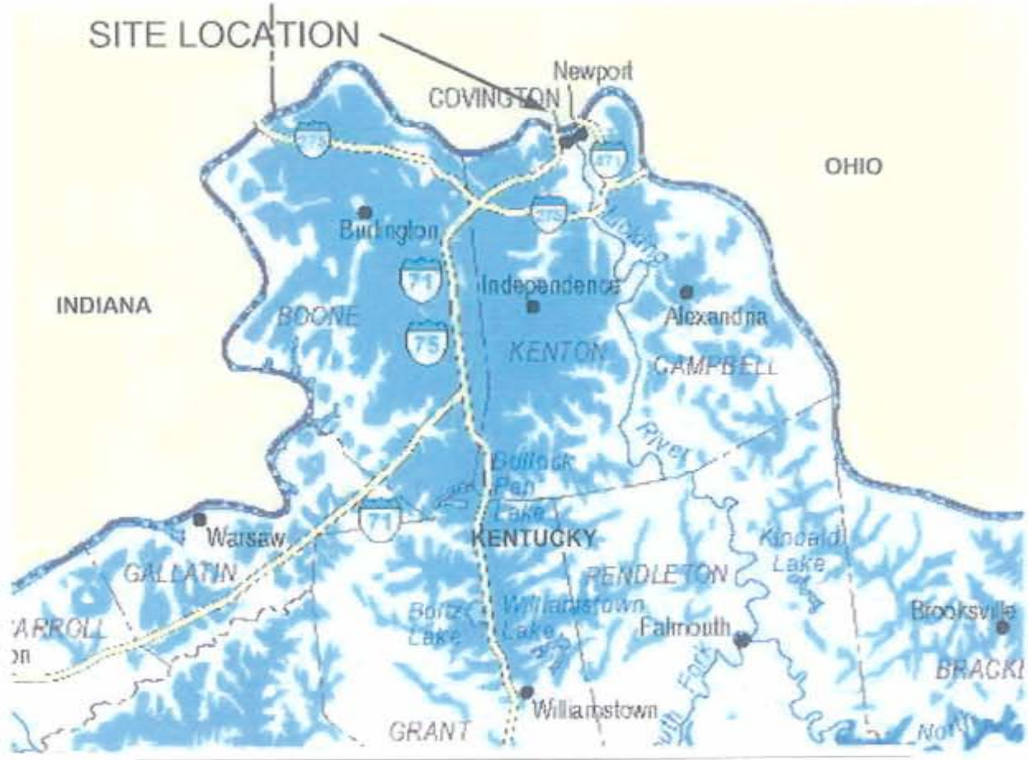
KARST OCCURRENCE IN KENTUCKY

This map was compiled from a digital version of the 1:500,000-scale geologic map of Kentucky (Noger, M.C., comp., 1988, Geologic map of Kentucky. U.S. Geological Survey). The areas of potential karst development were delineated using stratigraphic units mapped on the geologic map. The classification of the potential for karst development was based on the field experience of the authors and other data. A number of isolated carbonate units that would not have otherwise been differentiated on the geologic map were newly digitized for this map.

This karst map should not be used for evaluating karst geologic hazards or hydrogeology at scales larger than 1:500,000. The base geologic map was digitized at 1:500,000 scale and is limited in precision to that scale. Because of the small scale of the original geologic map, lithostratigraphic units were consolidated into thicker chronostratigraphic units to create an area large enough to delineate on the geologic map. In some cases, the consolidation resulted in carbonates (limestone or dolomite) and noncarbonates (sandstone or shale, for example) being grouped; these rocks are not redivided on this map. Although the potential for karst development can be predicted from lithology, other factors such as relief and length of time the rock is exposed are also important and were not considered in the making of this map. Finally, areas where the near-surface bedrock is insoluble and closely underlain by soluble rock are common, particularly in the Eastern Pennyroyal. Conduits that pirate drainage commonly extend through ridges capped with insoluble rocks. Therefore, some areas mapped as having limited potential that are adjacent to areas of higher potential are actually karst, but cannot be differentiated on this map.

Karst is a terrane that is generally underlain by limestone or dolomite, where the topography is formed chiefly by the dissolving of rock. Karst landscapes are commonly characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, large springs, and caves.

Karst regions are susceptible to unique problems such as sinkhole collapse, sinkhole flooding, and rapid groundwater pollution. Springs in karst areas are an important, productive source of groundwater. Rare biologic communities and endangered species can be found in the fragile underground environments developed in karst landscapes.



Source: Kentucky Geological Survey, University of Kentucky Website (http://kgsweb.uky.edu/olops/pub/kgs/mc33_12.pdf)

EXPLANATION

- Areas underlain by bedrock with high potential for karst development
- Areas underlain by bedrock with moderate potential for karst development
- Areas underlain by bedrock with limited or no potential for karst development

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FIGURE 3D – KARST OCCURRENCE IN KENTUCKY

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

PHYSIOGRAPHIC REGIONS OF OHIO

by C. Scott Brockman

Derived from Ohio ecoregions mapping project funded by U.S. Forest Service

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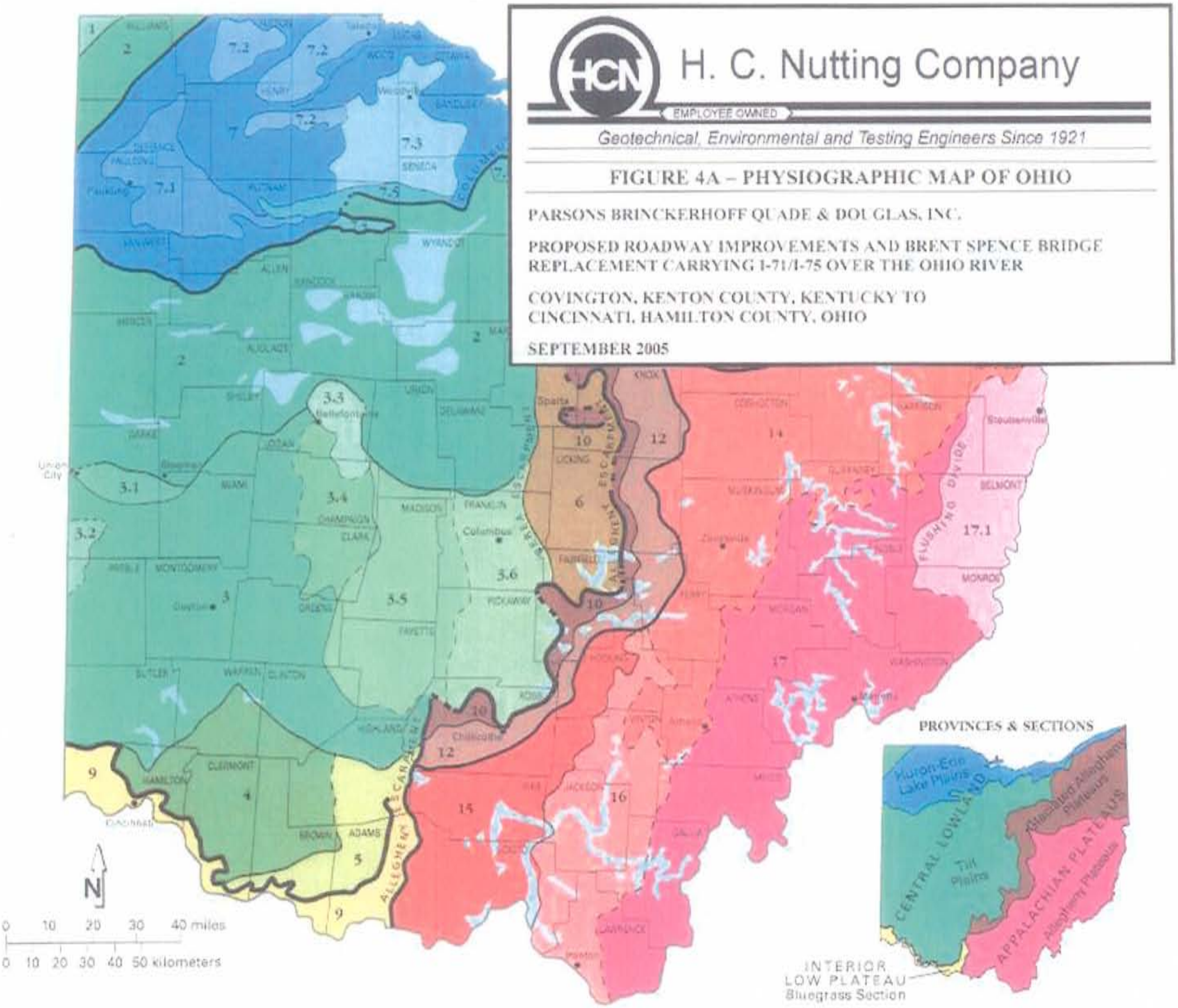
FIGURE 4A – PHYSIOGRAPHIC MAP OF OHIO

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005



Till Plains

1. Steuben Till Plain
2. Central Ohio Clayey Till Plain
   - 2.1. Berea Headlands of the Till Plain
3. Southern Ohio Loamy Till Plain
   - 3.1. Union City-Bloomer Transitional Terrain
   - 3.2. Whitewater Interlobate Plain
   - 3.3. Bellefontaine Upland
   - 3.4. Mad River Interlobate Plain
   - 3.5. Darby Plain
   - 3.6. Columbus Lowland
4. Illinoian Till Plain
5. Dissected Illinoian Till Plain
6. Galion Glaciated Low Plateau

Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

Huron-Erie Lake Plains

7. Maumee Lake Plains
   - 7.1. Paulding Clay Basin
   - 7.2. Maumee Sand Plains
   - 7.3. Woodville Lake-Plain Reefs
   - 7.4. Findlay Embayment
   - 7.5. Fostoria Lake-Plain Shoals
   - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
8. Erie Lake Plain
   - 8.1. Berea Headlands of the Erie Lake Plain

Bluegrass Section

9. Outer Bluegrass Region

Glaciated Allegheny Plateaus

10. Killbuck-Glaciated Pittsburgh Plateau
11. Akron-Canton Interlobate Plateau
12. Illinoian Glaciated Allegheny Plateau
13. Grand River Low Plateau
    - 13.1. Grand River Finger-Lake Plain

Allegheny Plateaus

14. Muskingum-Pittsburgh Plateau
15. Shawnee-Mississippian Plateau
16. Ironton Plateau
17. Marietta Plateau
    - 17.1. Little Switzerland Plateau

4/98

Source: Ohio Department of Natural Resources, Ohio Geological Survey Website (http://www.dnr.state.oh.us/geosurvey/pdf/physio.pdf)

STATE OF OHIO
George V. Voinovich, Governor

DEPARTMENT OF NATURAL RESOURCES
Donald C. Anderson, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GEOLOGIC MAP AND CROSS SECTION OF OHIO

H. C. Nutting Company

EMPLOYEE OWNED

Geotechnical, Environmental and Testing Engineers Since 1921

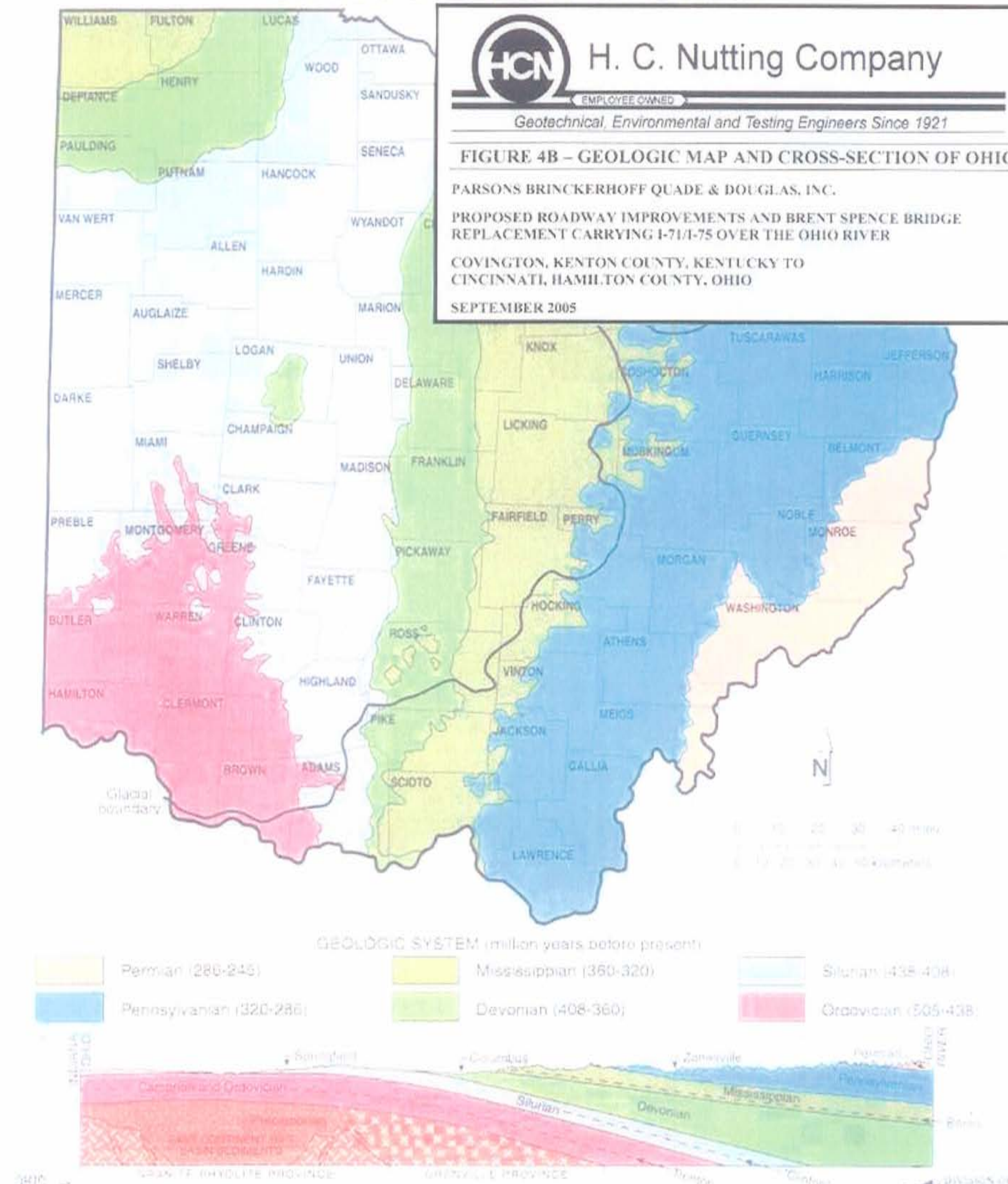
FIGURE 4B – GEOLOGIC MAP AND CROSS-SECTION OF OHIO

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005



Source: Ohio Department of Natural Resources, Ohio Geological Survey Website (http://www.dnr.state.oh.us/geosurvey/default.htm)

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GLACIAL MAP OF OHIO

H. C. Nutting Company

EMPLOYEE OWNED

Geotechnical, Environmental and Testing Engineers Since 1921

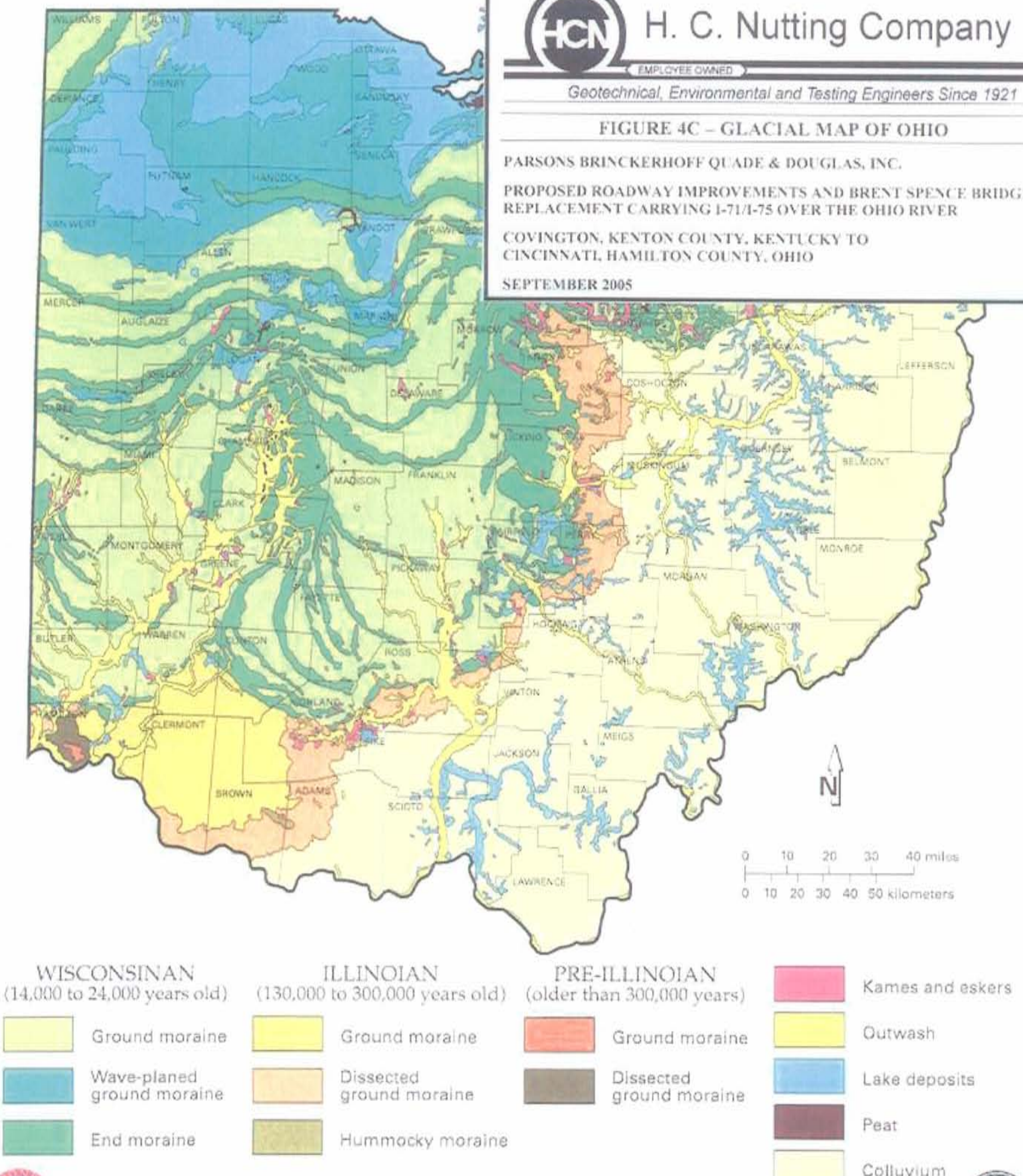
FIGURE 4C – GLACIAL MAP OF OHIO

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005



Source: Ohio Department of Natural Resources, Ohio Geological Survey Website (http://www.dnr.state.oh.us/geosurvey/pdf/glacial.pdf)

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

OHIO KARST AREAS

H. C. Nutting Company
EMPLOYEE OWNED
Geotechnical, Environmental and Testing Engineers Since 1921

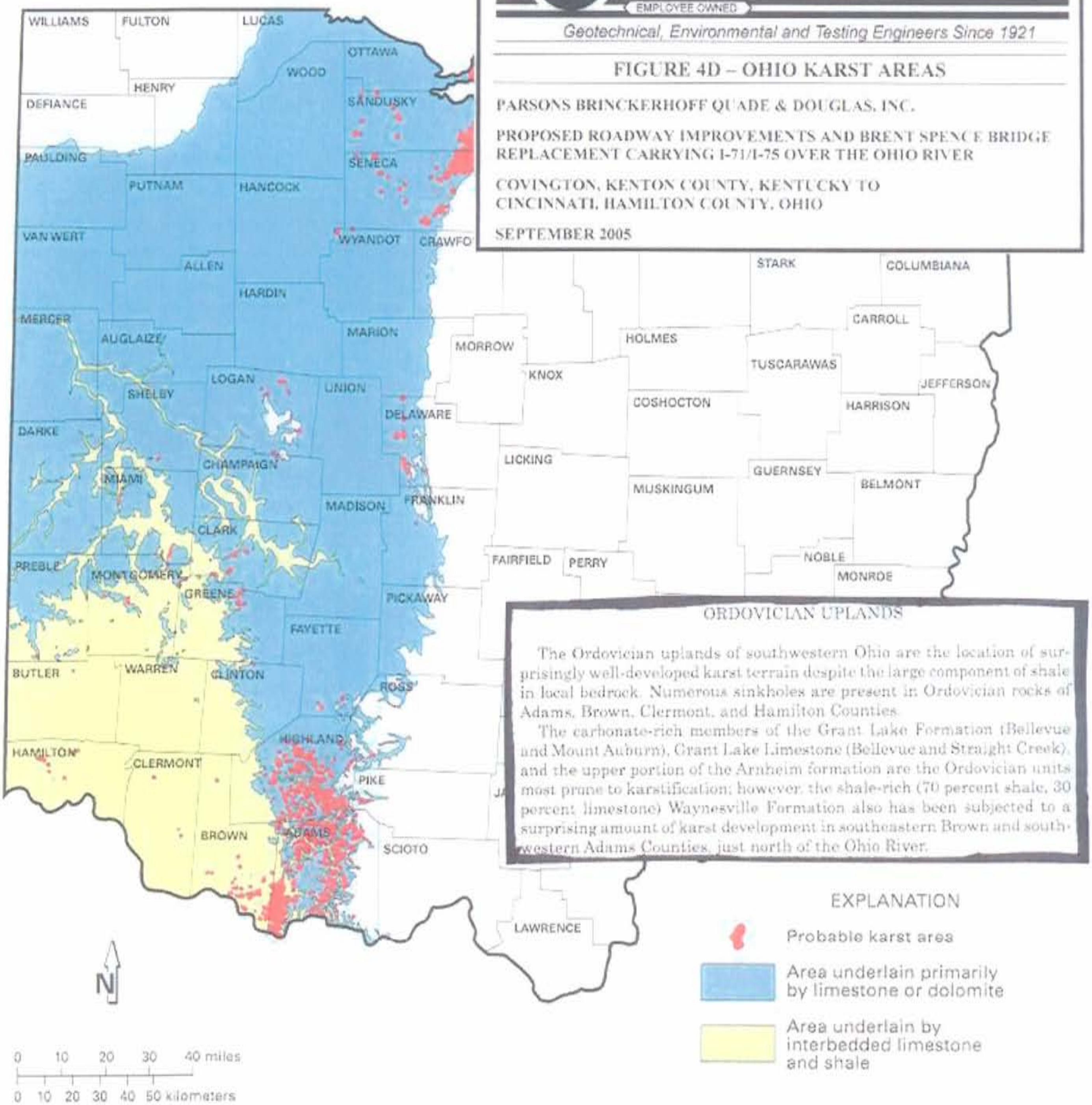
FIGURE 4D – OHIO KARST AREAS

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

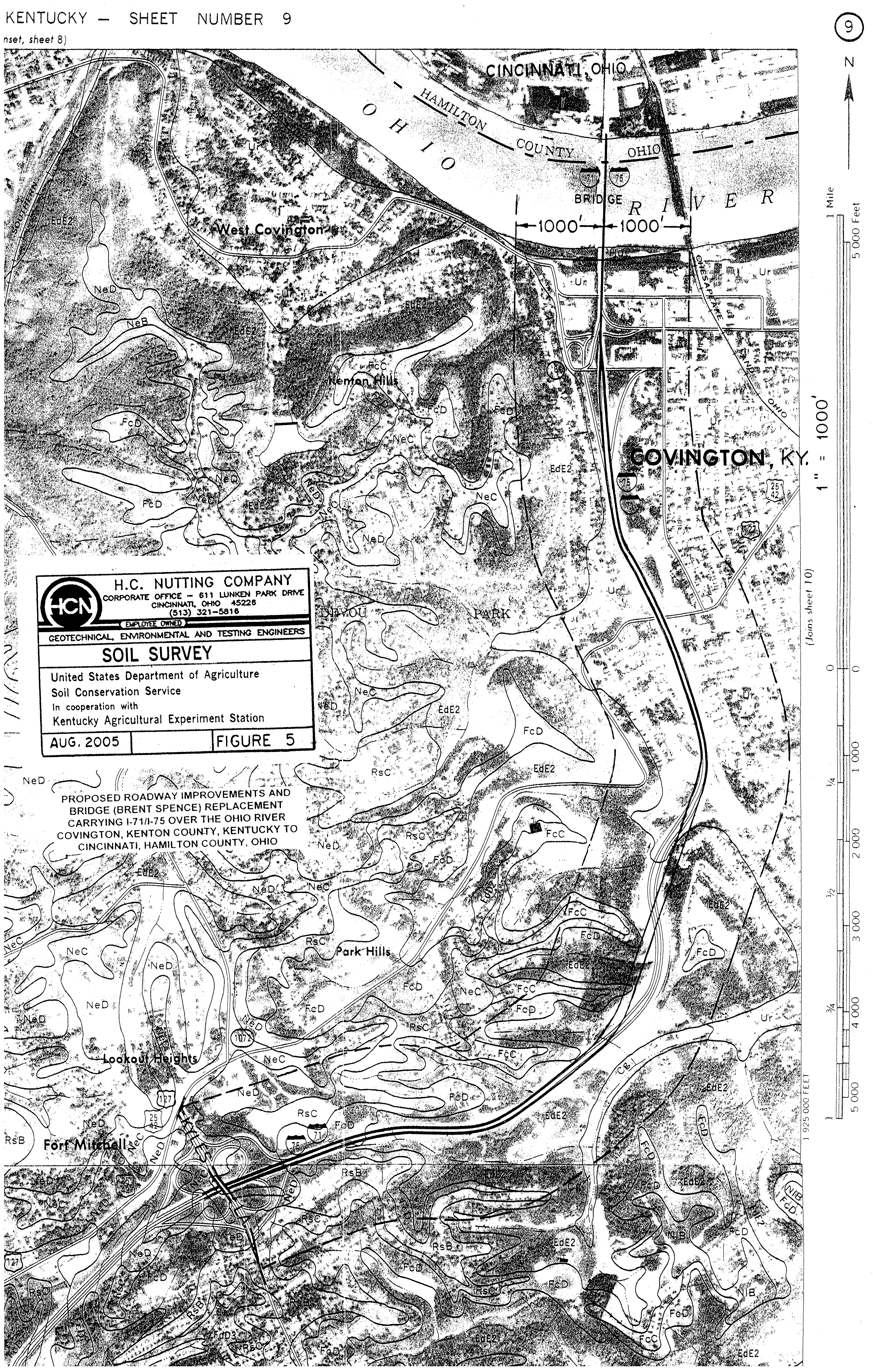


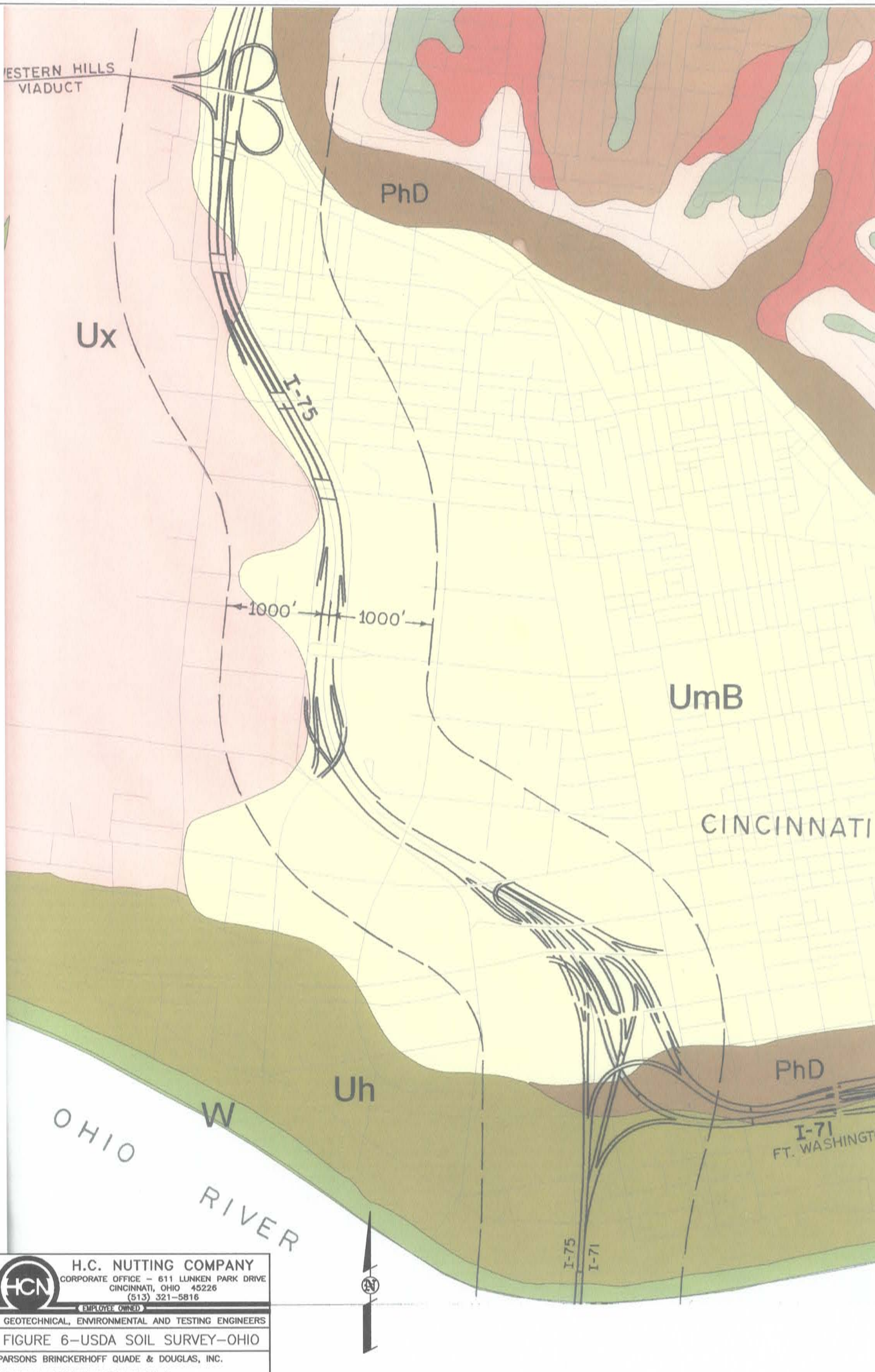
ORDOVICIAN UPLANDS

The Ordovician uplands of southwestern Ohio are the location of surprisingly well-developed karst terrain despite the large component of shale in local bedrock. Numerous sinkholes are present in Ordovician rocks of Adams, Brown, Clermont, and Hamilton Counties.

The carbonate-rich members of the Grant Lake Formation (Bellevue and Mount Auburn), Grant Lake Limestone (Bellevue and Straight Creek), and the upper portion of the Arnheim formation are the Ordovician units most prone to karstification; however, the shale-rich (70 percent shale, 30 percent limestone) Waynesville Formation also has been subjected to a surprising amount of karst development in southeastern Brown and southwestern Adams Counties, just north of the Ohio River.

Source: Ohio Department of Natural Resources, Ohio Geological Survey Website (http://www.dnr.state.oh.us/geosurvey/pdf/karstmap.pdf)


KENTUCKY — SHEET NUMBER 9
nset, sheet 8)
9
N
H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS
SOIL SURVEY
United States Department of Agriculture
Soil Conservation Service
In cooperation with
Kentucky Agricultural Experiment Station
AUG. 2005
FIGURE 5
PROPOSED ROADWAY IMPROVEMENTS AND
BRIDGE (BRENT SPENCE) REPLACEMENT
CARRYING I-71/I-75 OVER THE OHIO RIVER
COVINGTON, KENTON COUNTY, KENTUCKY TO
CINCINNATI, HAMILTON COUNTY, OHIO
CINCINNATI, OHIO
HAMILTON COUNTY
OHIO
OHIO RIVER
BRIDGE
1000'
1000'
West Covington
Kenton Hills
COVINGTON, KY.
DEVOU PARK
Park Hills
Lookout Heights
Fort Mitchell
1" = 1000'
(Joins sheet 10)
1 925 000 FEET
1 Mile
5 000 Feet



H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED

GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

FIGURE 6–USDA SOIL SURVEY–OHIO

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS &
BRENT SPENCE BRIDGE
REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO
CINCINNATI, HAMILTON COUNTY, OHIO
SEPTEMBER 2005

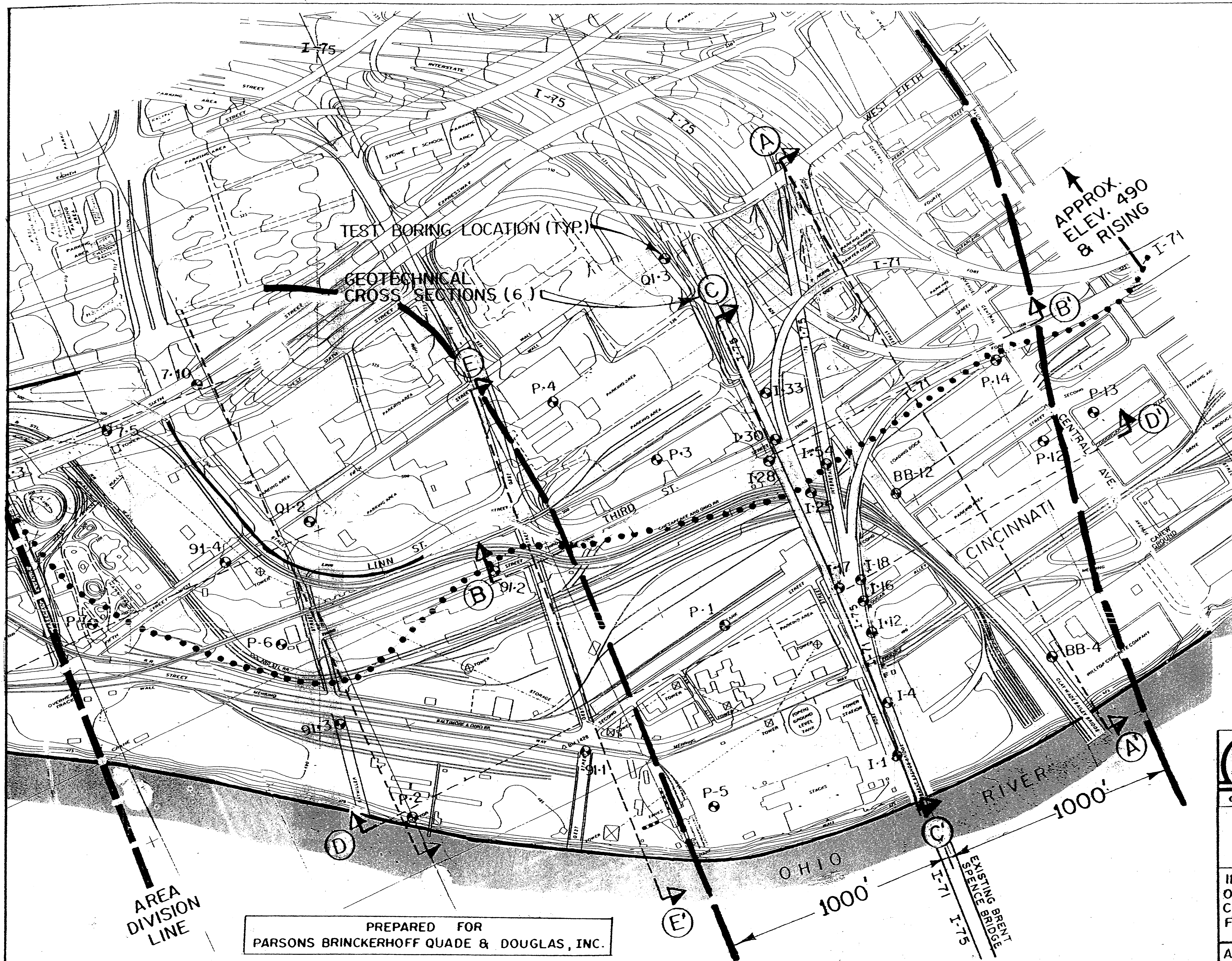
H.C. NUTTING COMPANY
CORPORATE OFFICE – 4120 AIRPORT RD.
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

SUMMARY OF SELECTED SUBSURFACE INVESTIGATIONS

COVINGTON QUADRANGLE
KENTUCKY-OHIO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 WEST CINCINNATI 15' QUADRANGLE
1987

FIGURE 7

JUNE, 2005



PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

DATA FROM 1991 GEOTECHNICAL INVESTIGATION BY THE H.C. NUTTING COMPANY

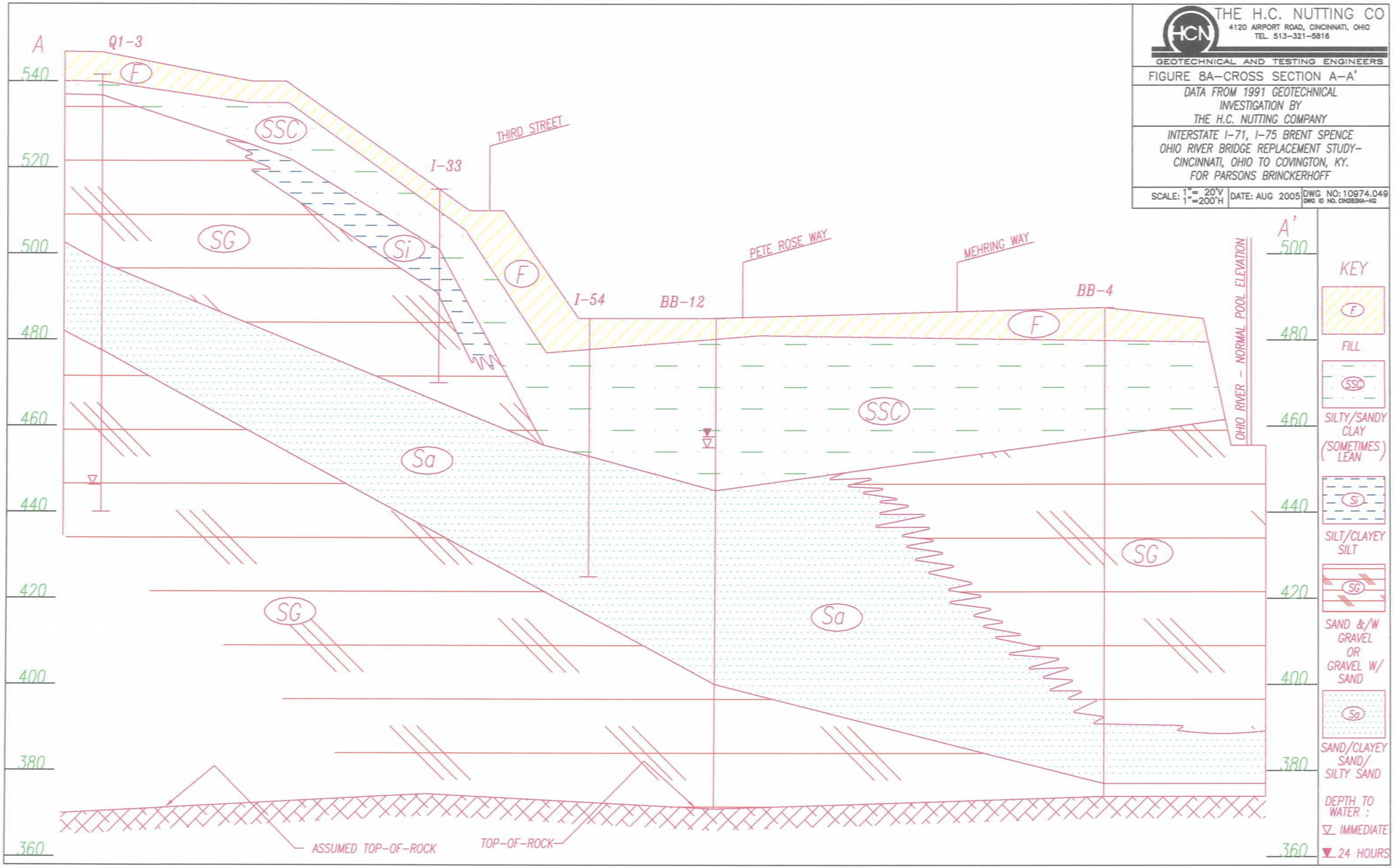
PLAN
SCALE : 1" = 400'

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

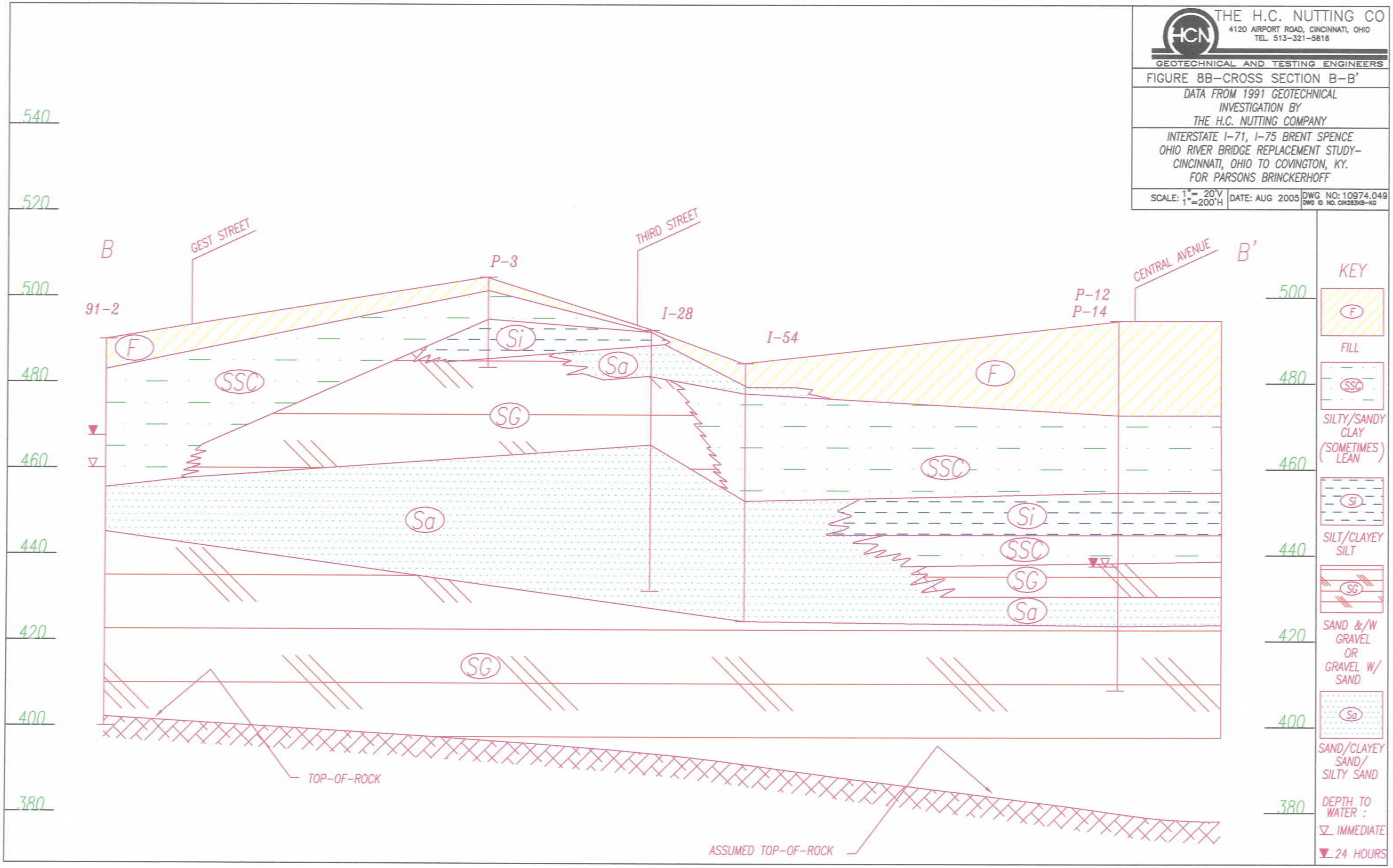
SUMMARY OF SUBSURFACE CROSS-SECTIONS A-A' TO F-F'

INTERSTATE I-71, I-75 BRENT SPENCE OHIO RIVER BRIDGE REPLACEMENT STUDY - CINCINNATI, OHIO TO COVINGTON, KY. FOR PARSONS BRINCKERHOFF

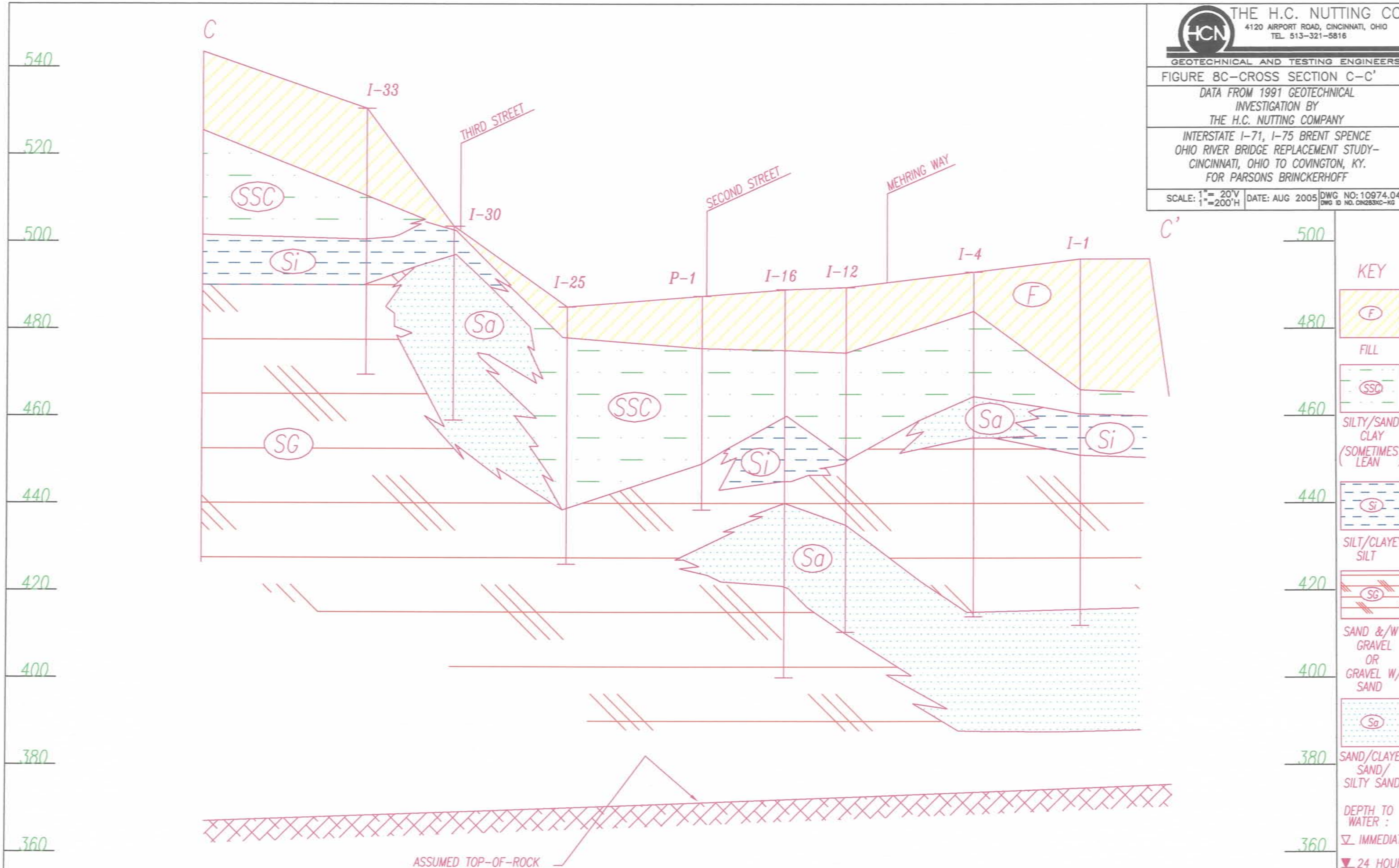
AUG. 2005	W.O. 10974.049	FIGURE 8



THE H.C. NUTTING CO
4120 AIRPORT ROAD, CINCINNATI, OHIO
TEL. 513-321-5816
HCN
GEOTECHNICAL AND TESTING ENGINEERS
FIGURE 8A-CROSS SECTION A-A'
DATA FROM 1991 GEOTECHNICAL INVESTIGATION BY THE H.C. NUTTING COMPANY
INTERSTATE I-71, I-75 BRENT SPENCE OHIO RIVER BRIDGE REPLACEMENT STUDY- CINCINNATI, OHIO TO COVINGTON, KY. FOR PARSONS BRINCKERHOFF
SCALE: 1"= 20'V 1"=200'H
DATE: AUG 2005
DWG NO: 10974.049
A
A'
Q1-3
I-33
I-54
BB-12
BB-4
THIRD STREET
PETE ROSE WAY
MEHRING WAY
OHIO RIVER - NORMAL POOL ELEVATION
F
SSC
Si
SG
Sa
540
520
500
480
460
440
420
400
380
360
ASSUMED TOP-OF-ROCK
TOP-OF-ROCK
KEY
FILL
SILTY/SANDY CLAY (SOMETIMES LEAN)
SILT/CLAYEY SILT
SAND &/W GRAVEL OR GRAVEL W/ SAND
SAND/CLAYEY SAND/ SILTY SAND
DEPTH TO WATER :
IMMEDIATE
24 HOURS



THE H.C. NUTTING CO
4120 AIRPORT ROAD, CINCINNATI, OHIO
TEL. 513-321-5816
HCN
GEOTECHNICAL AND TESTING ENGINEERS
FIGURE 8B-CROSS SECTION B-B'
DATA FROM 1991 GEOTECHNICAL INVESTIGATION BY THE H.C. NUTTING COMPANY
INTERSTATE I-71, I-75 BRENT SPENCE OHIO RIVER BRIDGE REPLACEMENT STUDY- CINCINNATI, OHIO TO COVINGTON, KY. FOR PARSONS BRINCKERHOFF
SCALE: 1"= 20'V 1"=200'H
DATE: AUG 2005
DWG NO: 10974.049
B
B'
GEST STREET
THIRD STREET
CENTRAL AVENUE
91-2
P-3
I-28
I-54
P-12
P-14
540
520
500
480
460
440
420
400
380
F
SSC
Si
Sa
SG
TOP-OF-ROCK
ASSUMED TOP-OF-ROCK
KEY
FILL
SILTY/SANDY CLAY (SOMETIMES LEAN)
SILT/CLAYEY SILT
SAND &/W GRAVEL OR GRAVEL W/ SAND
SAND/CLAYEY SAND/ SILTY SAND
DEPTH TO WATER :
IMMEDIATE
24 HOURS


THE H.C. NUTTING CO
4120 AIRPORT ROAD, CINCINNATI, OHIO
TEL. 513-321-5816
HCN
GEOTECHNICAL AND TESTING ENGINEERS
FIGURE 8C–CROSS SECTION C–C'
DATA FROM 1991 GEOTECHNICAL INVESTIGATION BY THE H.C. NUTTING COMPANY
INTERSTATE I–71, I–75 BRENT SPENCE OHIO RIVER BRIDGE REPLACEMENT STUDY– CINCINNATI, OHIO TO COVINGTON, KY. FOR PARSONS BRINCKERHOFF
SCALE: 1"= 20'V 1"=200'H
DATE: AUG 2005
DWG NO: 10974.049
C
C'
540
520
500
480
460
440
420
400
380
360
I–33
THIRD STREET
I–30
SECOND STREET
MEHRING WAY
I–25
P–1
I–16
I–12
I–4
I–1
F
SSC
Si
Sa
SG
ASSUMED TOP-OF-ROCK
KEY
FILL
SILTY/SANDY CLAY (SOMETIMES LEAN)
SILT/CLAYEY SILT
SAND &/W GRAVEL OR GRAVEL W/ SAND
SAND/CLAYEY SAND/ SILTY SAND
DEPTH TO WATER :
IMMEDIATE
24 HOURS

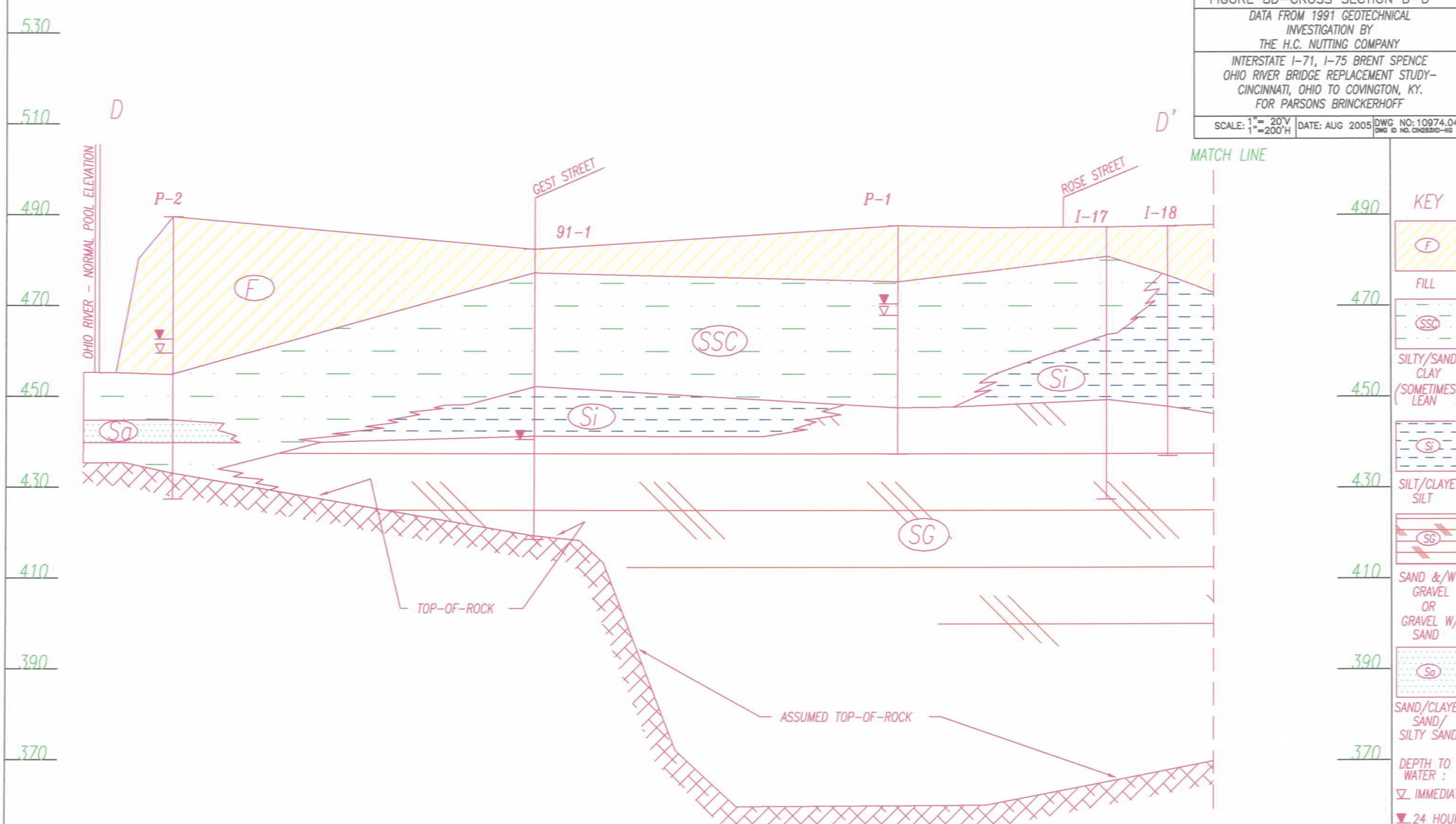
THE H.C. NUTTING CO
4120 AIRPORT ROAD, CINCINNATI, OHIO
TEL. 513-321-5816
GEOTECHNICAL AND TESTING ENGINEERS

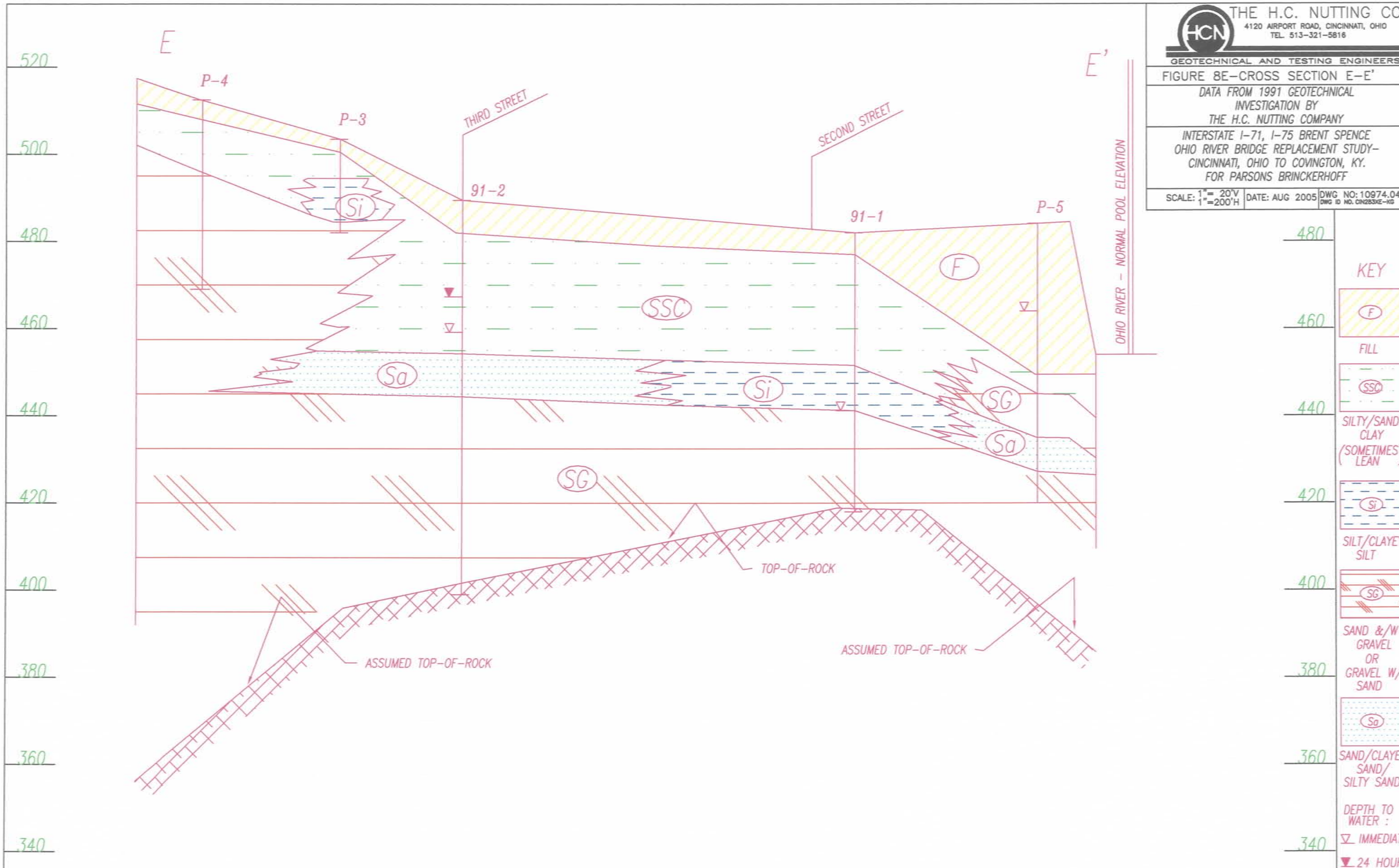
FIGURE 8D-CROSS SECTION D-D'

DATA FROM 1991 GEOTECHNICAL INVESTIGATION BY THE H.C. NUTTING COMPANY

INTERSTATE I-71, I-75 BRENT SPENCE OHIO RIVER BRIDGE REPLACEMENT STUDY- CINCINNATI, OHIO TO COVINGTON, KY. FOR PARSONS BRINCKERHOFF

SCALE: 1"= 20'V 1"=200'H	DATE: AUG 2005	DWG NO: 10974.049 DWG ID NO. CIN283XD-KG





THE H.C. NUTTING CO
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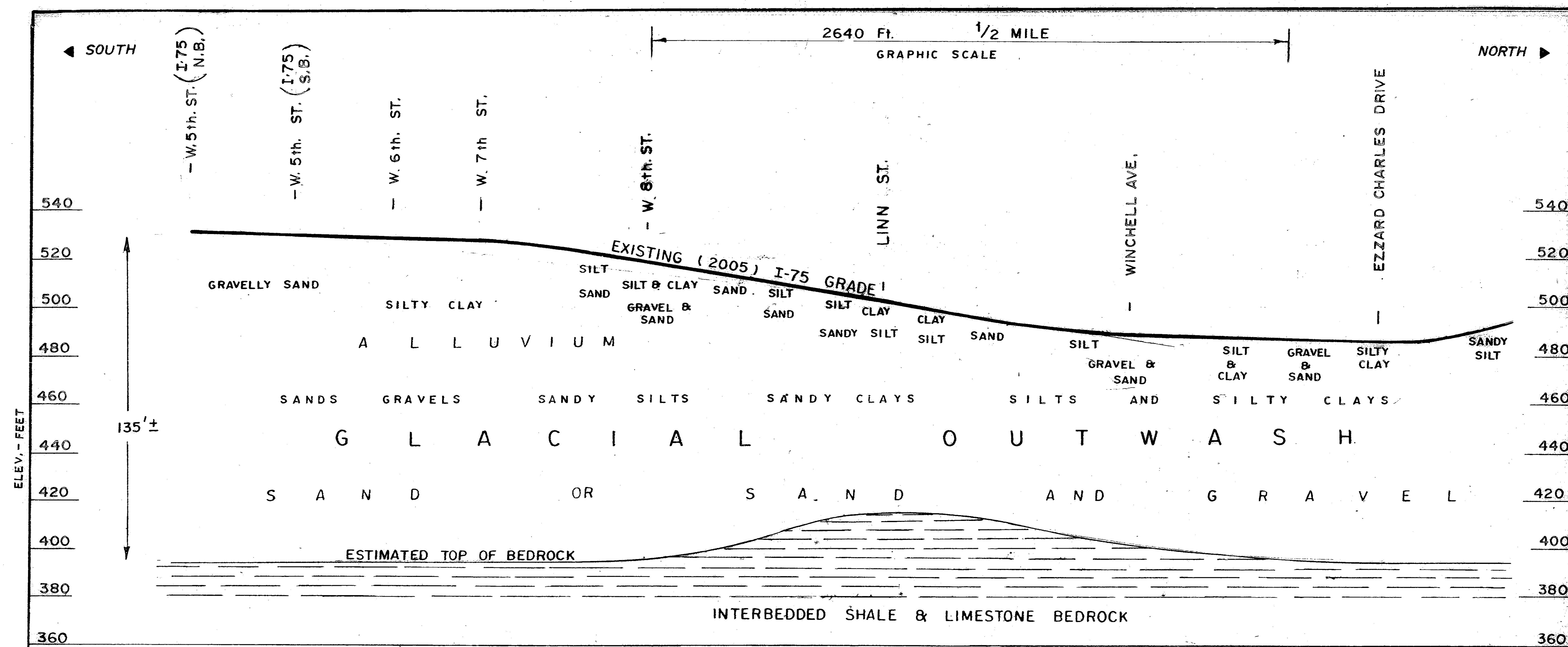
TEL. 513-321-5816
GEOTECHNICAL AND TESTING ENGINEERS
FIGURE 8E-CROSS SECTION E-E'
DATA FROM 1991 GEOTECHNICAL INVESTIGATION BY THE H.C. NUTTING COMPANY
INTERSTATE I-71, I-75 BRENT SPENCE OHIO RIVER BRIDGE REPLACEMENT STUDY-CINCINNATI, OHIO TO COVINGTON, KY. FOR PARSONS BRINCKERHOFF
SCALE: 1"= 20'V 1"=200'H
DATE: AUG 2005
DWG NO: 10974.049
E
E'
P-4
P-3
91-2
91-1
P-5
THIRD STREET
SECOND STREET
OHIO RIVER - NORMAL POOL ELEVATION
F
SSC
Si
Sa
SG
TOP-OF-ROCK
ASSUMED TOP-OF-ROCK
520
500
480
460
440
420
400
380
360
340
KEY
FILL
SILTY/SANDY CLAY (SOMETIMES LEAN)
SILT/CLAYEY SILT
SAND &/W GRAVEL OR GRAVEL W/ SAND
SAND/CLAYEY SAND/ SILTY SAND
DEPTH TO WATER :
IMMEDIATE
24 HOURS



GENERALIZED SUBSURFACE PROFILE

ALONG EXISTING I-75 CENTERLINE
CINCINNATI, OHIO

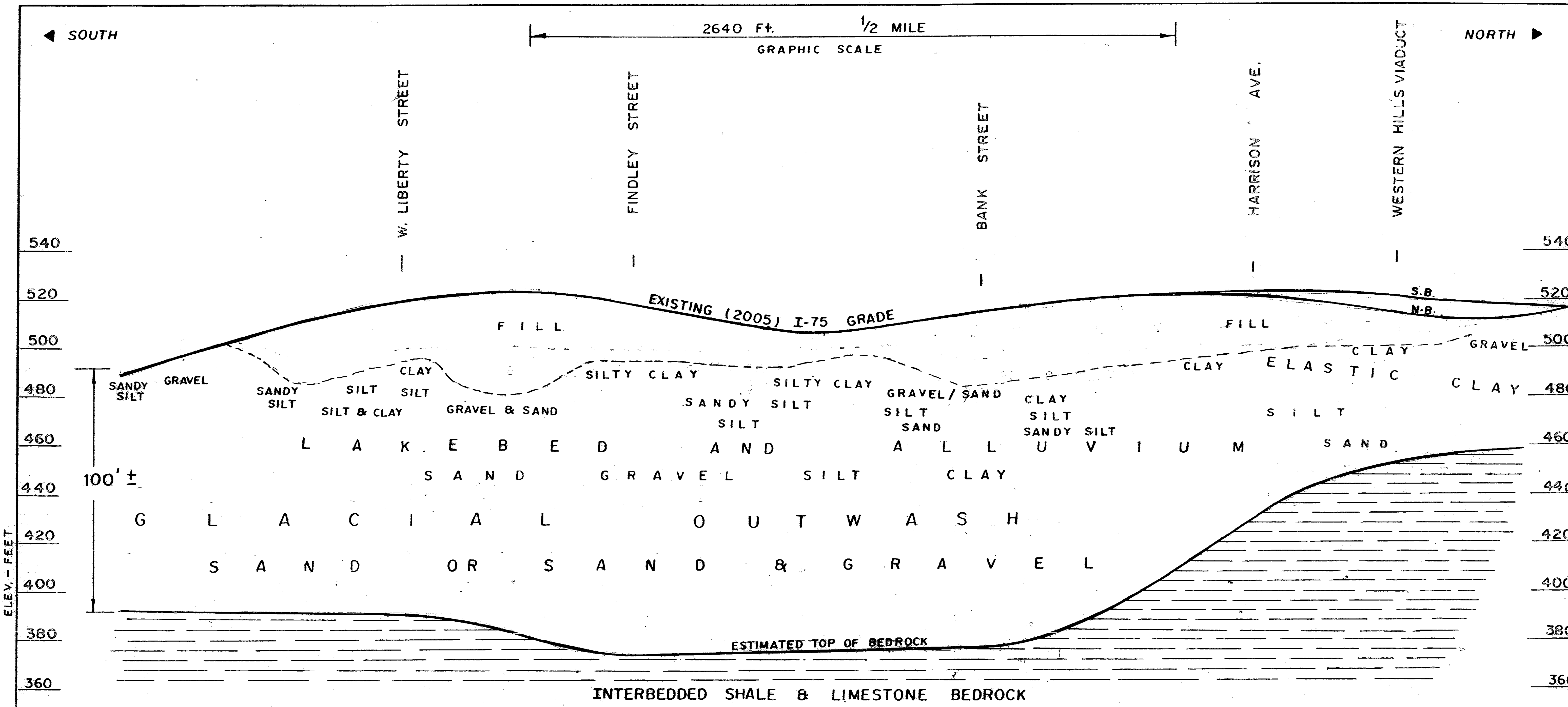
SCALE: 1" = 40' V.
1" = 400' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005		FIGURE 9A



GENERALIZED SUBSURFACE PROFILE

ALONG EXISTING I-75 CENTERLINE
CINCINNATI, OHIO

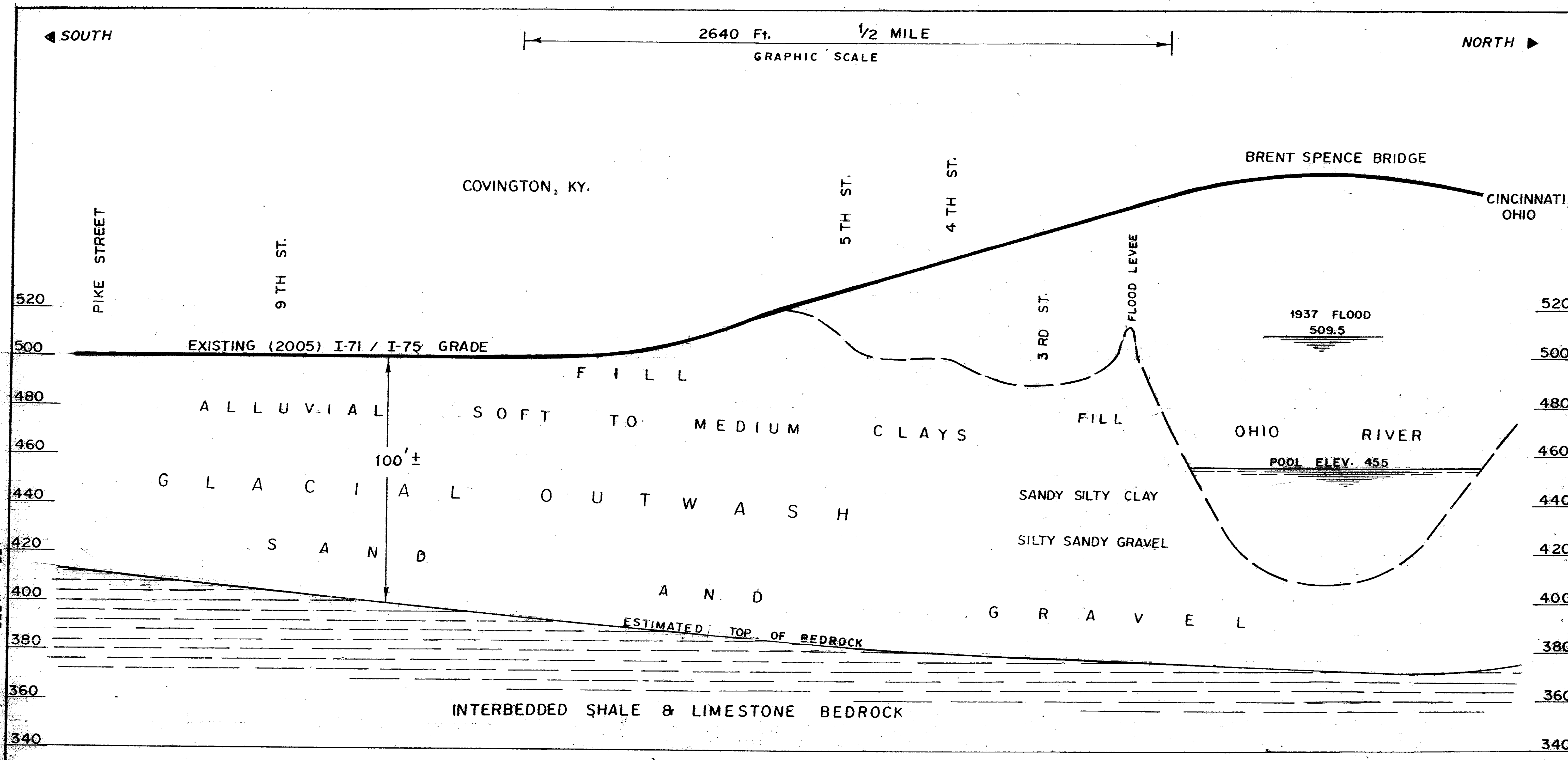
SCALE: 1" = 40' V.
1" = 400' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005	FIGURE 9B



GENERALIZED SUBSURFACE PROFILE

ALONG EXISTING I-71 / I-75 CENTERLINE
IN COVINGTON, KENTUCKY

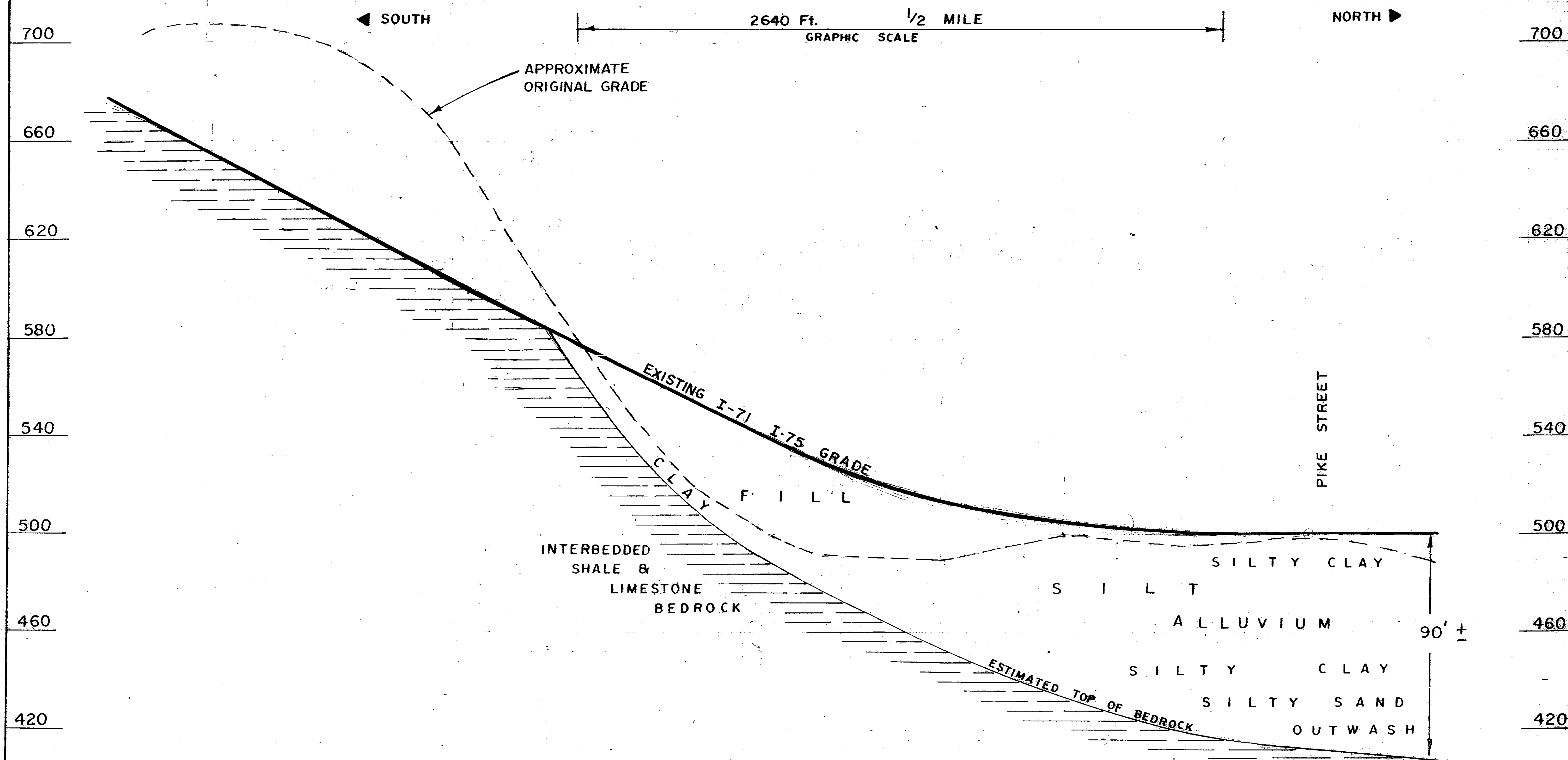
SCALE : 1" = 40' V.
1" = 400' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005 | FIGURE 9C



GENERALIZED SUBSURFACE PROFILE

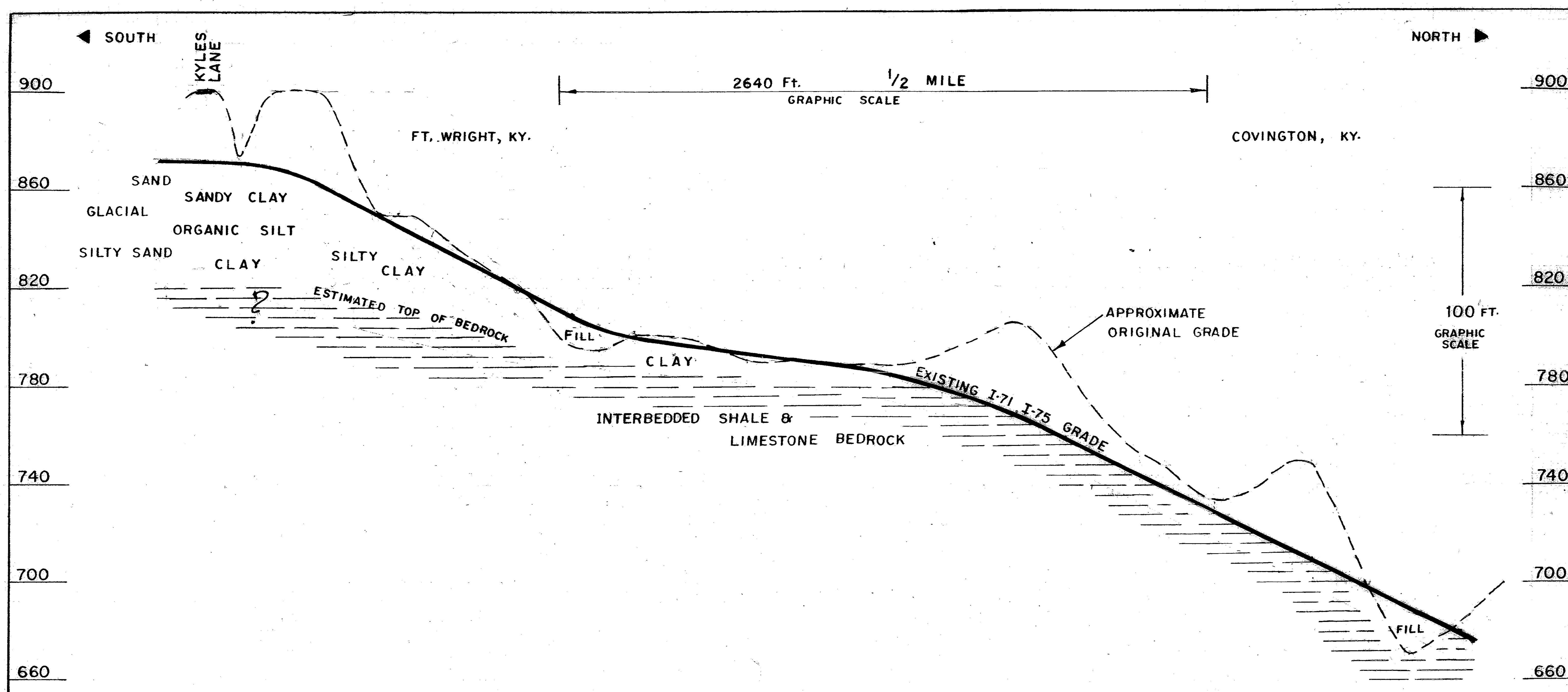
ALONG EXISTING I-71, I-75 CENTERLINE
FROM PIKE STREET 5000' SOUTH
COVINGTON, KENTUCKY
SCALE: 1" = 40' V.
1" = 400' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005		FIGURE 9D



GENERALIZED SUBSURFACE PROFILE

ALONG EXISTING I-71, I-75 CENTERLINE
FROM KYLES LANE INTERCHANGE 189 5000' NORTH
FORT WRIGHT & COVINGTON, KENTUCKY
SCALE: 1" = 40' V
1" = 400' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
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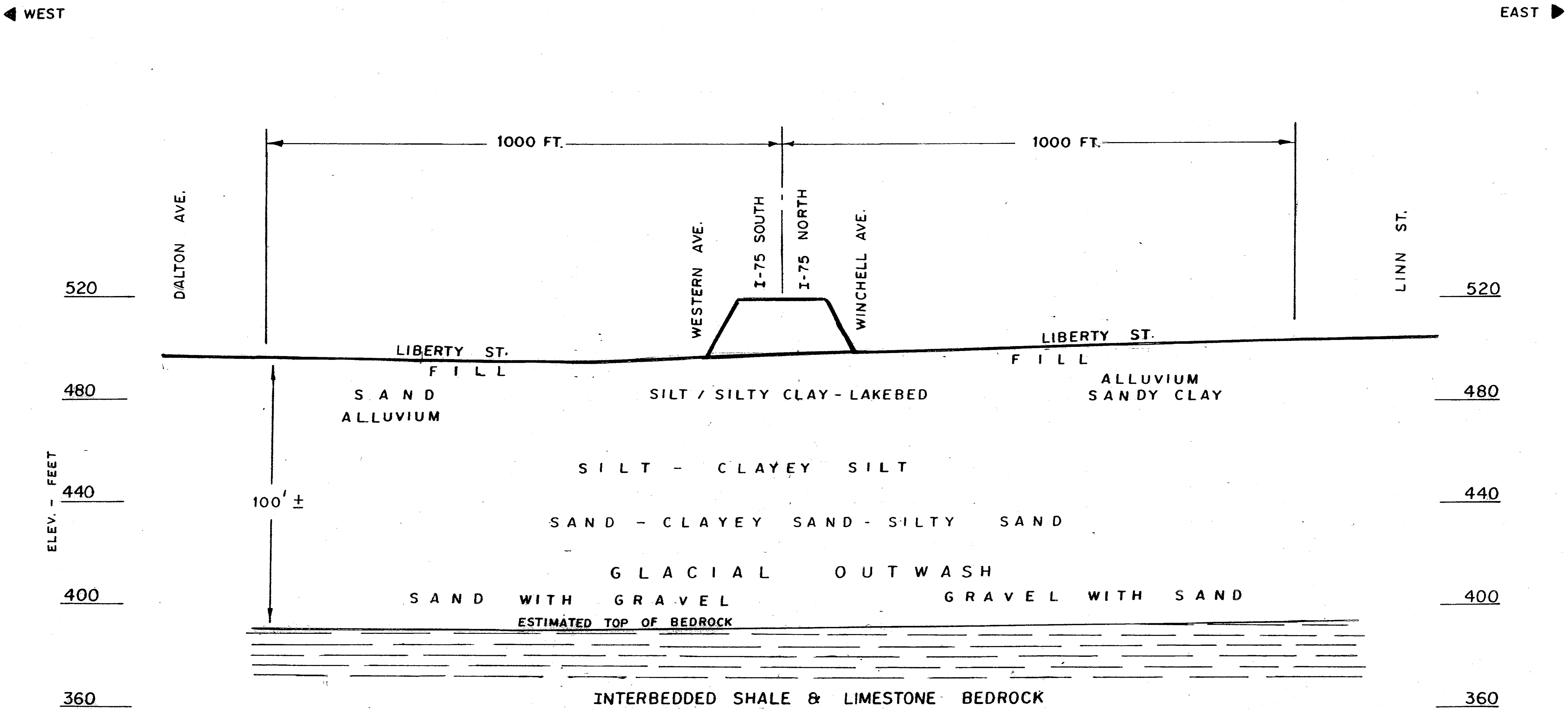
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005		FIGURE 9E



GENERALIZED SUBSURFACE CROSS SECTION

OF EXISTING I-75 AT LIBERTY STREET

CINCINNATI, OHIO

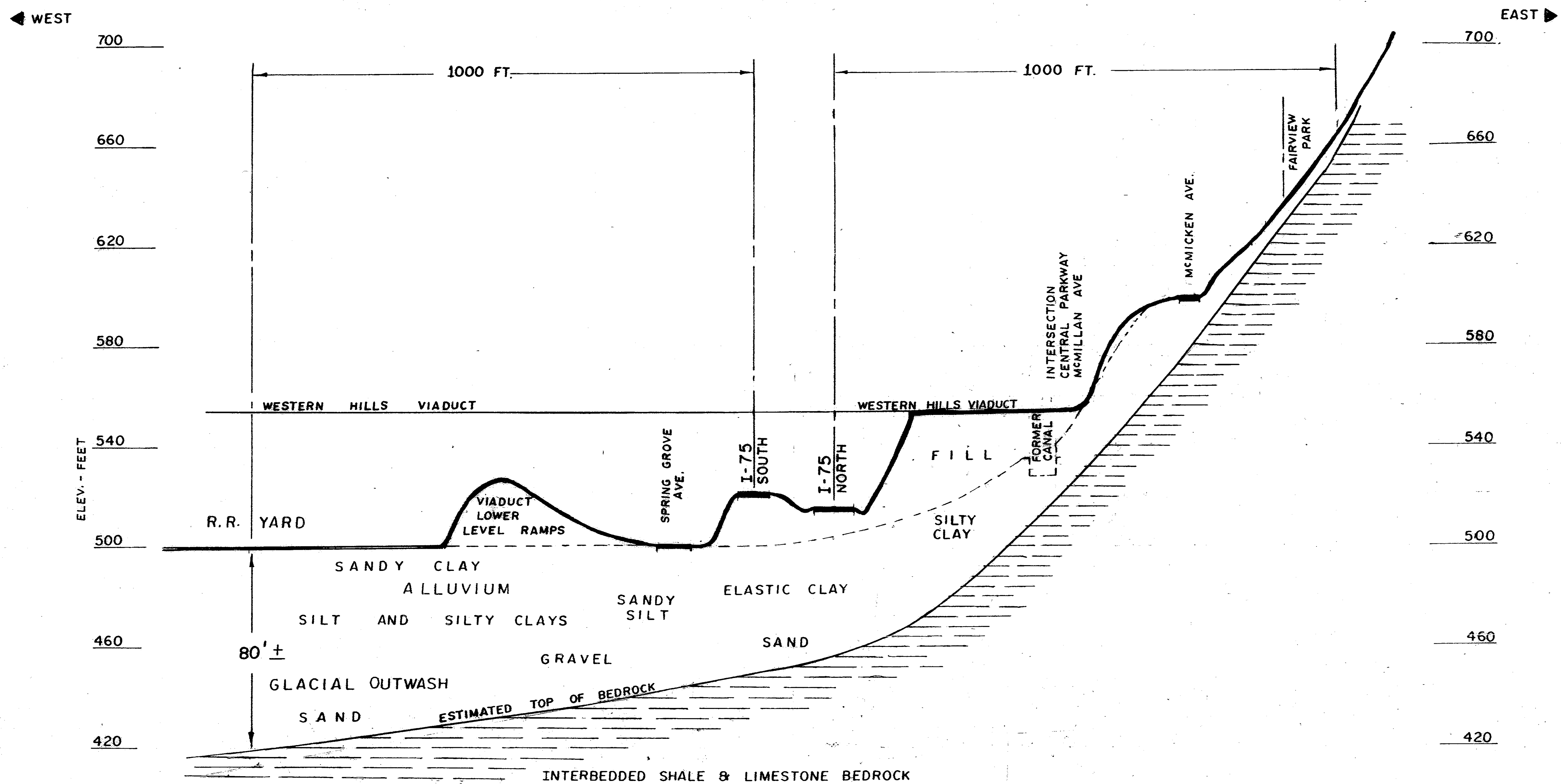
SCALE: 1" = 40' V.
1" = 200' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005		FIGURE 10A



GENERALIZED SUBSURFACE CROSS SECTION

OF EXISTING I-75 AT WESTERN HILLS VIADUCT
INTERCHANGE 2
CINCINNATI, OHIO

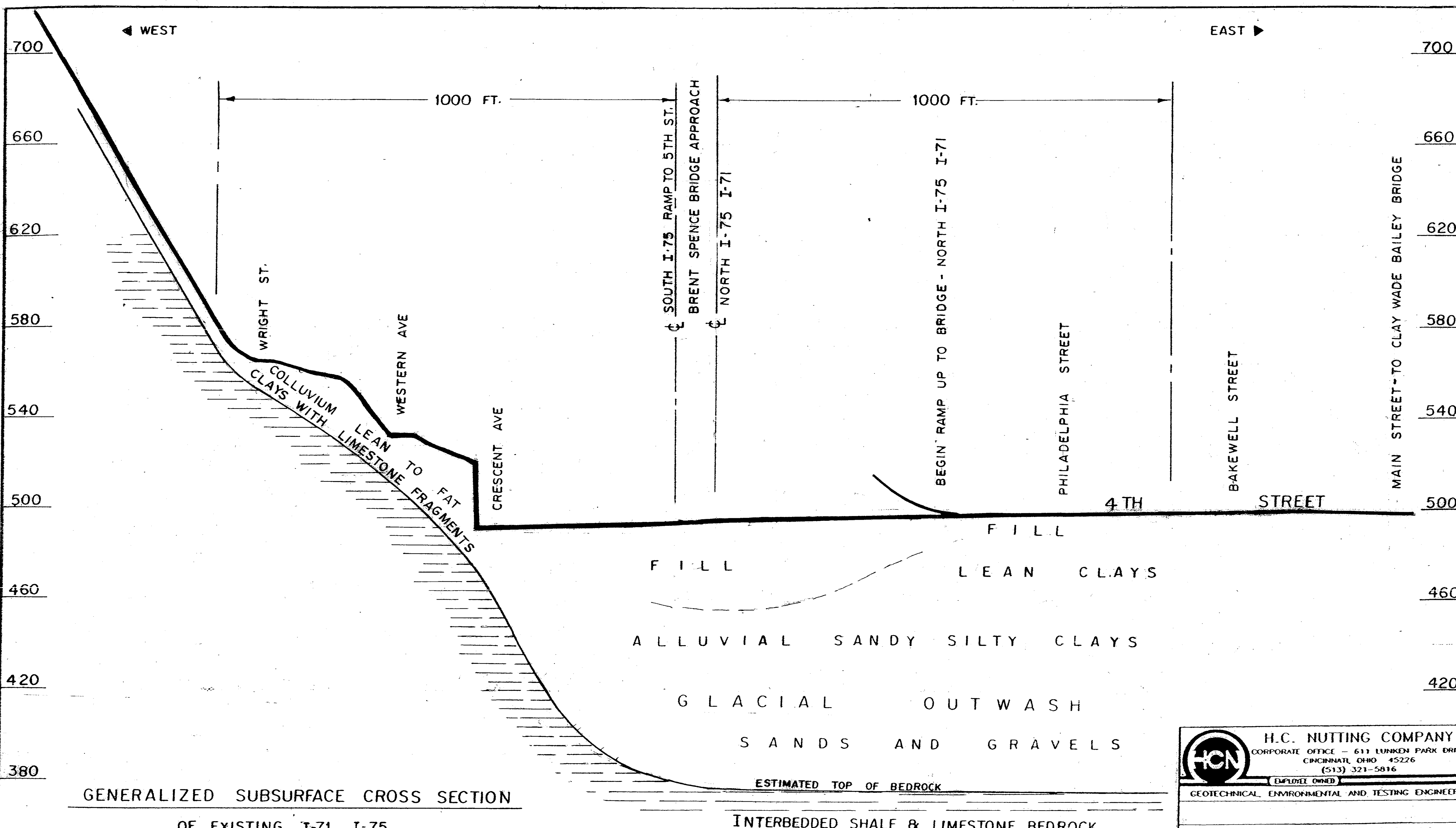
SCALE: 1" = 40' V.
1" = 200' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005	FIGURE 10B



GENERALIZED SUBSURFACE CROSS SECTION

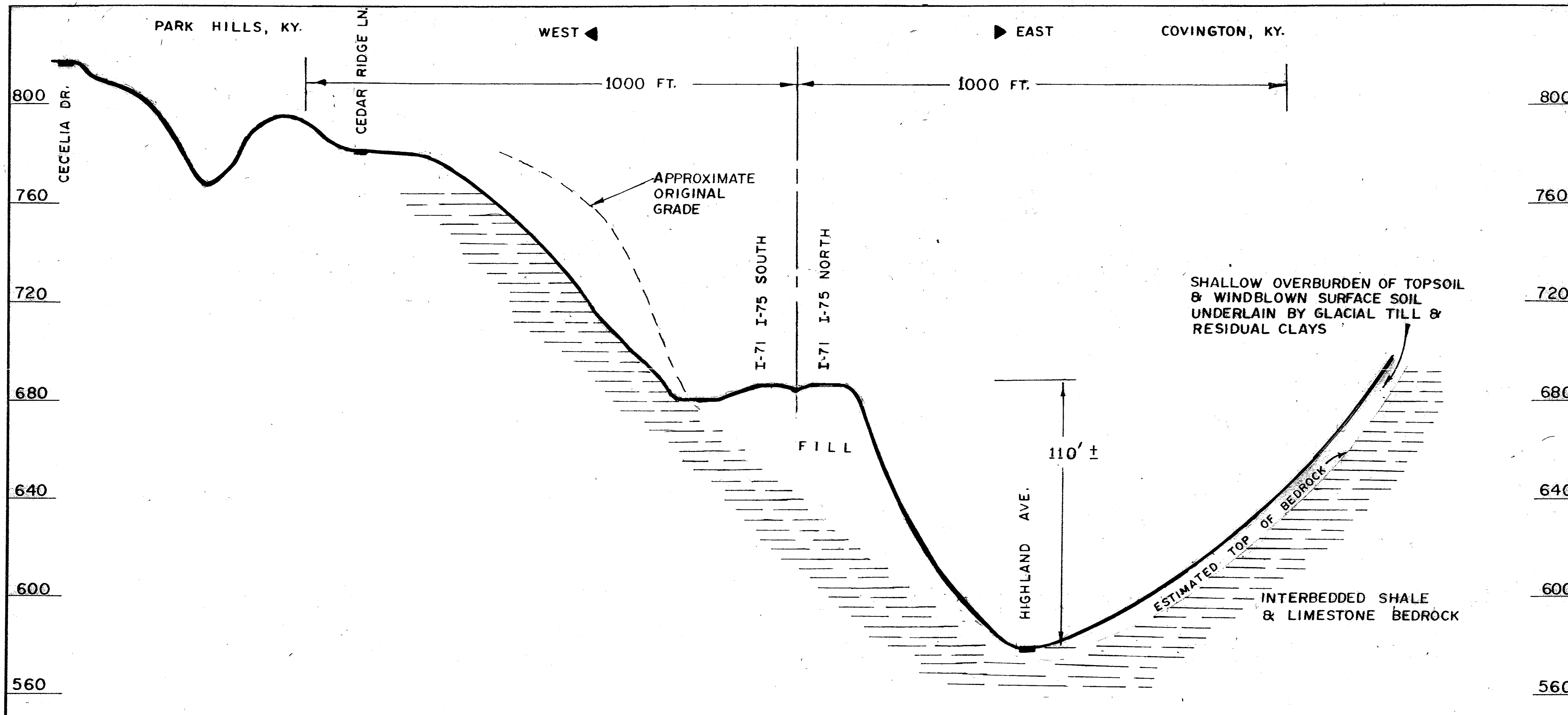
OF EXISTING I-71, I-75
AT 4TH STREET TO EAST AND PROJECTED 4TH STREET TO WEST
COVINGTON, KENTUCKY
SCALE: 1" = 40' V.
1" = 200' H.

PREPARED FOR
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

H.C. NUTTING COMPANY
CORPORATE OFFICE – 611 LUNKEN PARK DRIVE
CINCINNATI, OHIO 45226
(513) 321-5816
EMPLOYEE OWNED
GEOTECHNICAL, ENVIRONMENTAL AND TESTING ENGINEERS

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

AUG. 2005		FIGURE 10C



GENERALIZED SUBSURFACE CROSS SECTION

OF EXISTING I-71, I-75

5000 FT. NORTH OF KYLES LANE INTERCHANGE 189

PARK HILLS AND COVINGTON KENTUCKY

SCALE: 1" = 40' V.
1" = 200' H.

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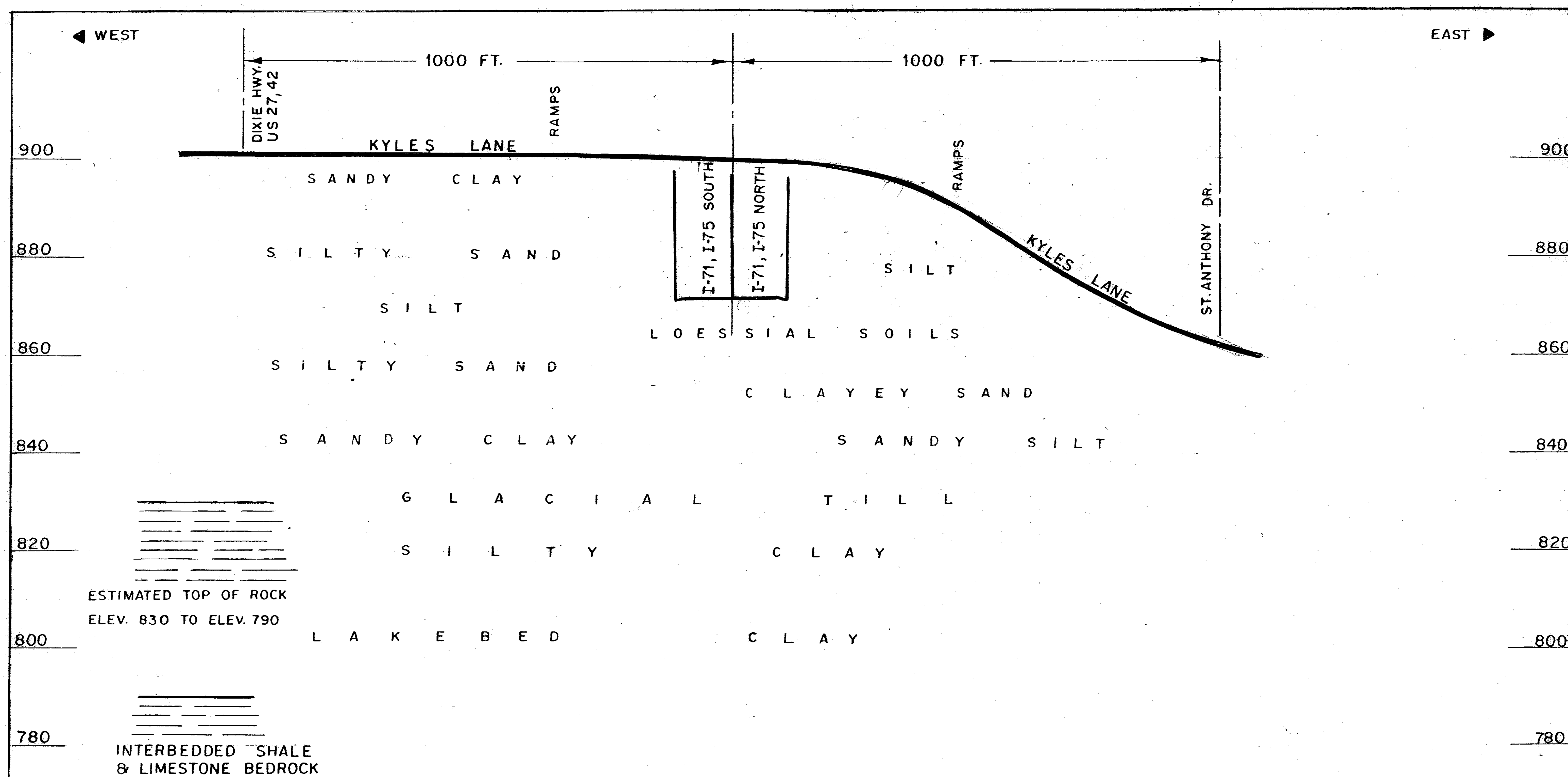
AUG. 2005

FIGURE 10D



GENERALIZED SUBSURFACE CROSS SECTION

OF EXISTING I-71, I-75 AT KYLES LANE
INTERCHANGE 189
FORT WRIGHT, KENTON COUNTY, KENTUCKY

SCALE: 1" = 20' V.
1" = 200' H.

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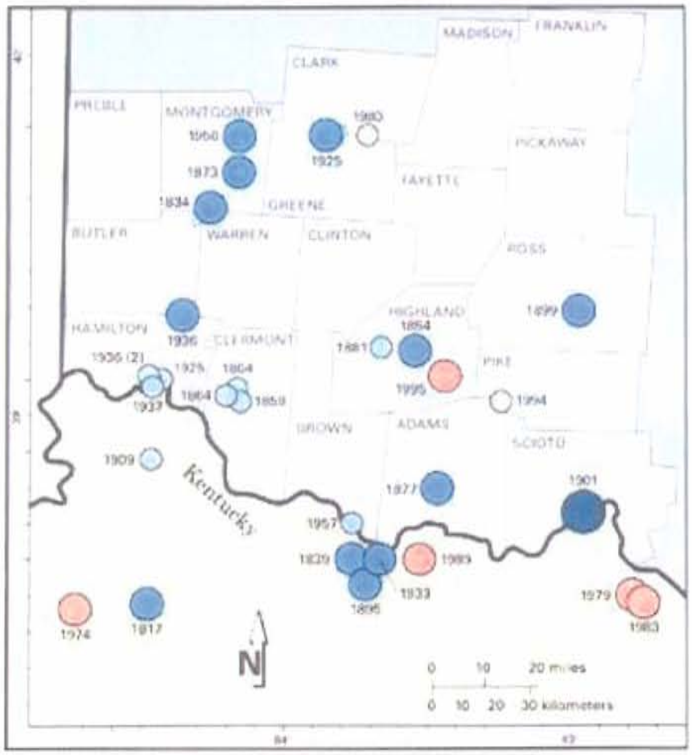
AUG. 2005		FIGURE 10E

Locations and Intensities of Historic Earthquakes, Southwestern Ohio

Source: Ohio Department of Natural Resources, Ohio Geological Survey Website
(http://www.dnr.state.oh.us/geosurvey/pdf/el09.pdf)



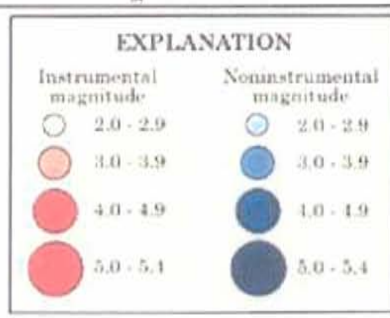


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FIGURE 11 – LOCATIONS AND INTENSITIES OF HISTORIC EARTHQUAKES, SOUTHWESTERN OHIO

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

Basement Structures in Ohio

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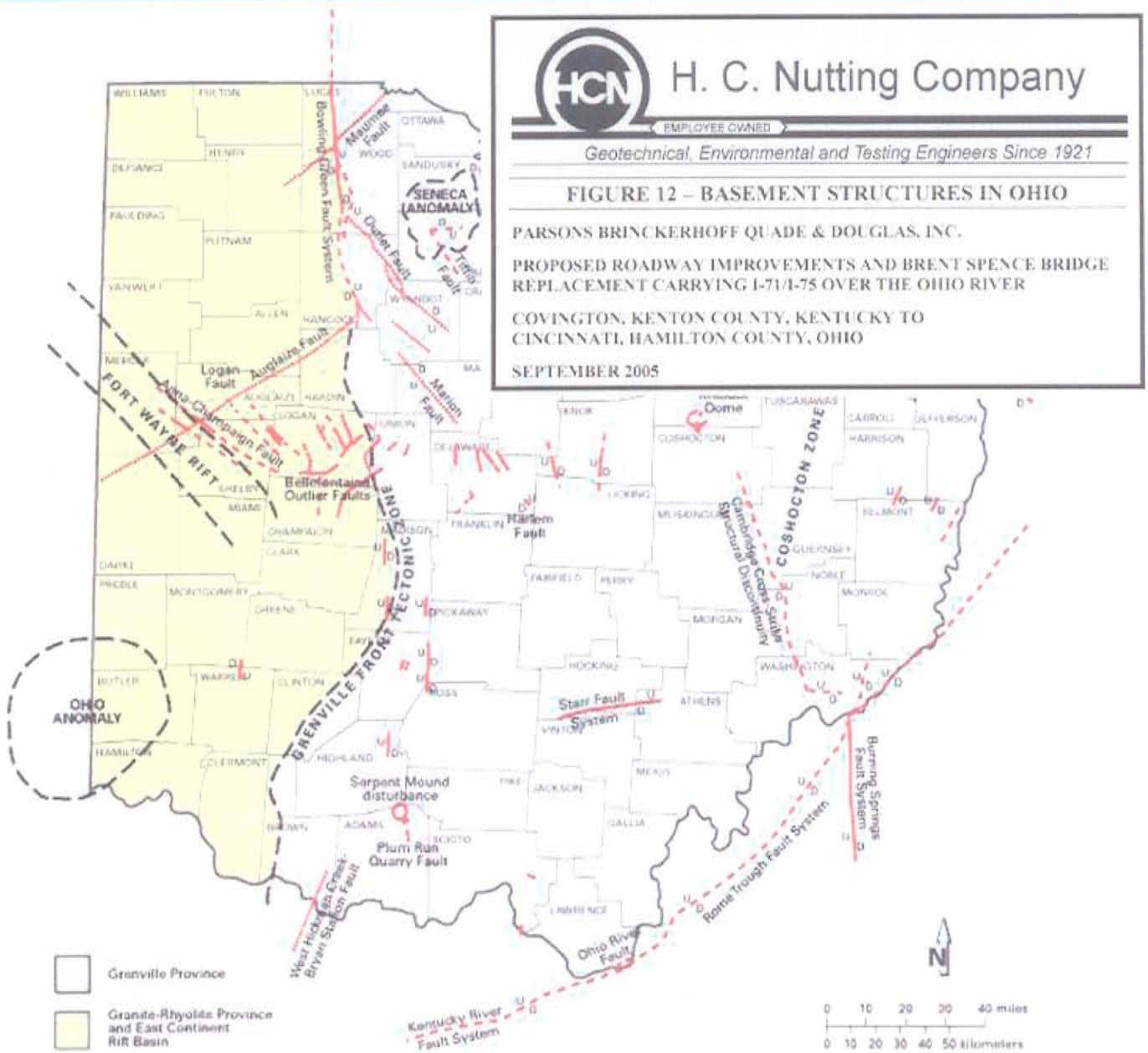
FIGURE 12 – BASEMENT STRUCTURES IN OHIO

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005



Basement structures in Ohio (modified from Division of Geological Survey Map PG-23, 2002). This map portrays a number of deep faults and other structures that have been identified by a variety of geologic studies. Some faults are well known, whereas others are speculative. Very few of them are visible at the surface. The Fort Wayne (Anna) rift in western Ohio is the site of numerous historic earthquakes.

Source: Ohio Department of Natural Resources, Ohio Geological Survey Website (http://www.dnr.state.oh.us/geosurvey/pdf/el09.pdf)

Source: U.S. Geological Survey Website
(http://earthquake.usgs.gov/hazmaps/products_data/2002/2002October/CEUS/CEUSpga2500v3.pdf)

Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
USGS Map, Oct. 2002

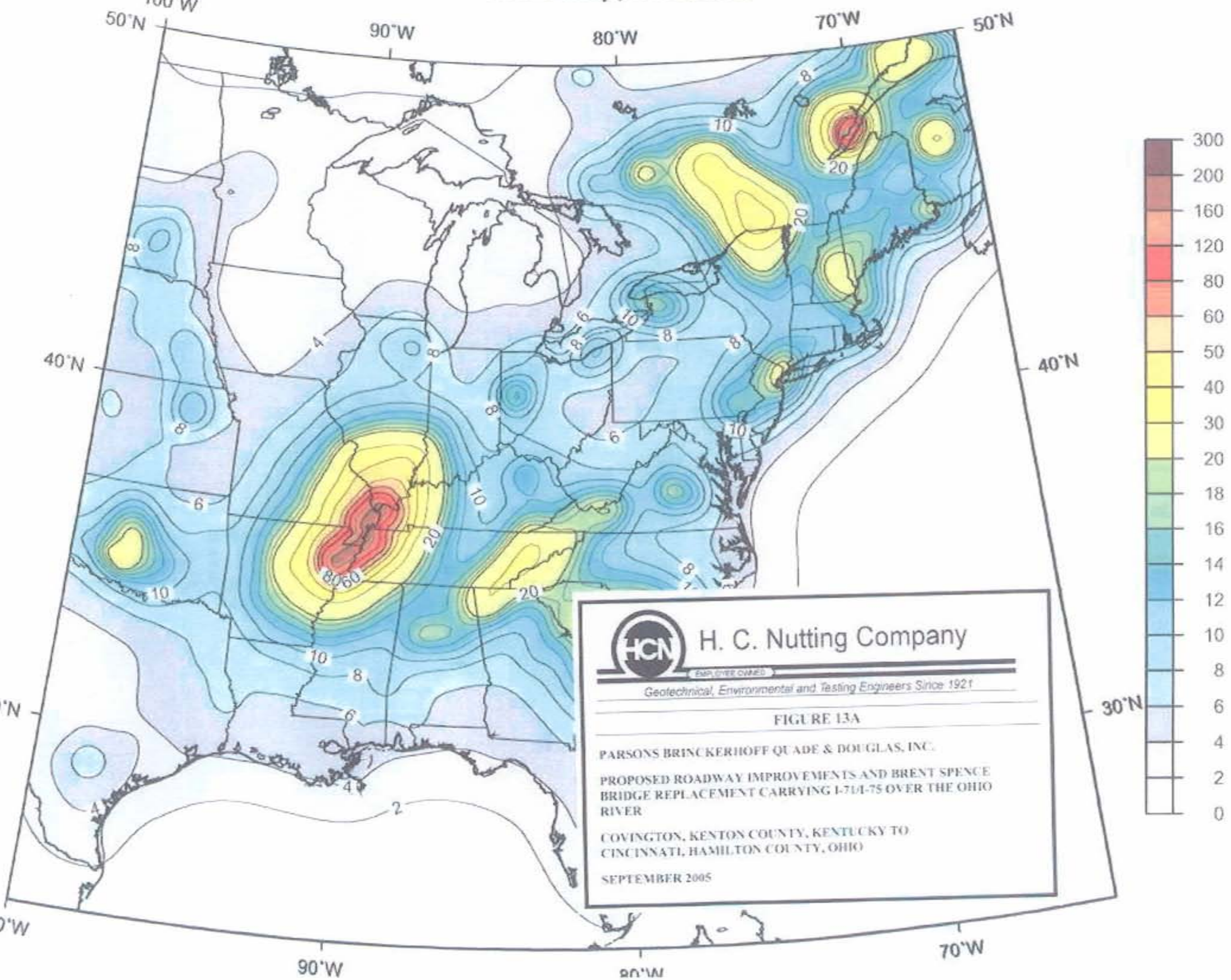


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FIGURE 13A

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

Source: U.S. Geological Survey Website
(http://earthquake.usgs.gov/hazmaps/products_data/2002/2002October/CEUS/CEUS5hz500v3.pdf)

0.2 sec SA (%g) with 10% Probability of Exceedance in 50 Years
USGS Map, Oct. 2002

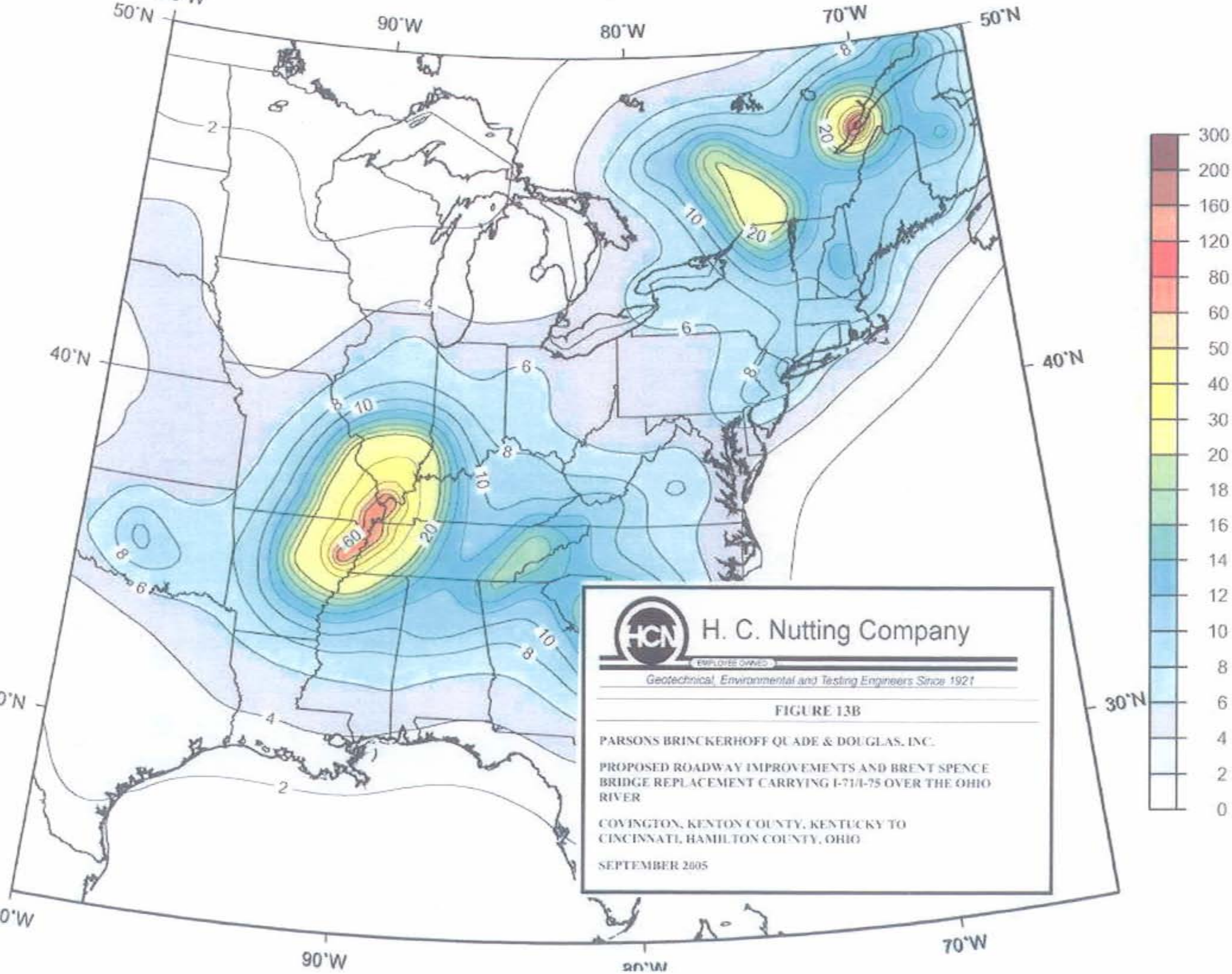

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FIGURE 13B

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

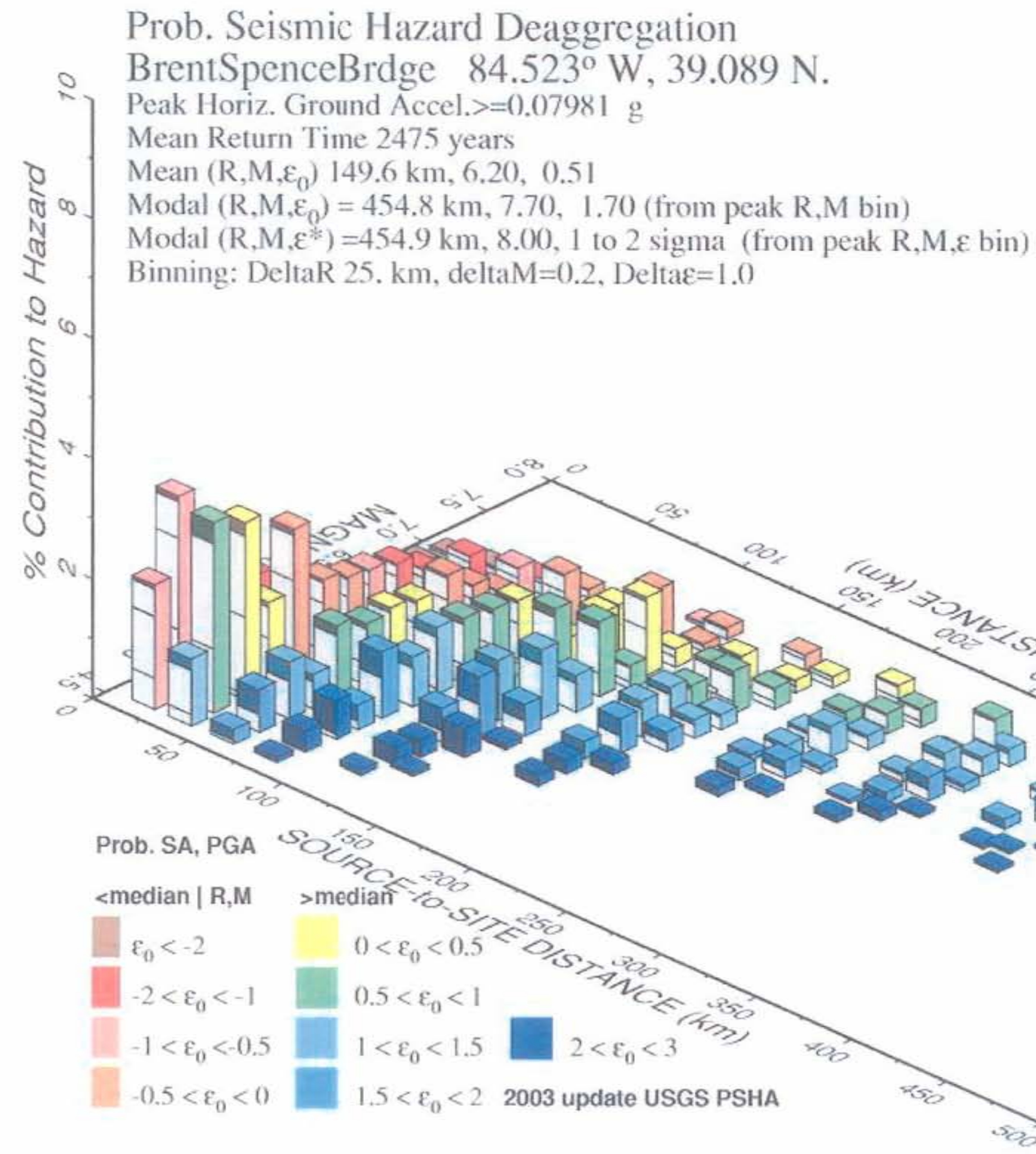

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FIGURE 14A

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

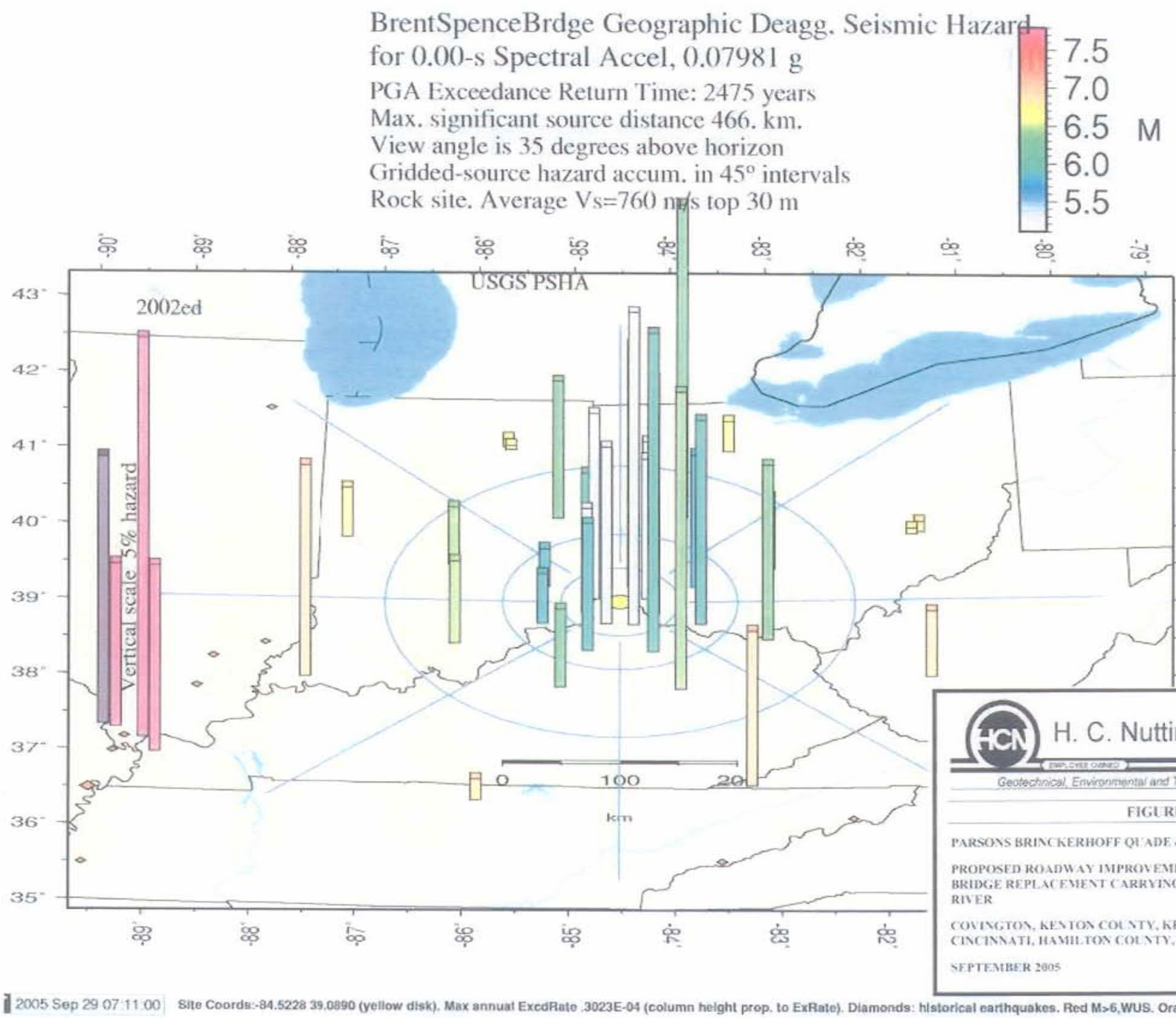

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FIGURE 14B

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

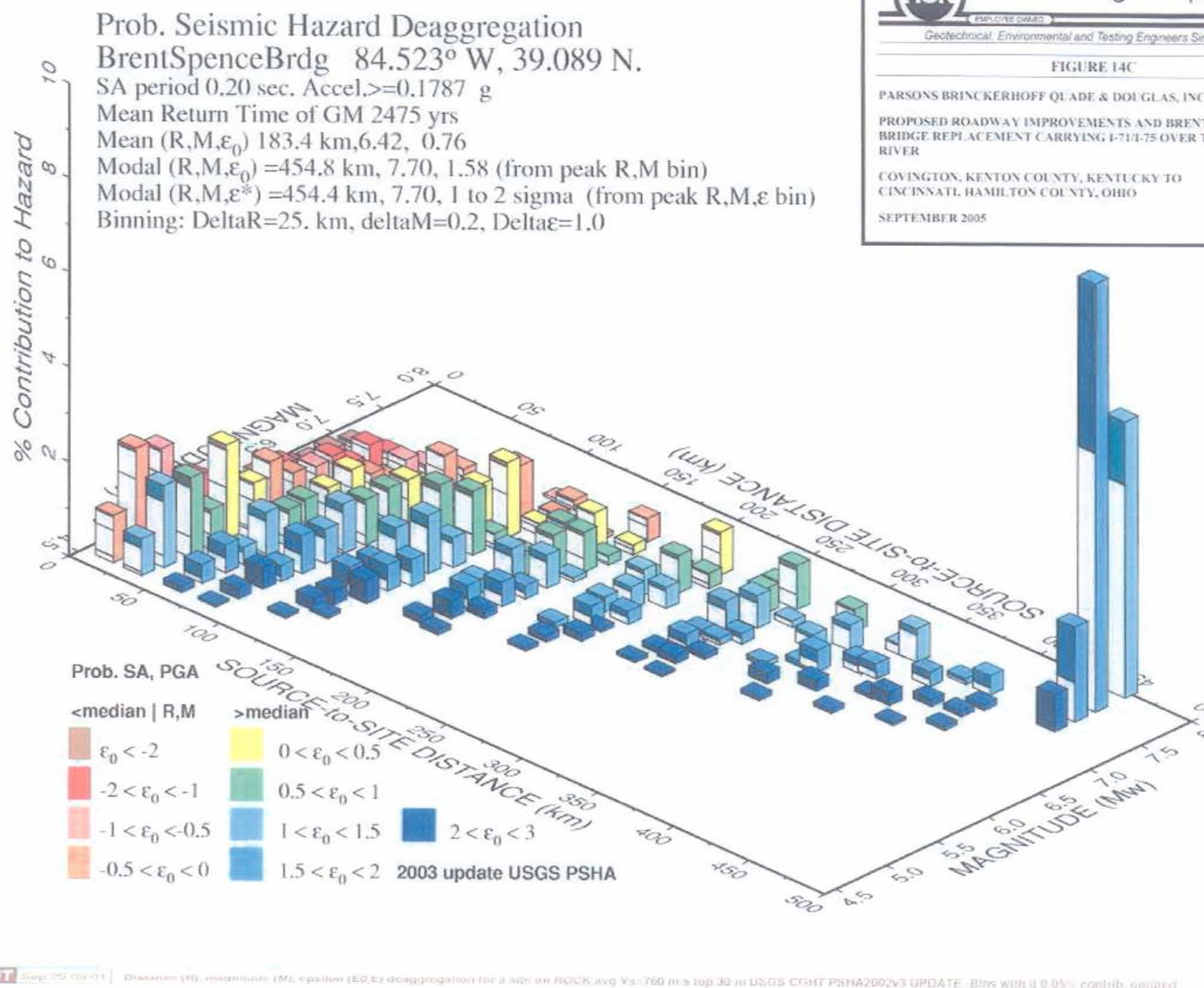

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FIGURE 14C

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

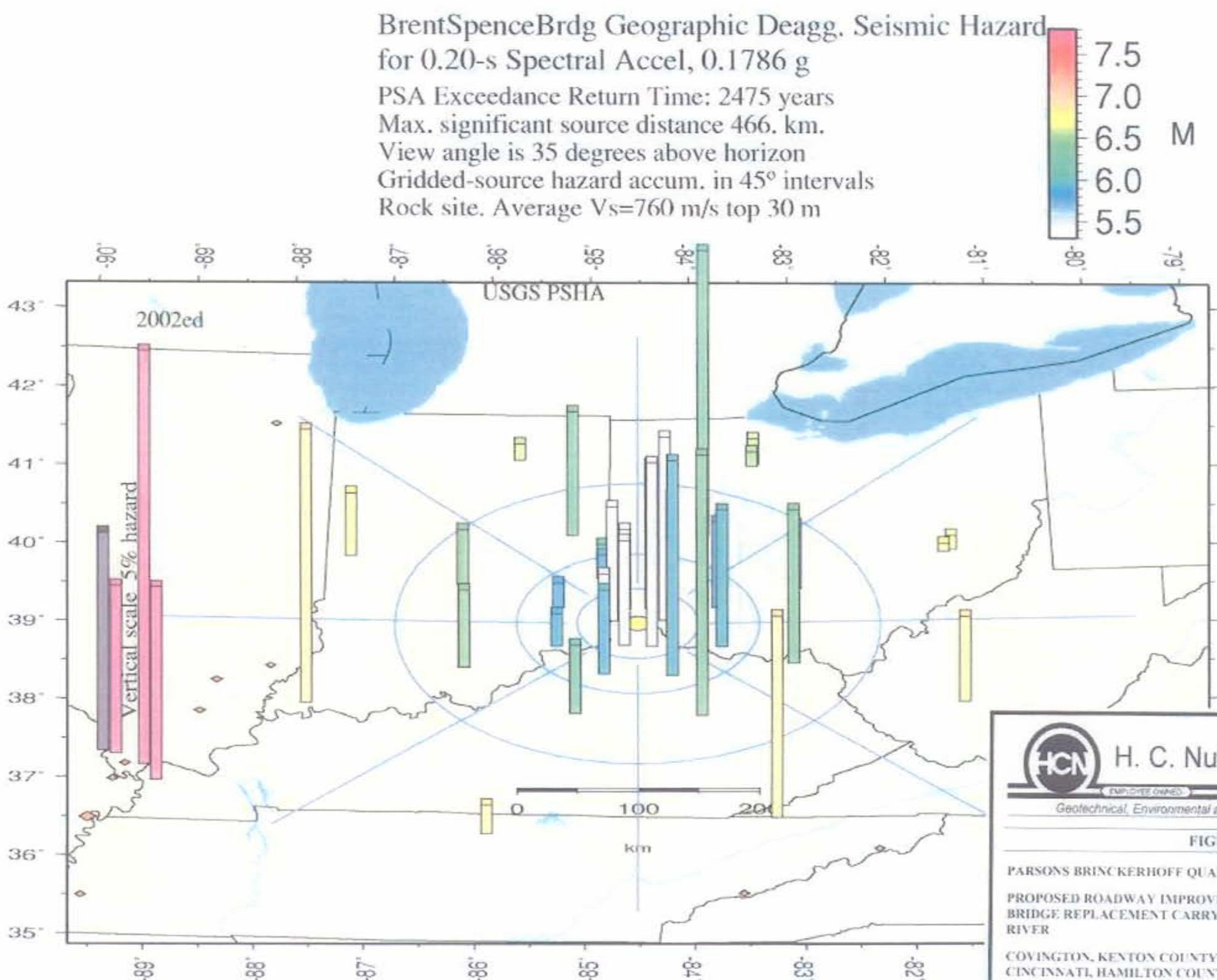

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FIGURE 14D

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

2005 Sep 29 09:01:53 Site Coords:-84.5226 39.0890 (yellow disk). Max annual ExcdRate .3826E-04 (column height prop. to ExRate). Diamonds: historical earthquakes. Red M>6,WUS. Orange M>5,CEUS

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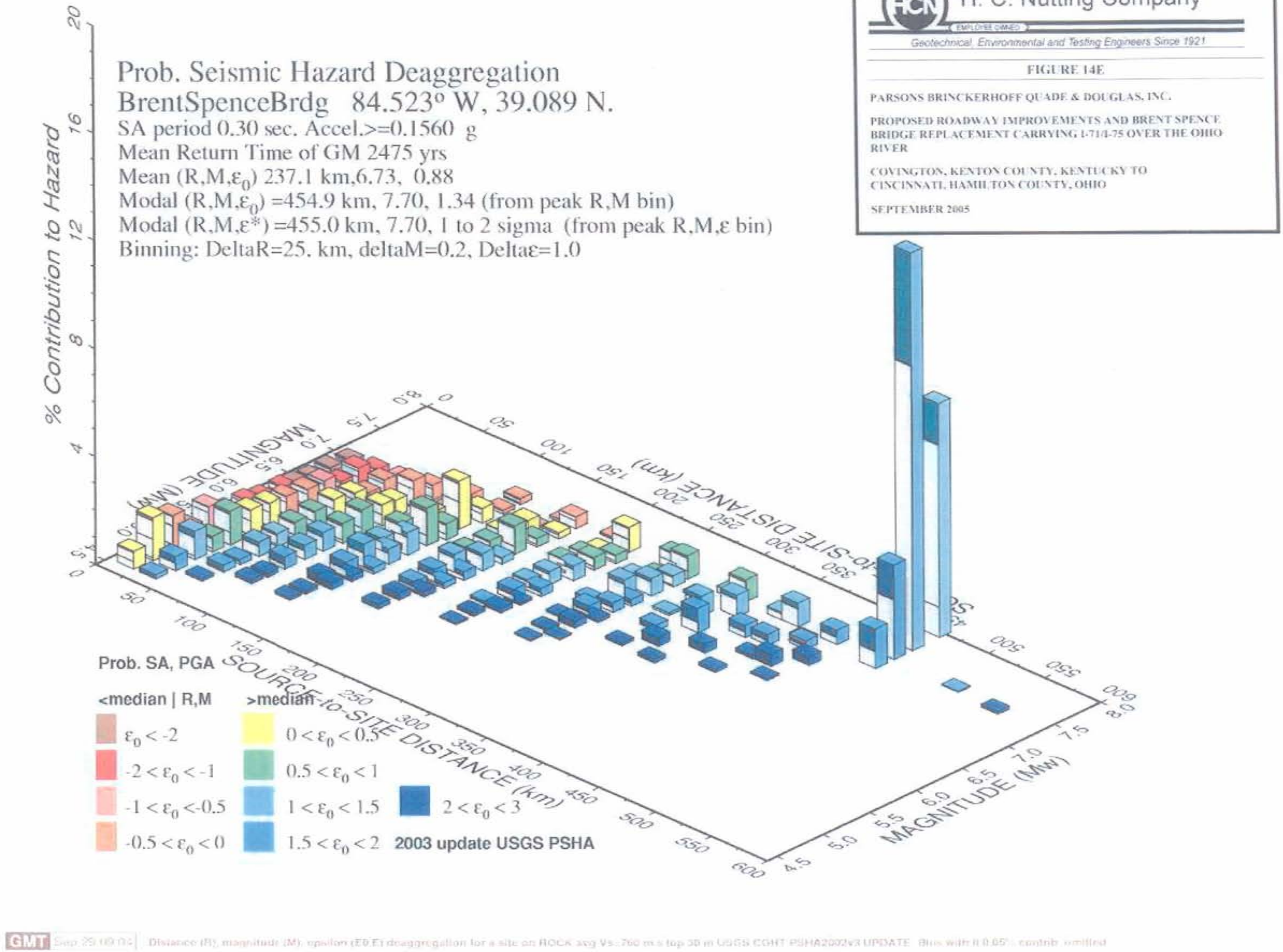
FIGURE 14E

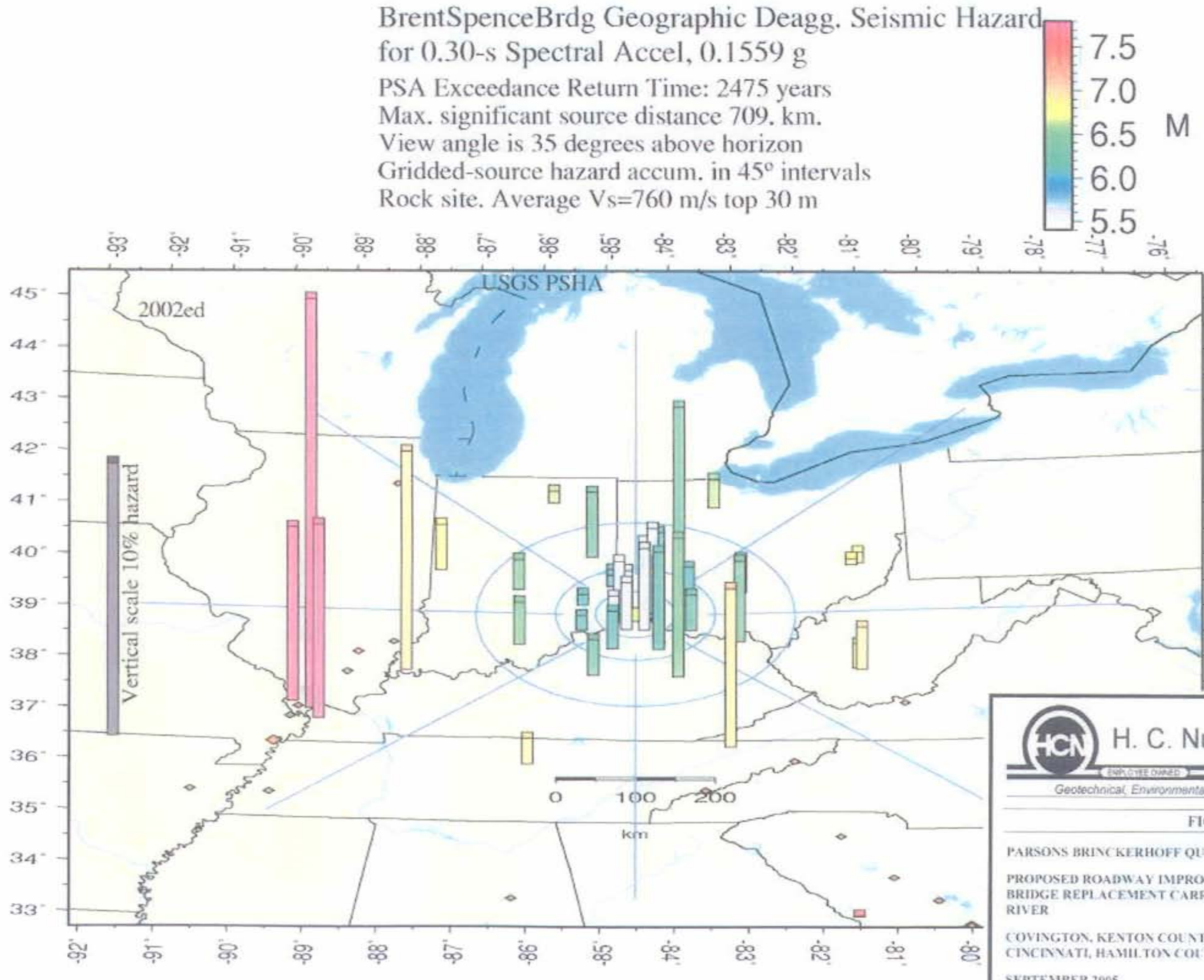
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005





2005 Sep 29 09:04:06 Site Coords:-84.5228 39.0890 (yellow disk). Max annual ExcdRate .6055E-04 (column height prop. to ExRate). Diamonds: historical earthquakes. Red M>6,WUS. Orange M>5,CEUS

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FIGURE 14F

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

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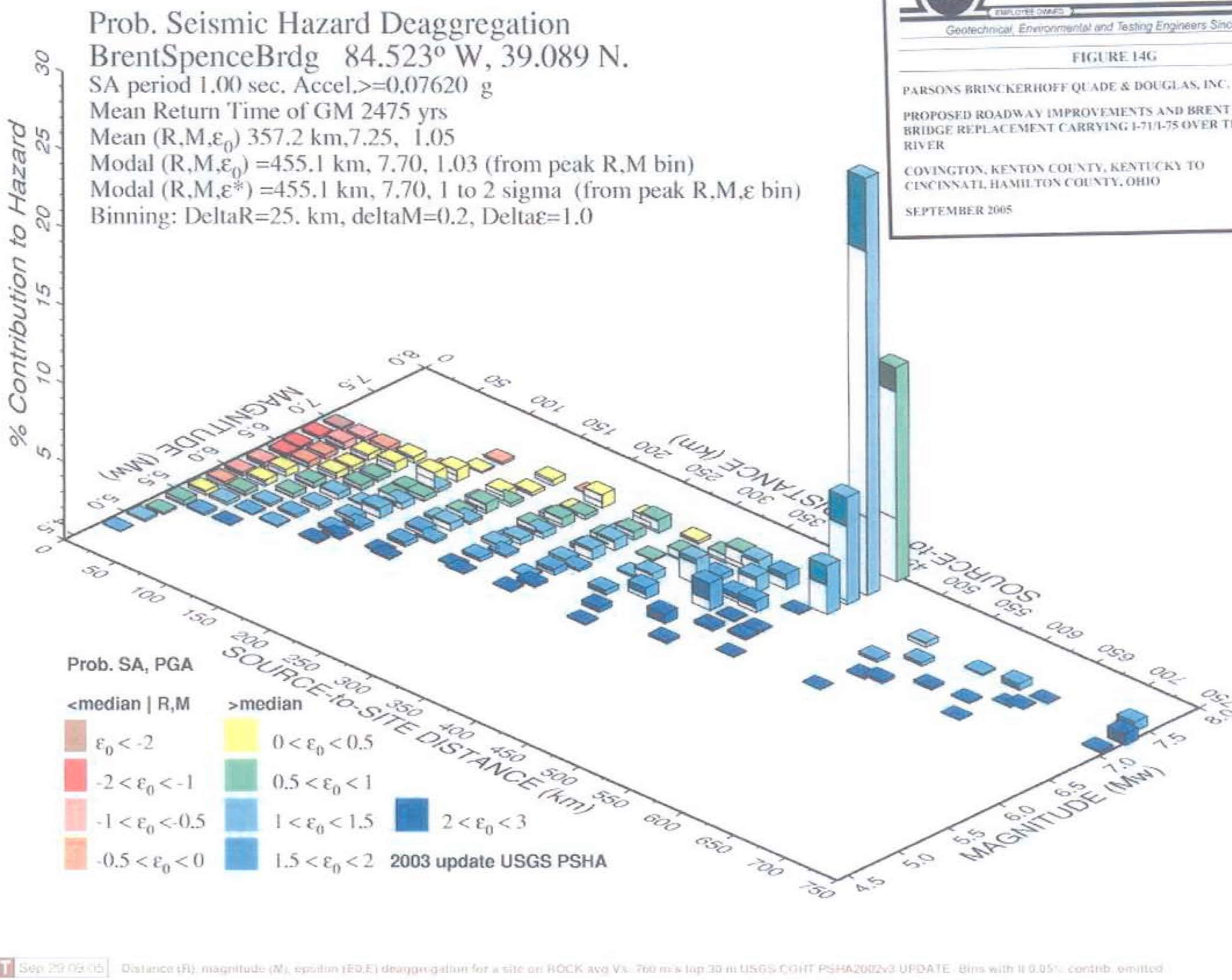
FIGURE 14G

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005



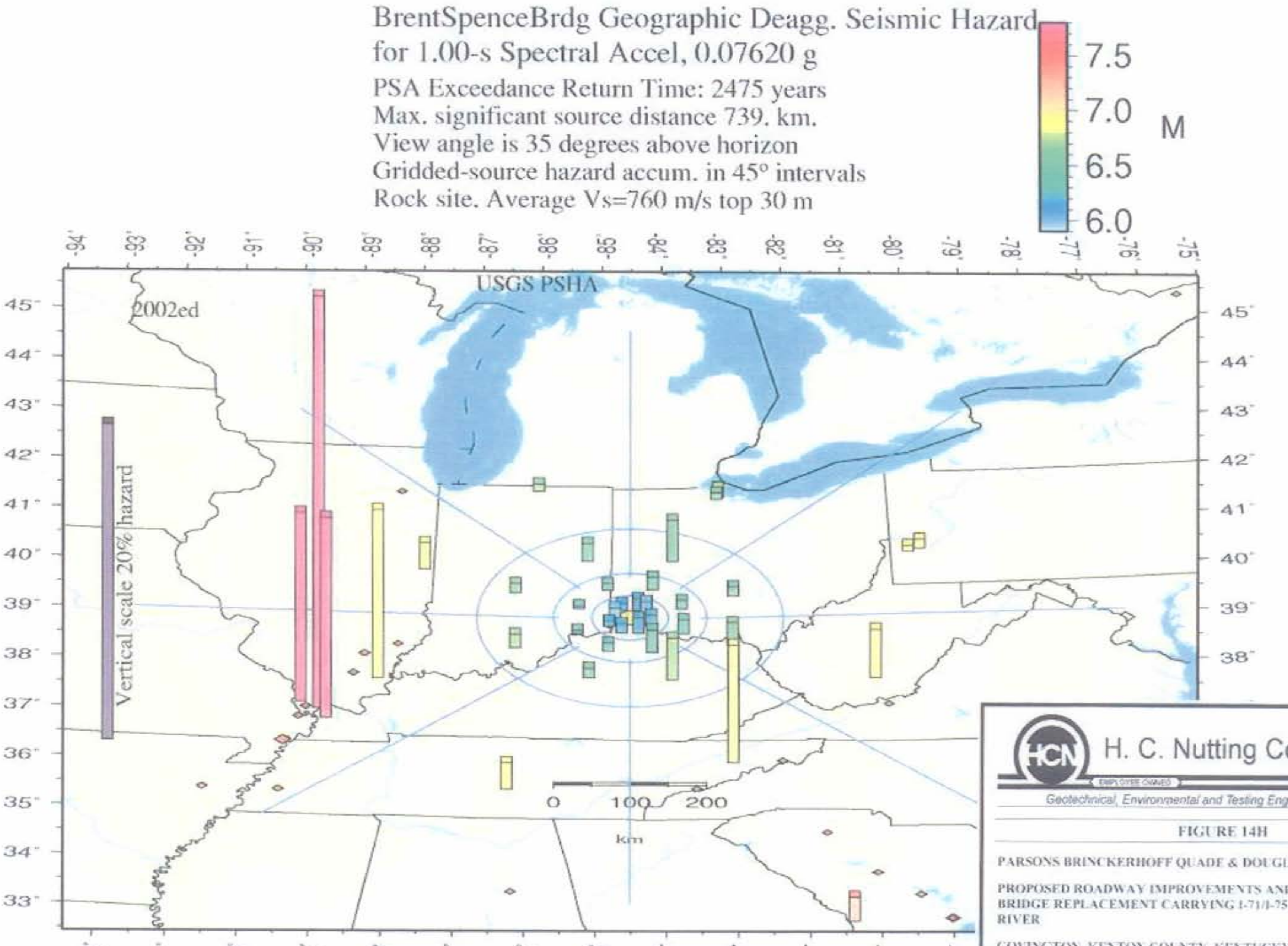


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FIGURE 14H

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

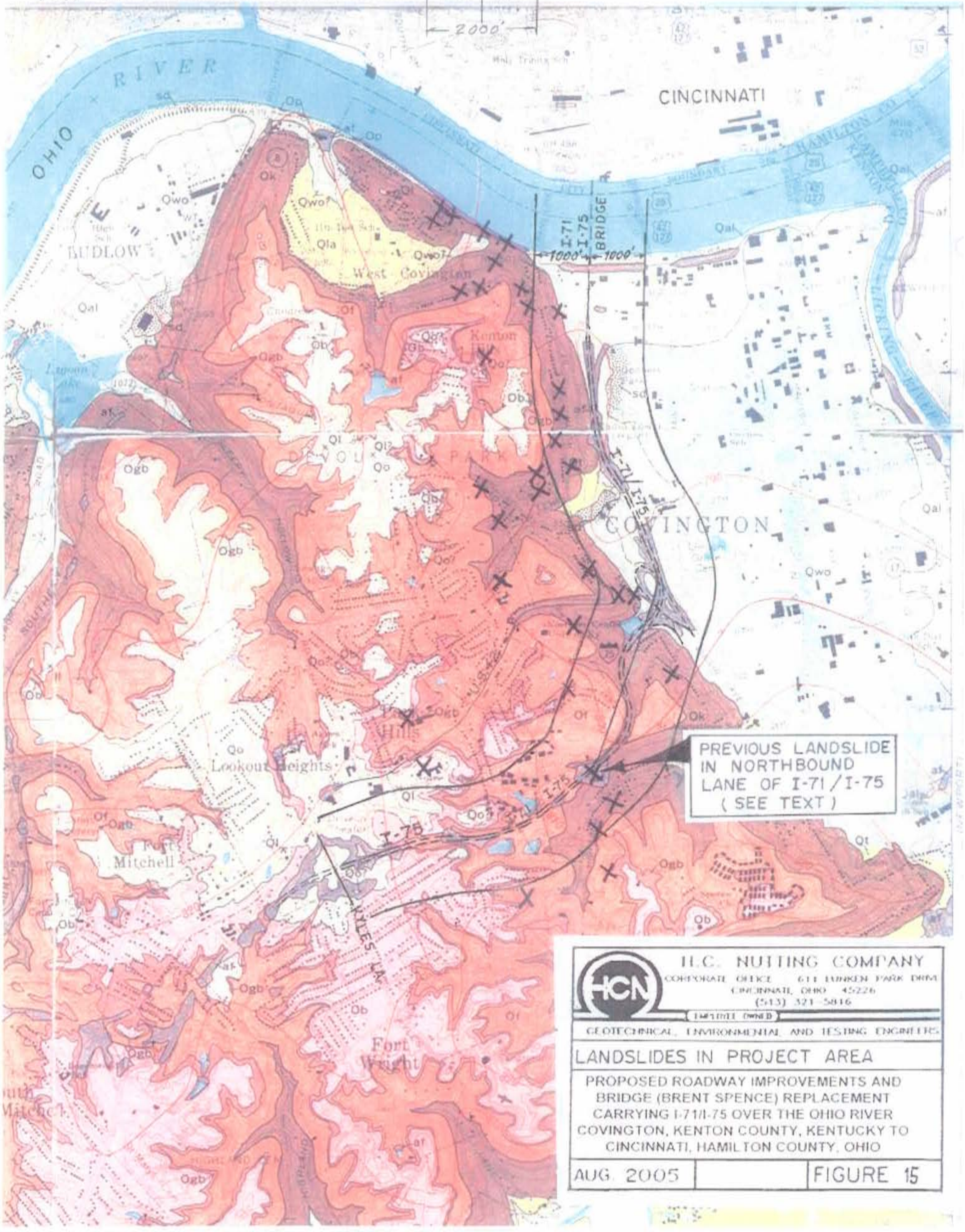
PROPOSED ROADWAY IMPROVEMENTS AND BRENT SPENCE BRIDGE REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER

COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

SEPTEMBER 2005

2005 Sep 29 09:05:58 Site Coords:-84.5228 39.0890 (yellow disk). Max annual ExcdRate .1056E-03 (column height prop. to ExRate). Diamonds: historical earthquakes. Red M>6,WUS. Orange M>5,CEUS

1961 U.S.G.S. BASE MAP - SLIGHTLY REDUCED | 1000' | 1000' | 2000'



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LANDSLIDES IN PROJECT AREA

PROPOSED ROADWAY IMPROVEMENTS AND BRIDGE (BRENT SPENCE) REPLACEMENT CARRYING I-71/I-75 OVER THE OHIO RIVER COVINGTON, KENTON COUNTY, KENTUCKY TO CINCINNATI, HAMILTON COUNTY, OHIO

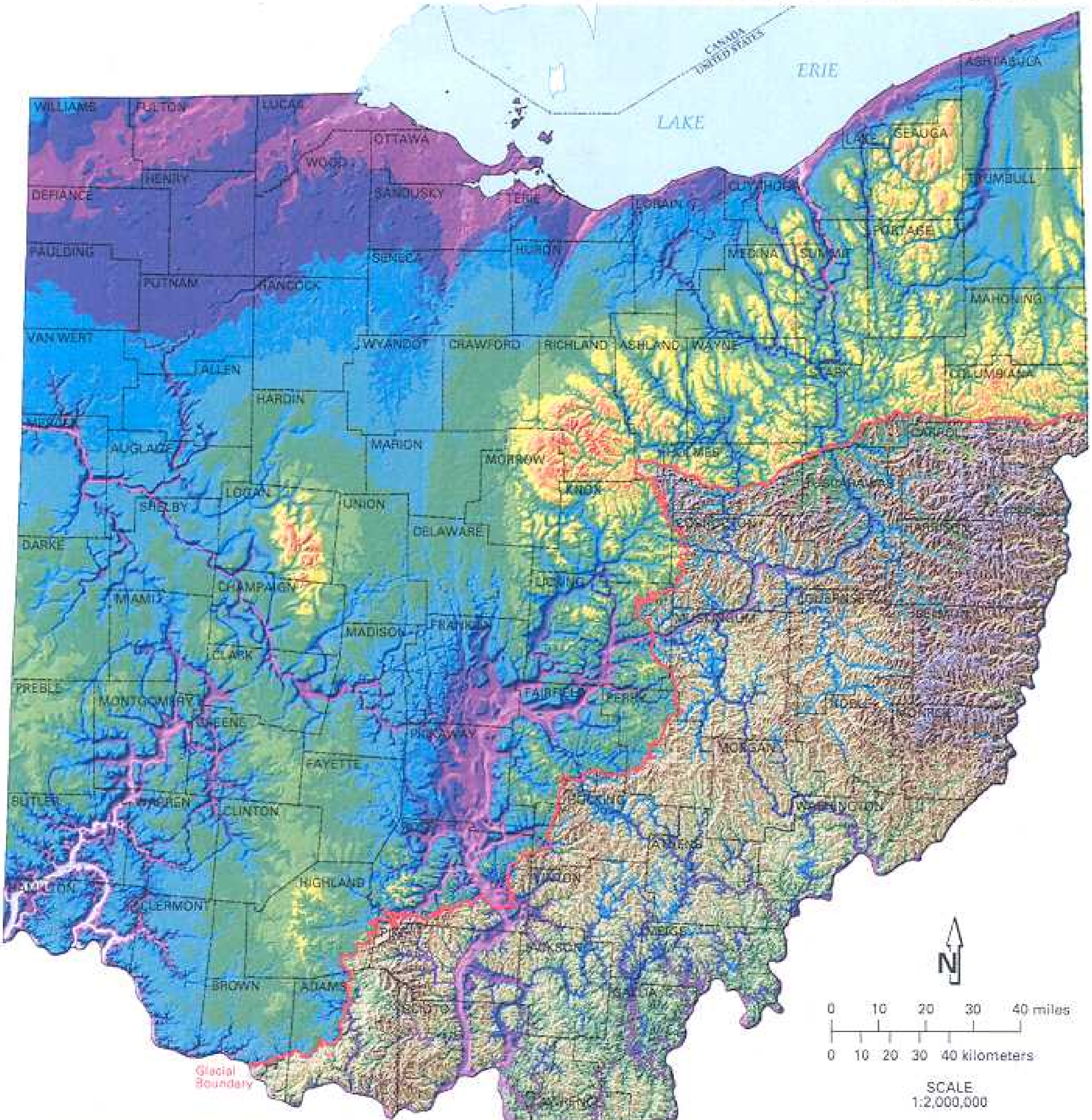
AUG. 2005		FIGURE 15

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

SHADED BEDROCK-TOPOGRAPHY MAP OF OHIO



Available as 1:500,000-scale (poster-size) print and in digital (GIS) format.
To order, contact Geologic Records Center at 614-265-6576.

Bedrock-topography	Elevation	Land surface
	1401-1500	
	1301-1400	
	1201-1300	
	1101-1200	
	1001-1100	
	901-1000	
	801-900	
	701-800	
	601-700	
	501-600	
	401-500	
	301-400	

Elevation in feet above sea level

SHADED BEDROCK-TOPOGRAPHY MAP OF OHIO

The shaded bedrock-topography map of Ohio depicts the configuration and elevation of the bedrock surface. In southeastern Ohio, the bedrock surface coincides with present-day land-surface topography and is depicted by earth-tone hues to represent elevation intervals. In glaciated western and northern Ohio, the bedrock surface is buried under mainly glacial sediments that can be several-hundred-feet thick. The land surface in this region was smoothed by glaciation (figure 1) and masks a complexly dissected, underlying bedrock surface. This dissected bedrock surface is the result of erosion before, during, and after glaciation. Spectral hues depict elevation intervals on the buried-bedrock surface and show the bedrock surface as if the overlying glacial sediment were removed.

Prior to and during glaciation, the north-flowing Teays River system dominated surface-water drainage patterns in western and southern Ohio (figure 2). Water flow direction in the main Teays valley was north from Wheelersburg (Scioto County) to Circleville (Pickaway County) and then northwest to Mercer County where the Teays Valley exited the state. Remnants of the Teays Valley are distinct on the present land surface in southern Ohio and form a continuous valley on the buried-bedrock surface across western Ohio. Modern rivers and streams still occupy portions of this valley system. Water flow in the Teays River system was disrupted by early glaciations as southward-advancing glaciers blocked outlets of the north-flowing river system. Drainageways, both large and small, were abandoned or filled with sediment as ice advanced and retreated.

In northwestern Ohio, the generally smooth buried-bedrock surface is the result of repeated scouring by glacial ice advancing westward out of the Lake Erie basin. Another distinctly scoured bedrock surface is in the Grand River Lobe (figure 2) in northeastern Ohio where smooth north-south trending valleys mirror ice-flow direction. South of the scour-dominated surface of northern Ohio, the bedrock surface has been sculpted by water to create a distinct drainage pattern (figure 2). Large volumes of glacial meltwater eroded the bedrock surface, widening and deepening existing valleys of the Teays system and creating new valleys. Some modern rivers and creeks flow in unusually wide valleys; evidence that far greater volumes of water generated from melting glaciers once flowed in these valleys. Flow direction in other valleys has been reversed as glacial ice or glacial sediments blocked formerly northward and westward flowing streams.

Southeastern Ohio is unglaciated and devoid of ice-deposited sediment (glacial till). However, many river valleys in southeast Ohio did carry glacial meltwater away from the ice front and toward the Ohio River. In the process, many of these valleys were at times made deeper by the erosive force of fast-flowing meltwater streams, and at other times partially filled with sediment. Some valleys in unglaciated Ohio contain thick deposits of clay and silt that accumulated on the bottoms of lakes that formed when glacial ice blocked the flow of rivers or when rapidly accumulating meltwater sediments blocked the mouths of rivers.

This map is one of the results of a 7-year effort by the ODNR, Division of Geological Survey to map the bedrock geology of Ohio. Bedrock-topography maps are essential to producing accurate bedrock-geology maps of glaciated Ohio and of partially buried valleys beyond the glacial limit. Bedrock-topography maps were created for all 788 7.5-minute topographic quadrangles in the state and are available from the Division's Geologic Records Center. Some pre-existing county bedrock-topography maps (1:62,500 scale) and data were photographically enlarged to 1:24,000 scale, revised, and utilized in the compilation of 1:24,000-scale, bedrock-topography maps. Data concentration and contour intervals on the original maps vary widely across the state in response to changing geologic and topographic conditions. Data consists mainly of water-well logs on file at the ODNR, Division of Water, supplemented by outcrop data, Ohio Department of Transportation bridge-boring data, and oil-and-gas-well data.

Elevation contours and over 158,000 data points from the 788 bedrock-topography maps were digitized and compiled for the glaciated portions of the state and for the major valleys beyond the glacial boundary containing significant accumulations of sediment deposited during and after glaciation. The bedrock-topography contours were digitally converted in the ARC GIS environment into a continuous grid model (60 meter grid spacing). This surface was shaded from the northwest slightly above the horizon to produce the appearance of a three-dimensional surface.

The land surface represents the topography of the bedrock surface in southeastern Ohio (excluding valleys beyond the glacial boundary) and in some glaciated areas near the glacial limit where meltwater sediments are thin or absent. Land-surface topography is based largely on data derived from the U.S. Geological Survey's National Elevation Dataset (30 meter grid spacing).

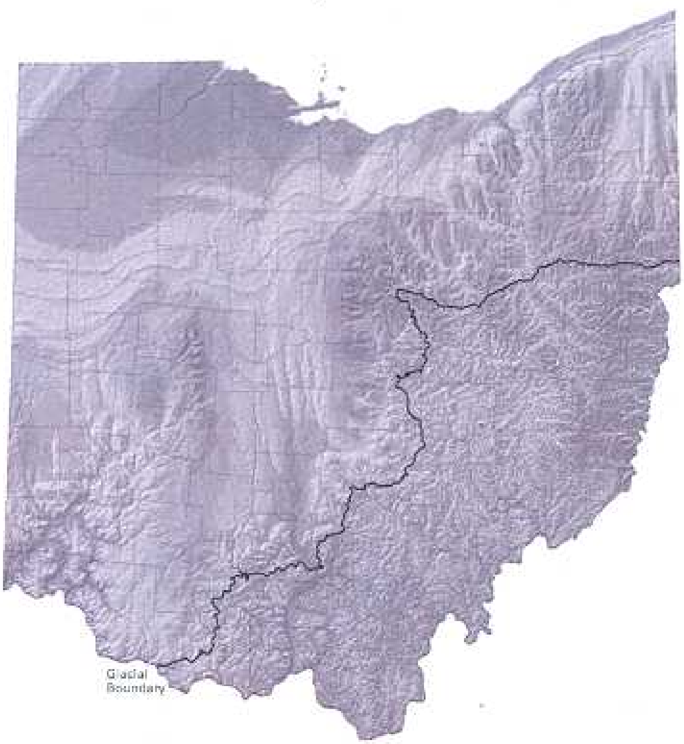


FIGURE 1.—Shaded elevation map of Ohio with the glacial boundary. Note the smooth landscape of glaciated northern and western Ohio compared to the high-relief landscape of unglaciated southeastern Ohio.

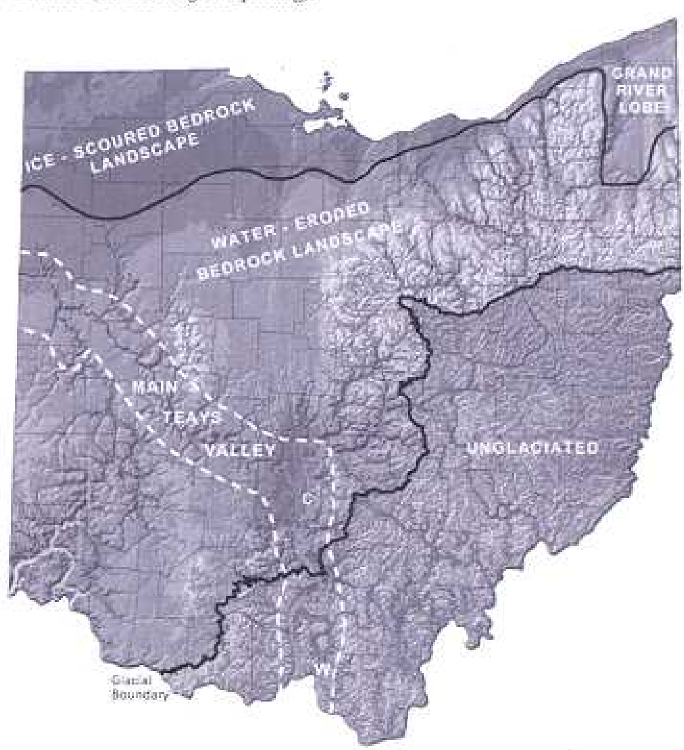
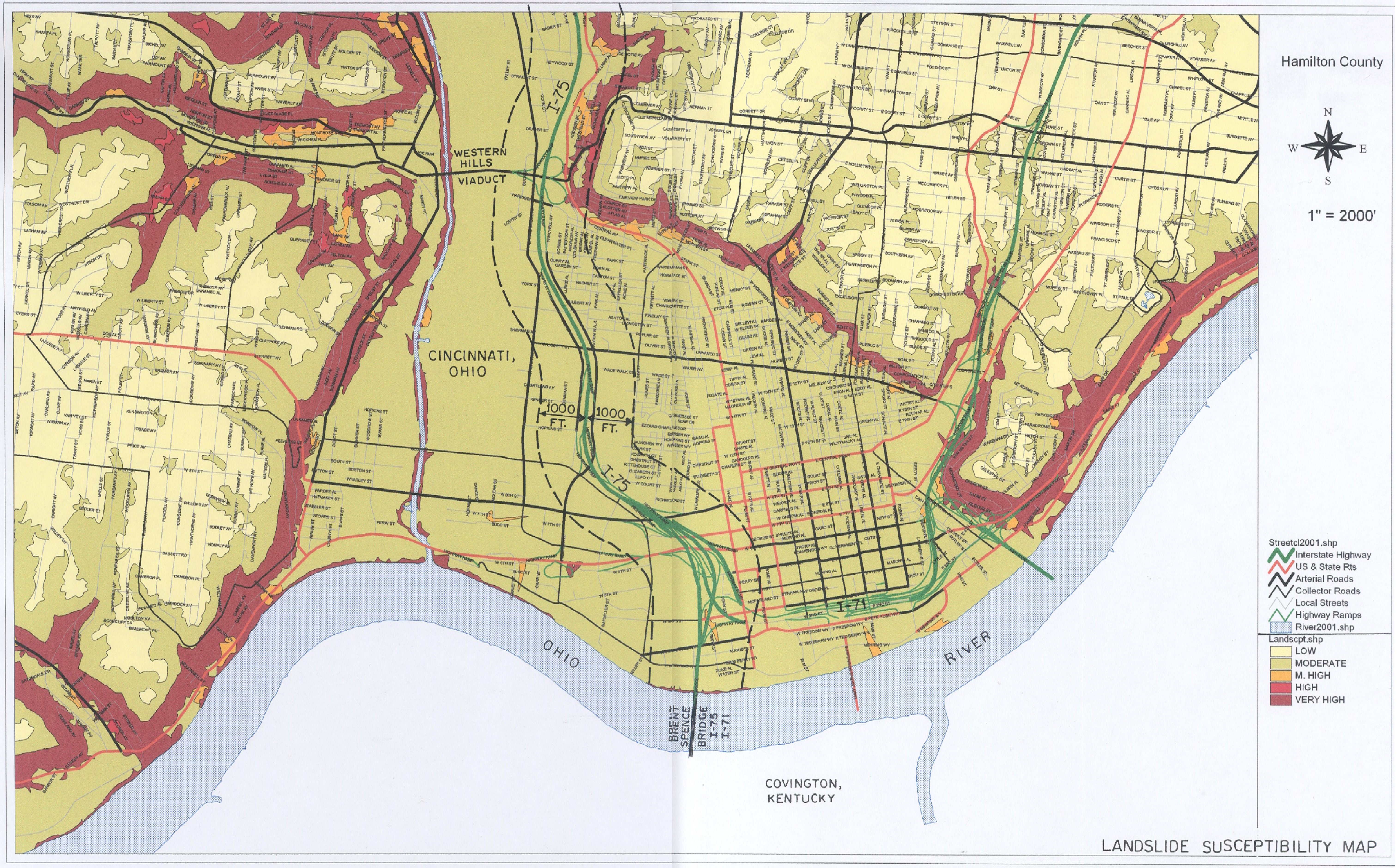


FIGURE 2.—Bedrock-topography map of Ohio showing the extent of the main Teays valley, the unglaciated portion of the state, and the ice-scoured and water-eroded portions of glaciated Ohio (C = Circleville, W = Wheelersburg).


Hamilton County
N
S
E
W
1" = 2000'
WESTERN HILLS VIADUCT
I-75
CINCINNATI, OHIO
1000 FT.
1000 FT.
I-75
I-71
OHIO
RIVER
BRENT SPENCE BRIDGE I-75 I-71
COVINGTON, KENTUCKY
Streetcl2001.shp
Interstate Highway
US & State Rts
Arterial Roads
Collector Roads
Local Streets
Highway Ramps
River2001.shp
Landscpt.shp
LOW
MODERATE
M. HIGH
HIGH
VERY HIGH
LANDSLIDE SUSCEPTIBILITY MAP