









Table with columns: Rank, Distance, and 100+ columns of Route IDs (e.g., ROUTE 1, ROUTE 2, ROUTE 3, etc.). The routes are organized in a grid-like pattern across the columns.

Route ALU = Route 1  
Route AAW = Route 2

Mill Creek - Hardin County 245 AV Line  
Sensitivity Analysis















**DEPARTMENT OF THE ARMY**  
HEADQUARTERS, US ARMY GARRISON  
FORT KNOX, KENTUCKY 40121-5000

DAD G O 2005

REPLY TO  
ATTENTION OF:

Directorate of Public Works

Mark S. Johnson  
Director, Transmission  
LG&E Energy LLC  
P.O. Box 32020  
Louisville, Kentucky 40232

Dear Mr. Johnson:

The three electric transmission routes proposed in your letter of September 28 have been evaluated. I concur with Route #2, following the existing gas line south to the Tip Top substation and the south side of US 60 West to the installation boundary. This route has little to no adverse impact to current or future training at Fort Knox. Proposed routes are identified on attached map.

Proposed Route #1 south of US 60 would segment a major maneuver training area causing significant adverse impact to current and future training and therefore is not acceptable.

Proposed Route #3 is parallel to US 31W on the west side from Muldraugh south to the installation boundary. The height of the electric line and support towers would significantly increase the safety risk factor for rotary and fixed wing aircraft operating from Godman Army Airfield and therefore is not acceptable.

Proposed Route #2 is the recommended route, and no other routes would be agreeable to Fort Knox.

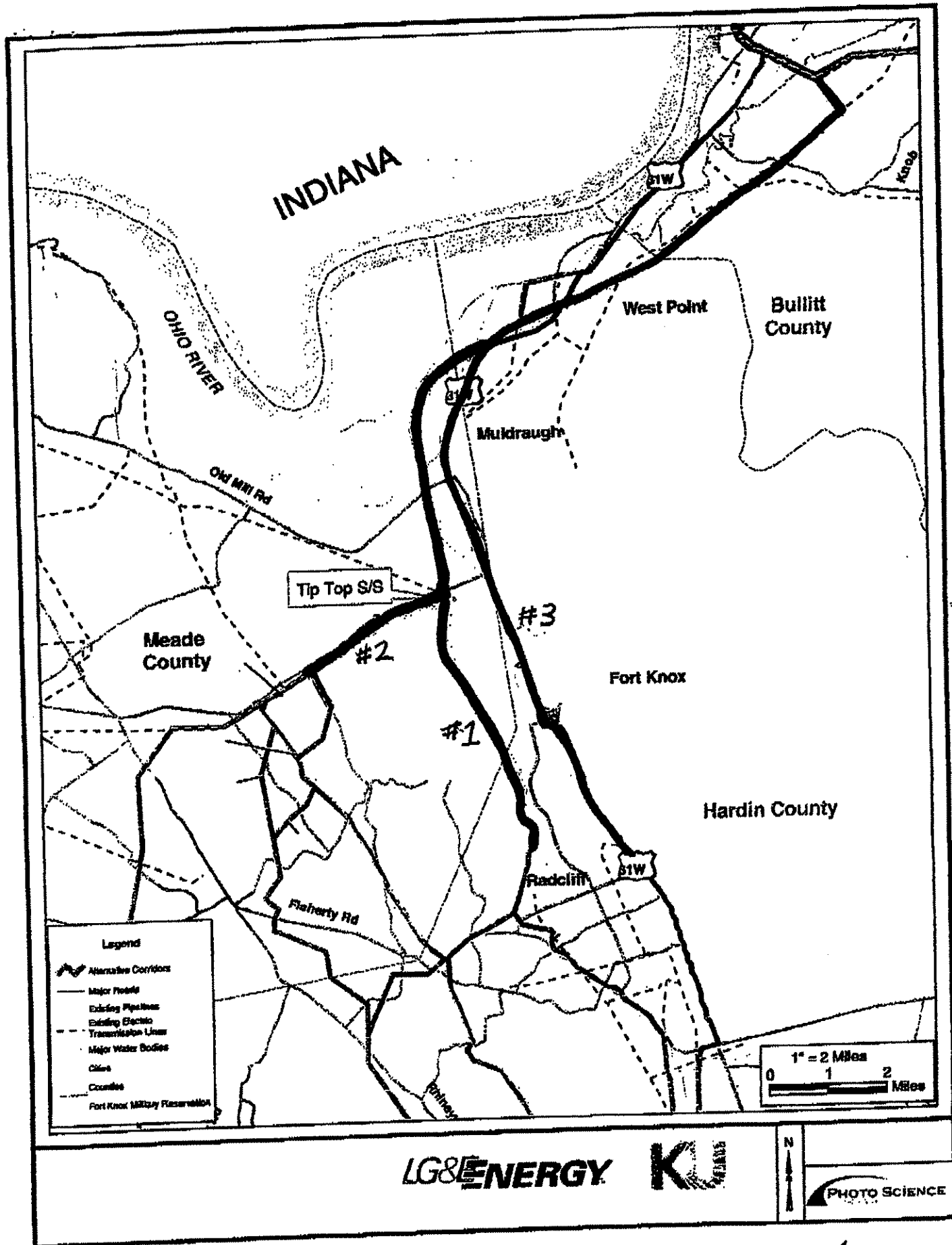
This evaluation should satisfy the Public Service Commission's requirement and allow your project to continue.

Please contact Mr. Bill W. Hickok, 502-624-8515, if you have any questions.

Sincerely,

Mark D. Needham  
Colonel, US Army  
Garrison Commander

Enclosure



LG&E ENERGY



PHOTO SCIENCE

Enclosure

**From:** McKay, Gregory A LRL [mailto:Gregory.A.McKay@lrl02.usace.army.mil]  
**Sent:** Monday, November 14, 2005 4:47 PM  
**To:** Winkler, Michael  
**Cc:** Devine, Lee Anne LRL  
**Subject:** Tree clearing in transmission line right-of-way

Mr. Winkler,

This is a follow-up to our previous conversations about tree clearing along proposed aerial transmission line corridors that cross federally jurisdictional wetlands. To reiterate, any discharge of dredged or fill material into waters of the U.S., including wetlands, will require a Department of the Army (DA) permit under Section 404 of the Clean Water Act. Similarly, any project involving a crossing of a navigable waterway requires a permit under Section 10 of the Rivers and Harbors Act.

Per our discussions, it is my understanding that you intend to avoid impacts involving the discharge of dredged or fill material in all of the wetlands located along the proposed transmission line corridors. Your projects will require tree clearing within the wetlands but would be limited to *felling trees and cutting other vegetation only to ground level*. A DA permit is not required in these circumstances, provided no mechanized land clearing is necessary and the sites can be accessed using low ground pressure equipment or construction mats (i.e. no fill is necessary to construct access roads or work platforms). *It is my recommendation that all felled trees and other vegetation be left in place where it falls*. No windrowing or brush piles should be created. If you determine that it is not possible to complete the project in this manner, you should contact me for further evaluation of the project.

Please contact me if you have any questions or need further clarification.

**Greg McKay**  
**Biologist**  
**US Army Corps of Engineers**  
**Louisville District**  
**PO Box 59**  
**Louisville, KY 40201**

**Phone (502) 315-6685**  
**Fax (502) 315-6677**

**COMMONWEALTH OF KENTUCKY**

**BEFORE THE PUBLIC SERVICE COMMISSION**

**In the Matter of:**

<b>APPLICATION OF LOUISVILLE</b>	)	
<b>GAS AND ELECTRIC COMPANY AND</b>	)	
<b>KENTUCKY UTILITIES COMPANY FOR</b>	)	
<b>A CERTIFICATE OF PUBLIC CONVENIENCE</b>	)	<b>CASE NO.</b>
<b>AND NECESSITY FOR THE CONSTRUCTION</b>	)	<b>2005-00472</b>
<b>OF ALTERNATIVE TRANSMISSION FACILITIES</b>	)	
<b>IN JEFFERSON, BULLITT, MEADE AND</b>	)	
<b>HARDIN COUNTIES, KENTUCKY</b>	)	

**DIRECT TESTIMONY OF  
BRANDON GRILLON  
E.ON U.S. SERVICES INC.**

**Filed: December 22, 2005**

1 **Q. Please state your name, position and business address.**

2 A. My name is Brandon Grillon. I am Senior Transmission Engineer for E.ON U.S.  
3 Services, Inc. on behalf of Louisville Gas and Electric Company (“LG&E”) and  
4 Kentucky Utilities Company (“KU”) (collectively the “Companies”). My  
5 business address is One Quality Street, Lexington, Kentucky 40507. My  
6 background and work experience are described in Appendix A.

7 **Q. What is the purpose of your testimony?**

8 A. The purpose of my testimony is to describe how data was gathered and analyzed  
9 in connection with the process by which the Companies evaluated potential routes  
10 for the proposed transmission facilities in this proceeding.

11 **Q. Please describe how the Companies gathered data for the analysis of the  
12 alternative routes for the line that is the subject of this proceeding.**

13 A. As Mr. Johnson states in his testimony, we identified an area of inquiry that is  
14 bounded by the easternmost and westernmost routes with approximately 100%  
15 collocation. Those routes may be seen as the outer routes on Application Exhibit  
16 4. We were able to use the USGS topographic quadrangle maps, aerial  
17 photography, GIS information from publicly available resources such as the  
18 Kentucky Division of Geographic Information, National Park’s National Registry  
19 of Historic Places, and digital parcels from the county property valuation  
20 administrator offices, and heads up digitized data from the aerial photography  
21 collected by Photo Science, Inc. in connection with Case No. 2005-00142 to  
22 prepare the maps and evaluate the routes. We identified 1,203 routes within the  
23 area of inquiry.

1 **Q. After the potential routes were identified what was done?**

2 A. After identifying the routes, data was compiled on each of these routes by Photo  
3 Science. We estimated the percent of each route that would be collocated with  
4 other transmission lines, pipelines or roads through the heads up digitization of  
5 aerial photography, field visits, and available GIS data from the Commission.  
6 That information was compiled in a spreadsheet for comparison purposes and is  
7 designated as Exhibit MSJ-1.

8 **Q. What was the next step in the process?**

9 A. We made cost estimates of the routes. We used historical construction and  
10 material data along with recently quoted material and labor prices to estimate the  
11 costs of the lines evaluated. In these estimates we also made the assumption of  
12 using 100% of fair market value according to public records in the property  
13 valuation administrators' offices to estimate the values of the easements for route  
14 comparison purposes only. That information was compiled in the spreadsheet  
15 designated as Exhibit MSJ-1 for comparison purposes.

16 **Q. With whom did you work in compiling and evaluating the data described  
17 above?**

18 A. I worked with the Companies' transmission line services personnel, real estate  
19 and right of way, environmental affairs and regulatory personnel and Photo  
20 Science, Inc. compiling and evaluating data for the Companies' decision-making  
21 process. In addition, I compiled data for Clayton M. Doherty, a contractor with  
22 Photo Science who also prepared a report that is filed in this proceeding and that  
23 contains an additional analysis of the route selection process.



1 **Q. Did Mr. Doherty include the data that you helped to gather in his Report?**

2 A. Yes. The data for all 1,203 routes is included in a CD Appendix to Mr. Doherty's  
3 Report.

4 **Q. Have the Companies determined the type of transmission structures that will  
5 be utilized in the construction of the line?**

6 A. Yes. Application Exhibit 3 contains diagrams of the typical types of structures  
7 that we anticipate using on this project. The structure required at any location  
8 along the route is primarily driven by the angle between the line "coming into"  
9 the tower and the line "going out of" the tower. To state it in non-technical terms,  
10 tighter turns require stronger towers. Exhibit 3 shows different structures for the  
11 typical tension tower, the typical large angle tower, and the typical tangent tower  
12 that we expect to utilize at various junctures along the route.

13 **Q. Does this conclude your testimony?**

14 A. Yes, it does.

15

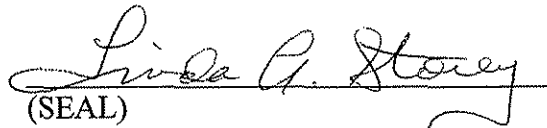
VERIFICATION

COMMONWEALTH OF KENTUCKY )  
 ) SS:  
COUNTY OF FAYETTE )

The undersigned, Brandon Grillon, being duly sworn, deposes and says he is Senior Transmission Engineer for E.ON U.S. Services, Inc., that he has personal knowledge of the matters set forth in the foregoing testimony, and the answers contained therein are true and correct to the best of his information, knowledge and belief.

  
\_\_\_\_\_  
Brandon Grillon

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 19 day of December, 2005.

  
\_\_\_\_\_  
(SEAL)  
Notary Public

My Commission Expires:  
March 24, 2009

## **Appendix A**

### **Benjamin Brandon Grillon**

Senior Transmission Engineer  
E.ON U.S. Services, Inc.  
One Quality Street  
Lexington, Kentucky 40507

#### **Education and Certifications**

University of Kentucky, B.S. in Civil Engineering – 1998  
Professional Engineering Certification – 2003

#### **Previous Positions**

Messer Construction Company, Lexington, Kentucky  
1998-1999 Project Engineer

Kentucky Utilities Company, Lexington, Kentucky  
1995-1998 Student Engineer

**COMMONWEALTH OF KENTUCKY**  
**BEFORE THE PUBLIC SERVICE COMMISSION**

**In the Matter of:**

<b>APPLICATION OF LOUISVILLE</b>	)	
<b>GAS AND ELECTRIC COMPANY AND</b>	)	
<b>KENTUCKY UTILITIES COMPANY FOR</b>	)	
<b>A CERTIFICATE OF PUBLIC CONVENIENCE</b>	)	<b>CASE NO.</b>
<b>AND NECESSITY FOR THE CONSTRUCTION</b>	)	<b>2005-00472</b>
<b>OF ALTERNATIVE TRANSMISSION FACILITIES</b>	)	
<b>IN JEFFERSON, BULLITT, MEADE AND</b>	)	
<b>HARDIN COUNTIES, KENTUCKY</b>	)	

**DIRECT TESTIMONY OF  
CLAYTON M. DOHERTY  
LINEAR PROJECTS, INC.**

**Filed: December 22, 2005**

1 **Q. Please state your name, position and business address.**

2 A. My name is Clayton M. Doherty. I hold the position of President of Linear  
3 Projects, Inc. My business address is 608 Herb River Drive, Savannah, Georgia  
4 31406-3217. A statement of my qualifications is attached as Appendix A.

5 **Q. What is the purpose of your testimony?**

6 A. My testimony will introduce the report which I prepared as a contractor for Photo  
7 Science, Inc. detailing the route evaluation process used by me to test and confirm  
8 the routes selected by Louisville Gas and Electric Company ("LG&E") and  
9 Kentucky Utilities Company ("KU") (collectively, the "Companies") for a new  
10 345 kV transmission line proposed to be constructed by the Companies from  
11 LG&E's Mill Creek Generating Station (the "Mill Creek Station") to KU's  
12 Hardin County Substation.

13 **Q. Are you sponsoring any exhibits?**

14 A. Yes. I am sponsoring Exhibit CMD-1, Route Analysis and Evaluation, Mill  
15 Creek – Hardin County 345 kV Transmission Line dated December 2005 (the  
16 "Report").

17 **Q. How was the Report prepared?**

18 A. The specific steps in its preparation are set forth in the Report. I obtained  
19 information from Photo Science and from Brandon Grillon, a member of the  
20 Companies' transmission line services group in Lexington, Kentucky, and other  
21 engineering and regulatory personnel with the Companies which I used in the  
22 preparation of the Report.

1 **Q. What is your conclusion with respect to the analysis of the possible routes for**  
2 **the line from the Mill Creek Station to the Hardin County Substation?**

3 A. I have concluded that the two routes selected by the Companies are reasonable  
4 routes for the transmission line. They are designated as the Mill Creek to Hardin  
5 County Route No. 1 (Route AJU in the Report) and the Mill Creek to Hardin  
6 County Route No. 2 (Route AJW in the Report). I understand that the Companies  
7 have stated that they prefer to construct the line along Route No. 1. I agree that it  
8 is the preferred route and I believe that such route is reasonable and does not  
9 amount to wasteful duplication. In my opinion, this Commission should grant the  
10 Companies' requested Certificate of Public Convenience and Necessity ("CCN")  
11 for the Mill Creek to Hardin County Route No. 1. If the Commission, however,  
12 chooses not to grant a CCN for Route No. 1, then the Mill Creek to Hardin  
13 County Route No. 2 is also a reasonable route, does not amount to wasteful  
14 duplication and is one for which a CCN should be granted.

15 **Q. Does this conclude your testimony?**

16 A. Yes, it does.

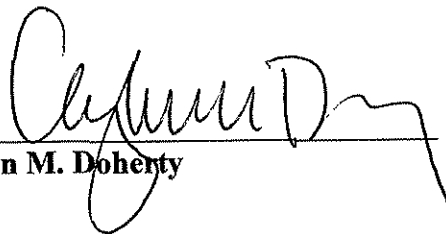
**VERIFICATION**

STATE OF GEORGIA )

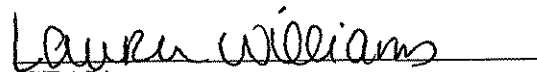
COUNTY OF Chatham )

SS:

The undersigned, Clayton M. Doherty, being duly sworn, deposes and says he is President of Linear Projects, Inc., that he has personal knowledge of the matters set forth in the foregoing testimony, and the answers contained therein are true and correct to the best of his information, knowledge and belief.

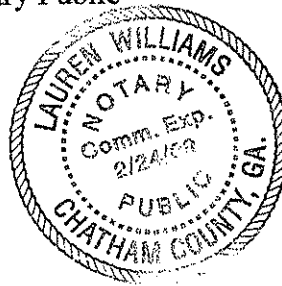
  
\_\_\_\_\_  
Clayton M. Doherty

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 19<sup>th</sup> day of December, 2005.

  
\_\_\_\_\_  
(SEAL)  
Notary Public

My Commission Expires:

2/24/09



## APPENDIX A

### **CLAYTON M. DOHERTY**

**Linear Projects, Inc.**  
**608 Herb River Drive**  
**Savannah, GA 31406**

**Experience**      *Environmental & Regulatory Coordinator*, electric transmission line and substation projects (1986-2001; 2005 – present). Manage land planning and environmental and regulatory compliance activities on over one hundred significant electric utility projects (\$300,000 - \$56,000,000). Conduct land use analysis; identify regulatory requirements; siting and routing studies; obtain local, state, and federal approvals. Prepare environmental reports and environmental assessments. Public scoping meetings, public officials briefings, agency coordination, expert witness testimony.

*Senior Planner, City of Key West*: zoning and land use, variance analysis, and development plan review. Prepare staff reports to planning board and city commission. Update City of Key West 2004 Statistical Abstract. State and federal emergency management training and exercises. Migrate planning department GIS software from ArcView 3.3 to ArcGIS 8.2.

**Expertise**      Prepare alternatives analyses and site/route selection documentation. Identify federal, state, and local government regulatory requirements. Initiate and manage contracts for environmental, cultural resource, and special needs surveys. Present land use and environmental considerations in project team meetings, public meetings, elected officials briefings, and government agency consultations. Develop and implement strategies for resolving complex regulatory compliance issues. Prepare environmental reports, environmental assessments and regulatory permit applications.

Technical editing of complex environmental and planning documents.

Analyze zoning and land use issues. Research and apply land development regulations. Determine project consistency with local government comprehensive plans.

**Policy Groups**      Secretary-Treasurer and Board Member, *The National Wetlands Coalition*.  
Board Member, *National Endangered Species Act Reform Coalition*.  
Policy Committee and Section 404 Task Force, *Utility Water Act Group*.  
Corporate Liaison, *National Rural Electric Environmental Association*.

**Employment**      Linear Projects, Inc. Savannah, GA 31406. 2005 - present.  
City of Key West Planning Department. Key West, FL 33040. 2003 - 2004.  
Georgia Transmission Corporation. Tucker, GA 30084. 1986 - 2001.  
Park-Land Planners, Ltd. Atlanta, GA. 1985 - 1986.  
Takeda Landscape Design. Seattle, WA. 1984 - 1985.



## **Education**

Master of Landscape Architecture, 1983. School of Environmental Design, University of Georgia. Thesis passed with distinction. Graduate electives in Land Planning and Historic Preservation.

Bachelor of Arts, English, with General Honors, 1971. College of Arts and Sciences, University of Georgia.

Benedictine Military School. Savannah, GA. 1967.

## **Training**

Federal Wetland Regulation. Wetland Training Institute [1990].

National Environmental Policy Act. Hunton & Williams [1990].

Wetland Functions and Values. Wetland Training Institute [1992].

Advanced Wetland Delineation. Wetland Training Institute [1993].

Medusa (Unix-based CAD) Rev. 13. [1994].

Total Quality Management. Qualtec Institute for Competitive Advantage [1994].

The Role of Environmental Audits and Site Assessments in Property Transfers. Georgia Tech [1994].

Introduction to Federal Projects and Historic Preservation Law. GSA Interagency Training [1995].

Advanced Seminar on Preparing Agreement Documents (NHPA Section 106). GSA Interagency Training [1997].

Introduction to ArcView GIS. ESRI [1999].

Community Emergency Response Team (CERT) - Train the Trainer. Florida Dept. of Community Affairs [2003].

Governor's Hurricane Conference. Florida Dept. of Community Affairs and Florida Emergency Preparedness Association [2003].

National Interagency Incident Management System (NIIMS) Incident Command System (ICS). U.S. Coast Guard [2003].

Introduction to ArcGIS. Photo Science, Inc. / ESRI [2004].

PC Training. Excel; Word; Access; PowerPoint; Desktop Publishing.

Corporate Culture Training. Team Building; Conflict Management; Giving and Receiving Feedback; Negotiating; Writing Goals and Objectives; Essentials of Project Management; Tools and Concepts for Continuous Improvement.

## **Community**

Rotary International. Community Service Committee Member and Fundraising Event Treasurer, Savannah Sunrise Rotary, 2004-present. Sunrise Rotary Club of the Conch Republic (Key West), 2003 - 2004.

Martin des Porres Society. Volunteer, 2004 - present.

Habitat for Humanity. Board Member and Chair, Site Selection Committee, Habitat for Humanity of Key West and the Lower Florida Keys [2002-2004].

## TRANSMISSION PROJECTS

### NEW TRANSMISSION LINES

#### **Siting Studies and Environmental Reports**

- Warrenton – Cedar Rock 115 kV Transmission Line
- Clark Road 115 kV Transmission Line Loop
- Gum Log Tap 115 kV Transmission Line
- Huntsville – Battlefield 115 kV Transmission Line
- Nord Kaolin Tap 115 kV Transmission Line
- Douglasville – Groover Lake – Factory Shoals 115 kV Transmission Line
- Due West – Brookstone – Cobb Water 115 kV Transmission Line
- Copper Pine Tap 46 kV Transmission Line
- Mitchell Prison Tap 46 kV Transmission Line
- Lost Mountain – Due West Tap 115 kV Transmission Line
- Peavey Tap 46 kV Transmission Line
- Brookstone Loop 115 kV Transmission Line Loop
- Big Canoe – Juno 115 kV Transmission Line
- Doles Tap 115 kV Transmission Line
- Georgia Feed Tap 46 kV Transmission Line
- Northeast Emanuel Tap 46 kV Transmission Line
- Jimps Tap 115 kV Transmission Line
- Morris Express Feeder 46 kV Transmission Line
- Sunset – Tallokas 115 kV Transmission Line
- ECI Tap 46 kV Transmission Line
- Collins Chip Mill Tap 115 kV Transmission Line
- Offerman Chip Mill Tap 115 kV Transmission Line
- Georgia Chip Mill Tap 115 kV Transmission Line
- Hopeful – Mount Olive 46 kV Transmission Line
- Sapelo River Tap 46 kV Transmission Line
- Barnesville Chip Mill Tap 69 kV Transmission Line
- North Lakeland Tap 115 kV Transmission Line
- Cane Creek – Juno 115 kV Transmission Line
- Town Creek 115 kV Transmission Line
- Long Reach Tap 115 kV Transmission Line
- North Americus – Weyerhaeuser 115 kV Transmission Line
- St. George Tap 115 kV Transmission Line
- Langboard Tap 115 kV Transmission Line
- Willacoochee – Langboard 46 kV Transmission Line
- Flint Headquarters Tap 46 kV Transmission Line
- SKC – Covington #3 115 kV Transmission Line
- Hercules – SKC 115 kV Transmission Line
- Rumble Road Loop 115 kV Transmission Line
- Tank Road Tap 115 kV Transmission Line
- Palmyra – Century 115 kV Transmission Line
- Georgia Feed Bio – Filter Tap
- Douglas – Baker Highway 115 kV Transmission Line

- Sterling Creek Tap 115 kV Transmission Line
- Baker Highway – Langboard 115 kV Transmission Line
- St. George – Macedonia 115 kV Transmission Line
- Willacoochee Tap 115 kV Transmission Line
- Millen – Midville 115 kV Transmission Line Rebuild
- Flint River – Smithville – Americus 115 kV Transmission Line Rebuild
- Rumble Road – Forsyth #2 115 kV Transmission Line Rebuild
- South Covington Tap 115 kV Transmission Line
- Arlington Junction – Crestview 115 kV Transmission Line
- Dailey Mill Tap 115 kV Transmission Line
- Nashville #1 – Weber 115 kV Transmission Line
- Barnesville Primary – Barnesville #1 115 kV Transmission Line
- Aldora Mills – Barnesville #2 115 kV Transmission Line
- East Moultrie – West Valdosta 230 kV Transmission Line

### **In Progress**

#### **Siting Studies, Environmental Assessments, and Regulatory Permitting**

- Environmental Assessment for Granting a Utility Easement on Ft. Knox
- Clearing Specifications for proposed Fort Knox easement
- Siting Study for proposed Mill Creek – Hardin County 345 kV Transmission Line

#### TRANSMISSION LINE RELOCATIONS AND MODIFICATIONS

#### **Siting Studies and Environmental Reports**

- Huntsville – Battlefield Tap 115 kV Transmission Line Rebuild
- Martins Landing – Holcomb Bridge 230 kV Transmission Line Rebuild and Relocation
- Due West Tap 115 kV Transmission Line Relocation
- Lost Mountain – Powder Springs 115 kV Transmission Line Relocation
- Millen – Midville 46 kV Transmission Line Modification
- Asbury – Nord Kaolin 115 kV Transmission Line Relocation
- Flint River – Smithville 115 kV Transmission Line Relocation
- Tallokas – Berlin 46 kV Transmission Line Relocation and Modification
- Branch – Bonaire 230 kV Transmission Line Modification
- Cedar Creek Tap 115 kV Transmission Line Modification
- Pine Grove – Thomasville 230 kV Transmission Line Modification
- Northrop B 115 kV Transmission Line Relocation
- Lumpkin – Providence 46 kV Transmission Line

#### NEW SUBSTATIONS

#### **Siting Studies and Environmental Reports**

- Reno (Grady County EMC #15) 115/25 kV Substation
- Roddenberry (Grady County EMC #16) 115/25 kV Substation

- Cedar Rock 115/46 kV Transmission Substation
- Clark Road (Jefferson EMC #20) 115/12 kV Substation
- Gum Log (Hart County EMC #15) 115/25 kV Substation
- Battlefield (GreyStone Power #23) 115/25 kV Substation
- Groover Lake (GreyStone Power #24) 115/25 kV Substation
- Nord Kaolin (Oconee EMC #14) 115/25 kV Substation
- Bleckley (Ocmulgee EMC #10) 115/25 kV Substation
- Webb Road (Troup EMC #18) 115/25 kV Substation
- Lake Arrowhead (Amicalola EMC #14) 115/12 kV Substation
- Copper Pine (Jackson EMC #5) 46/25 kV Substation
- Brookstone (Cobb EMC #30) 115/12 kV Substation
- Mitchell Prison (Mitchell EMC #21) 46/12 kV Substation
- Peavey (Middle Georgia EMC #10) 46/25 kV Substation
- Dasher (Colquitt EMC #14) 115/25 kV Substation
- Juno (Amicalola EMC #16) 115/25 kV Substation
- Azalea Park (Colquitt EMC #30) 115/25 kV Substation
- Pavo (Grady County EMC #10) 69/12 kV Substation
- Doles (Mitchell EMC #7) 115/25 kV Substation
- Georgia Feed (Pataula EMC #7) 46/0.48 kV Substation
- Stillmore (Excelsior EMC #6; Altamaha EMC #18) 115/12x25 kV Substation
- East Thomson (Jefferson EMC #27) 115/25 kV Substation
- Northeast Emanuel (Excelsior EMC #7) 46/12 kV Substation
- North Thomas (Grady County EMC #22) 12 kV Switching Station
- Wright's Chapel (Slash Pine EMC #11) 115/25 kV Substation
- Jimps (Excelsior EMC #13) 115/12 kV Substation
- Ellabelle (Canoochee EMC #13) 115/25 kV Substation
- East Warrenton (Jefferson EMC #28) 115/25 kV Substation
- ECI (Excelsior EMC #3) 46/25 kV Substation
- Banks Creek (Excelsior EMC #5) 115/25 kV Substation
- Pony Express (Snapping Shoals EMC #10) 46/12 kV Substation
- Collins Chip Mill (The Satilla REMC #10) 115/4.16 kV Substation
- Offerman Chip Mill (The Satilla REMC #11) 115/4.16 kV Substation
- Georgia Chip Mill (Ocmulgee EMC #12) 46/4.16 kV Substation
- North Dudley (Oconee EMC #3) 46/25 kV Substation
- Sleepy Hollow (Flint EMC #2) 115/25 kV Substation
- Sapelo River (Coastal EMC #1) 46/25 kV Substation
- Barnesville Chip Mill (Lamar EMC #14) 69/4.16 kV Substation
- Sterling Pulp (Colquitt EMC #31) 230/25 kV Substation
- North Lakeland (Slash Pine EMC #1) 115/25 kV Substation
- Browntown (Okefenoke REMC #15) 115/25 kV Substation
- Town Creek (Tri-County EMC #9) 115/12 kV Substation
- Long Reach (Coastal EMC #9) 115/25 kV Substation
- North Zebulon (Lamar EMC #15) 46/12 kV (115 spec.) Substation
- Kirkland (Snapping Shoals EMC #3) 230/25 kV Substation
- Wesley (Flint EMC #7) 115/25 kV Substation
- St. George (Okefenoke REMC #16) 115/25 kV Substation
- Langboard Temporary (The Satilla REMC #5) 46/25 kV Substation
- Langboard (The Satilla REMC #5) 115/46/12 kV Substation

- West Newton (Mitchell EMC #23) 46/25 kV Substation
- Gunns (Washington EMC #14) 46/14.4 kV Substation
- Flint Headquarters (Flint EMC #18) 46/12 kV Substation
- SKC America Temporary (Snapping Shoals EMC #20) 46/25 kV Substation
- Mesena (Jefferson EMC #29) 46/25 kV (115 spec.) Substation
- Camilla (Mitchell EMC #1) 46/25 kV Substation
- North Nicholls (The Satilla REMC #23) 115/25 kV Substation
- Highway 99 (Okefenoke REMC #17) 115/25 kV Substation
- South Glennville (Canoochee EMC #8) 115/25 kV Substation
- Tobesofke Creek (Lamar EMC #2) 69/12 kV (115 spec.) Substation
- West Wrightsville (Washington EMC #4) 46/25 kV Substation
- Tank Road (The Satilla REMC #14) 115/25 kV Substation
- New Sumner (Mitchell EMC #24) 46/25 kV (115 spec.) Substation
- Hangdog Crossing (Grady County EMC #3) 69/25 kV Switching Station
- Pinetucky (Jefferson EMC #1) 46/25 Substation
- College Avenue (The Satilla REMC #24) 115/25 Substation
- Baker Highway (The Satilla REMC #15) 115/25 kV Substation
- Gunn Road (Flint EMC #19) 230/12 kV Substation
- Cookville (Sumter EMC #26) 115/25 kV Substation
- Best Buy (Little Ocmulgee EMC #11) 46/12 kV Substation
- Sterling Creek (Coastal EMC #10) 115/25 kV Substation
- Kinards Mill (Central Georgia EMC #10) 115/25 kV Substation
- Highway 127 (Flint EMC #40) 115/12 kV Substation
- South Covington (Snapping Shoals EMC #7) 115/25 kV Substation
- Crestview (Mitchell EMC #12) 46/12 kV Substation
- Dailey Mill (Central Georgia EMC #3) 115/25 kV Substation
- Weber (Colquitt EMC #32) 115/25 kV Substation

#### SUBSTATIONS SITE ADVANCED LAND PURCHASES

##### **Siting Studies**

- Lake Arrowhead (Amicalola EMC #14) 115/12 kV Substation
- Juno (Amicalola EMC #16) 115/25 kV Substation
- Lavender Road (Jackson EMC #36) 115/25 kV Substation
- St. George (Okefenoke REMC #2) 115/25 kV Substation
- Brookstone (Cobb EMC #30) 115/12 kV Substation
- Highway 127 (Flint EMC #18) 115/12 kV Substation
- Peeksville (Central Georgia EMC #4) 115/25 kV Substation

#### SUBSTATION MODIFICATIONS

##### **Environmental Reports**

- Hi-Hat (Okefenoke REMC #10) 115/25 kV Substation
- Lost Mountain (Cobb EMC #12) 115/12 kV Substation
- Lanes Bridge (Satilla EMC #12) 46/25 kV Substation

- Pine Grove (Satilla EMC #1) 115/25 kV Substation
- Brookfield (Colquitt EMC #6) 46/25 kV Substation
- Willacoochee (Satilla REMC #6) 46/25 kV Substation
- Highway 301 (Excelsior EMC #7) 46/25 kV Substation
- Dublin (Altamaha EMC #4) 46/25 kV Substation
- Quitman (Colquitt EMC #13) 69/12 kV Substation (drainage)
- Screven (Satilla REMC #13) 115/25 kV Substation
- Snipesville (Satilla REMC #4) 46/25 kV Substation
- Jimps (Excelsior EMC #13) 115/25 kV Substation
- Quitman (Colquitt EMC #13) 69/12 kV Substation (capacity)
- Hawkinsville #1 (Middle Georgia EMC #5) 46/25 kV Substation
- North Dudley (Oconee EMC #3) 46/25 kV Substation
- South Brooks (Colquitt EMC #20) 69/25 kV Substation
- Pavo (Grady EMC #10) 69/12 kV Substation
- Rose Hill (Colquitt EMC #19) 115/25 kV Substation
- East Wrightsville (Washington EMC #3) 46/25 kV Substation
- West Thomson (Jefferson EMC #8) 46/25 kV Substation
- Hopeful (Mitchell EMC #8) 46/25 kV Substation
- Forrest Road (ITS) 115/69/12 kV Substation (cap bank)
- Charing (Flint EMC #6) 46/25 kV Substation
- Forrest Road (ITS) 115/69/12 kV Substation (third feeder)
- West Homerville (Slash Pine #7) 115/25 kV Substation
- Bolingbroke (Central Georgia EMC #11) 115/12 kV Substation
- Smarr (Central Georgia EMC #22) 115/12 kV Substation
- Geneva (Flint EMC #9) 46/25 kV Substation
- Century (Sumter #10) 115/12 kV Substation
- Tallokas (Colquitt EMC #7) 46/25 kV Substation
- Hangdog Crossing (Grady EMC #3) 115/25 kV Substation
- Roddenbery (Grady EMC #16) 115/25 kV Substation
- Georgia Feed (Pataula EMC #8) 46/0.48 kV Substation
- West Leslie (Sumter #7) 46/25 kV Substation
- Cool Branch (Pataula EMC #7) 46/12 kV Substation
- Culloden (Lamar EMC #6) 115/12 kV Substation

## **GENERATION PROJECTS**

### HYDROELECTRIC FACILITIES

#### Tallassee Shoals Hydroelectric Project

- GaDNR Surface Water Withdrawal Permit Revision
- FERC Post-Construction Aquatic Sampling Program
- FERC Filing: Minimum Instantaneous Flow Issue
- FERC Filing: Site Planning for Public Access Area
- FERC Filing: Revision to Public Access Plan
- GaDNR Annual Surface Water Withdrawal Reports
- FERC Annual Minimum Instantaneous Flow Compliance Reports

Pickens County Pumped Storage Hydroelectric Project

Transmission Line Macro-Corridor Study

- Siting Methodology Development
- Preliminary Data Collection
- Constraint Mapping and Analysis
- Macro-Corridor Selection

COGENERATION FACILITIES

Stone Container Corporation Cogeneration Project

Transmission Line Macro-Corridor Study

FOSSIL FUEL FACILITIES

Plants Wansley and Scherer

Dual Rail Service Development Study Group

**MISCELLANEOUS PROJECT SUPPORT**

FACILITY SITE PLANNING

- Electric Cooperative Training Center, Smarr, GA
- Public Access Areas: Tallassee Shoals Hydroelectric Project
- Hephzibah Regional Operating Headquarters: Jefferson EMC

LANDSCAPE PLANS

- Reno Substation
- Tallassee Shoals Public Access Area
- Sugarloaf Substation
- Northeast Emanuel Substation
- Ellabelle Substation

INDUSTRIAL PARK FEASIBILITY STUDIES

- Winder-Barrow County Airport Industrial Park (complete)
- Banks Crossing Industrial Park (inventory and analysis)
- Unadilla Industrial Park (inventory and analysis)

PSC AND LOCAL ZONING RESEARCH

- Virginia City – Clinch River 138 kV Transmission Line

TECHNICAL EDITING

*Decentralized Stormwater Controls for Urban Retrofit and CSO Reduction, Low Impact Development, Inc., Water Environment Research Foundation.*

### **EMC SUPPORT**

#### ENVIRONMENTAL ASSESSMENTS

- Hephzibah Regional Operating Headquarters, Jefferson EMC

#### ENVIRONMENTAL PERMITTING

- Section 10 Permit, Kings Ferry Crossing, St. Mary's River, Okefenoke REMC
- Section 10 Permit, St. George Crossing, St. Mary's River, Okefenoke REMC

### **ENVIRONMENTAL ISSUES**

- EPRI EMDEX Project Site Coordinator (EMF Exposure Assessment Project, 1988-1989)
- Clean Water Act/Wetlands Delineation, Functional Assessment, and Permitting
- Section 7 Interagency Coordination, Endangered Species Act
- Section 106 and Agreement Documents

### **PROFESSIONAL AFFILIATIONS**

- Secretary-Treasurer, Board of Directors, and Director of Membership Development, The National Wetlands Coalition, 1994 - 2001.
- Board of Directors, National Endangered Species Act Reform Coalition, 1995 - 1996.
- Chairman, Water Quality Subcommittee, G&T Manager's Association Technical Advisory Committee, 1996 - 1999.
- Member, Transmission Environmental Subcommittee, G&T Manager's Association Technical Advisory Committee, 1996 - 1999.
- Member, Policy Committee, Utility Water Act Group, 1994 - 1996.
- Member, Section 404 Task Force, Utility Water Act Group, 1994 - 1996.
- Member, Society of Wetlands Scientists, 1991-2001.
- EMDEX Site Coordinator, EPRI EMDEX Project, 1988-1989.
- Mobile River Basin Aquatic Ecosystem Recovery Plan Coalition, 1995 - 1996.
- Newsletter Editor for the Professional Environmental Marketing Association, 1995 - 1996.
- National Rural Electric Environmental Association, 1994 - 1997.
- American Water Resources Association, 1998.

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- Various Corporate Culture Training Programs. Team Building; Conflict Management; Giving and Receiving Feedback; Negotiating; Writing Goals and Objectives; Essentials of Project Management; Tools and Concepts for Continuous Improvement. Oglethorpe Power/Georgia Transmission Corporation. 1992-2001.

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- EPRI Wetlands and Surface Water Discharge Compliance Workshop, Birmingham, AL. 1994.
- National Rural Electric Environmental Association, various meetings, Colorado, Alabama, Missouri, South Carolina, Washington, D.C. 1994-1999. Presented paper "The Implications of the *Tulloch* Rule for Utility Landclearing in Wetlands" in Colorado.
- National Hydropower Association, Adirondack Policy Forum, Lake George, NY. 1995.
- International Right-of-Way Association, 41st Annual International Education Seminar, Louisville, KY, 1995. Presented paper "Utility Industry Impacts on Environmental Biodiversity."
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- Terrene Institute: First Annual National Wetland Mitigation Banking Conference, Washington, DC. 1998
- Terrene Institute: Second Annual National Wetland Mitigation Banking Conference, Atlanta, GA. 1999
- Governor's Hurricane Conference. Tampa, FL. 2003

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ROUTE ANALYSIS AND EVALUATION

FOR THE PROPOSED  
MILL CREEK – HARDIN COUNTY  
345 KV TRANSMISSION LINE

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December 2005

## **Executive Summary**

### ROUTE ANALYSIS AND EVALUATION

#### FOR THE PROPOSED MILL CREEK – HARDIN COUNTY 345 kV TRANSMISSION LINE

Louisville Gas and Electric Company and Kentucky Utilities Company (LG&E/KU) have conducted a comprehensive routing analysis for the proposed Mill Creek to Hardin County 345 kV Transmission Line project. LG&E/KU's analysis followed a five-step process outlined by staff of the Kentucky Public Service Commission (KPSC) during an informal conference on October 4, 2005. LG&E/KU's comprehensive analysis reviewed GIS-based data provided by Photo Science as well as internal cost data for 1,203 routing alternatives. This analysis resulted in the recommendation of a preferred route and an alternate route.

Linear Projects Inc., a subcontractor for Photo Science, was asked to prepare a parallel analysis and evaluation of alternate transmission line routes available to LG&E/KU, using the same data available to LG&E/KU to analyze and evaluate the same 1,203 routing alternatives. While Linear Projects' analysis and evaluation methodology differs from that used by LG&E/KU, Linear Projects' *Route Analysis and Evaluation* validates and confirms LG&E/KU's conclusions regarding the reasonableness of the preferred and alternate routes. Furthermore, it is the opinion of Linear Projects that neither the preferred route nor the alternate route results in a "wasteful duplication of facilities" and that either of the two routes may reasonably be granted a Certificate of Public Convenience and Necessity.

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## 1.0 Introduction

Louisville Gas and Electric Company and Kentucky Utilities Company (LG&E/KU) propose to construct approximately 41.9 miles of new 345 kV transmission line originating at the existing Mill Creek Generating Station in Jefferson County and terminating at the existing Hardin County Substation (Figure 1.0).

### 1.1 Route Selection Process Background

In 2003, LG&E/KU requested Photo Science Inc. (PSI) to assemble GIS (Geographic Information System) mapping for use in analysis and evaluation of routes for its Mill Creek - Hardin County 345 kV Transmission Line project. Route identification was performed using mapped information and field visits to identify constraints and opportunities for developing and evaluating routing alternatives.

Electric utility professionals typically approach transmission line routing by identifying available opportunities which avoid and/or minimize adverse effects of the project to the built and natural environments while considering relevant engineering considerations, including collocation and costs. The use of GIS-based mapping makes this process far more efficient. Where various resource-based maps were once available only on paper and at different scales and map projections, ArcGIS software assembles this information in a digital format and converts data to the same scale and projection. Once this digital database has been assembled, a professional may map various routing alternatives and inventory potential impacts to the built and natural environments. Similarly, the digital ArcGIS database assembles engineering data and evaluates routing alternatives according to technical criteria.

The original routing exercise performed by LG&E/KU and PSI followed this approach, which resulted in LG&E/KU selecting a preferred route and submitting a request for a Certificate of Public Convenience and Necessity ("CPCN") for that route to the Kentucky Public Service Commission (KPSC) on May 11, 2005 (Case Number 2005-00142).

On September 8, 2005, KPSC issued an order stating its intention to apply a CPCN standard focused on determining (1) whether the facilities are needed, and (2) whether construction will result in a "duplication of facilities" [*Kentucky Utilities Company v. Public Service Commission*, 252 S.W.2d 885 (Ky. 1952)]. KPSC agreed that the Mill Creek – Hardin County 345 kV Transmission Line is needed, but stated that LG&E/KU did not fully document its transmission line siting decision in a sufficiently comprehensive manner to allow the KPSC to determine whether the standards set forth in the *Kentucky Utilities* case with reference to "duplication of facilities" are satisfied. On page 10, the order states



in particular that “...the Commission finds that LG&E/KU failed to adequately consider the use of existing rights-of-way, transmission lines, and corridors.”

Many collocation alternatives were in fact considered during the original route selection process but were quickly discarded for reasons that were readily obvious to utility professionals. However, LG&E/KU's original KPSC filing did not fully document these routes and the reasons why they were not believed to be good routing alternatives for the Mill Creek – Hardin County project.

LG&E/KU and representatives of interveners met informally with KPSC staff on October 4, 2005 to better understand KPSC's expectations with respect to routing documentation. Among those expectations are that the utility look for all possible routes that will work electrically, with emphasis on existing corridors, and that the utility perform a comprehensive evaluation designed to show that the chosen route is reasonable. KPSC staff emphasized the need for a thorough, well-documented evaluation, and stated that there must be documentation for all routes considered.

Following guidance in other CPCN orders and recommendations of KPSC staff provided at the informal conference, LG&E/KU conducted a comprehensive analysis of all reasonable routing alternatives for the proposed transmission line. At the same time, LG&E/KU asked Linear Projects to develop an independent analysis and evaluation of the routes as a means of providing an alternate perspective on LG&E/KU's routing analysis. Linear Projects worked closely with Photo Science and LG&E/KU to ensure that the same data and other pertinent information was used. While LG&E/KU's decision-making was independent of Linear Projects' analysis and evaluation, Linear Projects' analysis and evaluation validates and confirms LG&E/KU's conclusions.

## **1.2 Revised Route Selection Process**

The routes evaluated in this study represent both those routes originally considered by utility professionals to be good routing alternatives (alternatives which avoid and/or minimize impacts to the built and natural environment while considering engineering and technical criteria) as well as all other alternatives which are technically feasible and focus on collocation (rebuilding and/or paralleling existing transmission lines and other corridors).

After reviewing existing power lines, natural gas lines, and roads in the project area (Figure 1.2), a total of 1,203 routes, composed of various combinations of 156 discrete segments, was analyzed and evaluated using the *Alternative Route Analysis and Evaluation* model (hereafter, *Analysis and Evaluation* model) taken from the EPRI (Electric Power Research Institute) and GTC (Georgia Transmission Corp.) Standardized Methodology for Siting Overhead Electric Transmission Lines (hereafter, Standardized Methodology). In the interest of

making this report manageable, the data for all 1,203 routes is issued as a CD appendix to this report.

### **1.3 Overview of Alternate Route Analysis and Evaluation**

It is beyond the scope of this siting study to provide an exhaustive explanation of the Standardized Methodology. However, it should be noted that the criteria used in the *Analysis and Evaluation* model to score and rank routes are the kinds of criteria typically considered by utility professionals going through a route selection process. Utility land planners and transmission line design engineers would normally consider information derived from aerial photography, property parcel maps, and such off-the-shelf mapped information as soils surveys, National Wetland Inventory maps, the location of historic resources listed on the National Register of Historic Places, etc., in evaluating transmission line routes and proposing a preferred route.

Furthermore, the “weighting” of each criterion in the *Analysis and Evaluation* model represents the input of a comprehensive slate of stakeholders representing the interests of utilities, state and federal resource agencies, environmental groups, property owner groups, and others. The process that generated the weights used in the *Analysis and Evaluation* model, therefore, was based on the willingness and ability of competing interests to arrive at a consensus with respect to the relative values of paired resources. At the very least, taken as a whole, this *Analysis and Evaluation* model provides a transparent and representative process for arriving at routing decisions.

A final step involves “normalizing” the data. Normalizing places all of the criteria on an identical scale ranging from zero to one. Normalizing is necessary in order to more readily compare dissimilar criteria having different weights. Once normalized, values approaching zero represent the least impact while values approaching one represent the greatest impact. For three Engineering Considerations criteria, such as collocation with existing transmission lines, “more is better;” in these cases, the values are first normalized and then inverted so that routes with the highest degree of collocation score low (a low score equaling “desirable”).

In summation, the *Analysis and Evaluation* model is a GIS-database application which does four things: (1) for each route, the methodology counts the number and magnitude of impacts; (2) for all routes, the methodology weighs the relative importance of resources impacted and the magnitude of those impacts; (3) for all routes, with respect to three different “perspectives,” the methodology evaluates how each route compares to all other routes; and, (4) finally, for all routes, the methodology evaluates how each route compares to all other routes when all three of the different “perspectives” are weighted equally.

Metadata (information about the data) for all criteria used in this application of the *Analysis and Evaluation* model is included in Appendix 11.0.

### **1.3.1 Built Environment Perspective**

The Built Environment perspective considers how each route compares to all other routes when impacts to the Built Environment are considered to be *five times more important* than impacts to the Natural Environment or to Engineering Considerations.

Resources the *Analysis and Evaluation* model considers for the Built Environment perspective and their weights include:

1. Residences Within ROW (44.3%) – Residences within the right-of-way of a routing alternative would be razed and families would have to be relocated; this is the most heavily weighted criterion in the Built Environment perspective.
2. Proximity to Residences (13.1%) – Residences outside the right-of-way but within 300 feet of the right-of-way are considered to feel more of an impact from the route than residences farther away.
3. Proposed Developments (5.4%) – Areas that were identified as being under construction from the aerial photography were included.
4. Proximity to Commercial Buildings (3.6%) – Somewhat greater impact to properties within 300 feet of commercial buildings than if the line is farther away.
5. Proximity Industrial Buildings (1.8%) – Slightly greater impact to properties within 300 feet of industrial buildings than if the line is farther away.
6. Schools, Churches, Cemeteries, and Parks (16.3%) – Crossing these kinds of land uses is considered to be more of an impact to the community than crossing other kinds of properties.
7. NRHP-listed Structures and Districts (15.5%) – For purposes of this project, NRHP properties within 3,000 feet of a route are considered in the evaluation.

### **1.3.2 Natural Environment Perspective**

The Natural Environment perspective considers how each route compares to all other routes when impacts to the Natural Environment are considered to be *five times more important* than impacts to the Built Environment or to Engineering Considerations.

Resources the *Analysis and Evaluation* model considers for the Natural Environment perspective and their weights include:

1. Natural Forests (9.3%) – Natural forests are valued for aesthetic and biodiversity reasons, and clearing forested areas can erode soil and cause sedimentation of waterways; crossing natural forests, therefore, is weighted as a somewhat greater impact than crossing other land cover types.
2. Stream / River Crossings (38%) – Streams and rivers are best protected by leaving them, their banks, and their streamside buffers intact; crossing streams and rivers, therefore, is one of two more heavily weighted criteria in the Natural Environment perspective.
3. Wetland Areas (40.3%) – Wetlands are valued as important habitats and for their ability to filter and sequester pollutants before they enter receiving streams; they also function best when left undisturbed. Depending on the nature of the activities performed in wetlands and the jurisdictions in which they occur, there may be significant permitting issues as well. Crossing wetlands is therefore one of two more heavily weighted criteria in the Natural Environment perspective.
4. Floodplain Areas (12.4%) – Floodplains trap sediments and provide wildlife habitat. Because floodplain development is often restricted, floodplain forests are often the last stands of mature hardwood forest in the developed landscape. Crossing floodplain areas, therefore, is weighted as a somewhat greater impact than crossing uplands in general.

### **1.3.3 Engineering Considerations Perspective**

The Engineering Considerations perspective considers how each route compares to all other routes when Engineering Considerations are considered to be *five times more important* than impacts to the Built Environment or to the Natural Environment.

Resources the *Analysis and Evaluation* model considers for the Engineering Considerations perspective and their weights include:

1. Length (Miles) – In general, longer lines affect more landowners and land and require more resources to build and maintain a new transmission line; more right-of-way must be cleared and kept cleared; the longer the line, the more that facility is exposed to outage-causing events.
2. Percent of Rebuild with Existing T/L (65.6%) – Double-circuiting an existing transmission line is viewed favorably because minimal (sometimes, no) new land rights are required; however, double-circuiting is not completely favorable, since it exposes two lines on the same set of support structures to outages from accidents or structural defects that result in failure of a structure. Also, visual impacts to important community resources may result from the greater height needed to accommodate both lines.
3. Percent of Collocation with Existing Utilities (19.2%) – Paralleling existing transmission lines or gas pipelines can be very favorable, since it

consolidates similar utility land uses and may minimize adverse impacts on properties and communities. Like rebuilding, however, paralleling existing lines is sometimes not completely favorable, since whatever homes, churches, wetlands, or streams are adjacent to the existing line will be impacted by the new line.

4. Percent of Collocation with Roads (7.8%) – Paralleling roads can be slightly favorable, since it consolidates linear rights-of-way across the landscape. Like rebuilding, however, paralleling existing roads is not necessarily completely favorable, since the built environment rises up next to roads; this is especially true with regard to historic structures. Also, since most roads don't stay straight for very long, properties are more heavily impacted by guy wires needed to turn angles to follow roads. Finally, to the extent that visual impacts rely on having observers, roads are clearly one of the places where greater numbers of people will be present to see a transmission line.
5. Total Project Costs (7.4%) – Transmission is an expense that a utility would avoid, wherever possible, preferring to serve existing and new loads from existing transmission resources. Furthermore, costs of new transmission must be borne by ratepayers. Nevertheless, project cost is not weighted as heavily in the Engineering Considerations perspective as collocation opportunities.

#### **1.3.4 Simple Composite**

The Simple Composite considers how each route compares to all other routes when impacts to the Built Environment, to the Natural Environment, and to Engineering Considerations are considered to be *equally important*.

- Built Environment Perspective (33.33%)
- Natural Environment Perspective (33.33%)
- Engineering Considerations Perspective (33.33%)

#### **1.3.5 Finalist Routes and Expert Judgment**

The *Analysis and Evaluation* model does two things very well. First, the model handles the raw number-crunching involved in counting things which can be counted (e.g., the number of streams crossed by a route's centerline or the number of residences within a route's right-of-way). Secondly, the model can apply the weights (i.e., the expressions of relative importance between and among affected resources) to the impacts for each route and ranks the routes in terms of how they affect the built and natural environments and how well they address engineering considerations.

The application of the *Analysis and Evaluation* model to a set of routing alternatives is not intended to yield the one perfect or preferred route, simply

because the model is merely a tool that measures, compares, and ranks only those things that can be measured, compared, and ranked. There are, however, other considerations involved in selecting a route that are less susceptible to measurement and which fall within the realms of local knowledge, complex regulatory requirements, and other factors which may be considered to fall within the realm of Expert Judgment. Examples of considerations which might fall within the realm of Expert Judgment include:

- visual impact issues;
- local community concerns;
- risks of schedule delay;
- special permitting requirements;
- construction and maintenance accessibility;
- number of properties crossed;
- amount of new right-of-way required;
- other case-by-case issues that may have a bearing on final routing decisions.

But if the *Analysis and Evaluation* model should not be relied upon by itself to select one preferred route, it does an excellent job of identifying those routes which have the least impact on the built and natural environments or which best address engineering and technical criteria. For purposes of this application of the *Analysis and Evaluation* model, the top five routes in the three perspectives within each basket of routes as well as the top five routes in the Simple Composite within each basket of routes are considered first cut routes which advance to an additional evaluation by expert judgment. Also, for routes which cross over between baskets of routes, the top five routes in the three perspectives within the cross over routes basket of routes as well as the top five routes in the Simple Composite within the cross over routes basket of routes are considered first cut routes as well.

These first cut routes, called “Top Fives” routes in this report, will be compared with one another on the basis of how well they rank when examined against significant criteria. Routes which emerge from that initial analysis will again be evaluated against each other until two routes remain. The goal of this comprehensive analysis is to identify two reasonable routes which best meet the requirements of this project while avoiding wasteful duplication.

### **1.3.6 Analysis and Evaluation Model Limitations**

In the Standardized Methodology, an important step takes place before the application of the *Analysis and Evaluation* model – a high-level but comprehensive analysis of the project area which examines all opportunities and constraints for routing a transmission line. The purpose of this initial screening is to identify areas comprising the top three percent (3%) of all routing possibilities available. Utility professionals then draw up several practicable

routes based on those “top three percent” corridors. The *Analysis and Evaluation* model phase of the Standardized Methodology then analyzes and evaluates those several top routing alternatives.

This first step of the Standardized Methodology, this high-level GIS-based screening of the project area, was not performed for this project. After KPSC rejected KU’s initial proposed route due to lack of emphasis on collocation opportunities and a lack of appropriate siting documentation in general, the project team undertook an exhaustive analysis of collocation opportunities within the project area, focusing on all collocation opportunities which would work from an electrical standpoint. The project area was determined to be bounded only when collocation opportunities nearing 100% were achieved on the east (various electric transmission lines, gas pipelines, and roads which comprise the East basket of routes) and on the west (existing Tip Top – Cloverport 138 kV Transmission Line, a Big Rivers 69 kV transmission line, and the Hardinsburg – Hardin County 138 kV Transmission Line which comprise the BREC routes). Other collocation opportunities evaluated include (1) exiting Tip Top Substation south through Fort Knox and (2) exiting Fort Knox to the west of Tip Top Substation. These collocation opportunities and their variations raised the total number of routes to be evaluated to 1,203. Many of these routes, going through intensively developed areas, would require tens and even hundreds of residential relocations, affecting homes, churches, parks, schools and other places of importance to communities to such a degree that they have little to recommend them as routes other than that they are collocation routes.

Normally, using the EPRI model, it would be a simple matter to discard such routes because the model would have already done its job of minimizing residential relocations while it identified the top three percent corridors. However, once the 1,203 collocation-inspired routes were submitted to the same analytic procedures, some pretty extreme values were normalized (see Section 1.3 of this report), which created unforeseen difficulties for the *Analysis and Evaluation* model.

First, when working as intended, the model effectively draws distinctions among several truly good routes by “normalizing” project impact data to a common scale of zero to one. For example, one of four routing alternatives might require one residential relocation. The model would normalize this impact and assign the three routes not requiring a relocation a value of zero (lower is better) and assign the route which requires relocation a one (higher is worse).

The effect of allowing hundreds of routes that require tens and hundreds of residential relocations into the analysis is that, when the model normalizes the data, routes that require ten, twenty, or thirty relocations don’t appear significantly bad next to routes that require 155 such relocations. That is, they may be assigned a normalized value of 0.1 or 0.2, with higher (worse) scores going to alternatives that relocate over one hundred homes. While it is true that

affecting ten or twenty homes is much less of an impact than affecting hundreds, it is still many more than the zero homes requiring relocation that is normally any utility's preferred goal. Because the range in this application is so great, though, an impact to several dozen homes appears quite reasonable to the model.

Second, as it currently exists, there is no provision in the *Analysis and Evaluation* model whereby extremely long routes and very costly routing alternatives can be discarded. At 7.4 percent of the Engineering Considerations perspective, cost accounts for only about 2.5% of an route's overall scoring in the Simple Composite. In the *Analysis and Evaluation* model applied to every conceivable route, a route that collocates 100% might be two or three times longer than a route of more efficient length and still earn 84.8% in the Engineering Considerations perspective, or 28.3% of a route's overall scoring in the Simple Composite.

We therefore considered ways to reign in the potential for runaway scoring for collocation in the *Analysis and Evaluation* model. It seems a reasonable solution to these normalization and weighting difficulties to allow the *Analysis and Evaluation* model to perform its task within several groups of similar routes and to apply the Expert Judgment phase to as wide a cross-section of top-scoring routes as could reasonably be handled. For the purposes of this study, then, the following is a synopsis of Linear Projects' methodology.

### **1.3.7 *Analysis and Evaluation* Applied to Baskets of Routes**

As discussed in Section 1.1, both the September 8, 2005, KPSC order and the October 4, 2005 informal conference with KPSC staff identified the requirement to comprehensively evaluate all electrically-equivalent options for routing a proposed transmission line. This exercise should be focused on avoiding a wasteful duplication of facilities (*i.e.*, emphasis on collocation).

Route Creation. In response to KPSC staff guidance, the LG&E/KU project team identified a comprehensive collection of routing alternatives between Mill Creek Generating Station and Hardin County Substation. The routes were drawn in as segments (156 segments total). Segments were delineated that (1) collocate with existing linear infrastructure - existing electric transmission lines, gas pipelines, and highways/roads, (2) consist of cross country routes that minimize impacts to the built and/or natural environments, and (3) consist of collocation and cross country segments that connect corridors of existing linear infrastructure. All possible segment combinations from Mill Creek Generating Station to Hardin County were identified that (1) do not cause routes to travel away from the source or (2) do not create angles greater than 90 degrees. The major focus of this exercise was to comprehensively identify all routes which collocate with existing corridor infrastructure. The total number of routes developed in this exercise was 1,203.



### Statistics.

PSI collected statistics for each of the 1,203 routes. These same metrics were used by LG&E/KU in their decision-making process as well as by Linear Projects in this validation and confirmation exercise. See tables in digital appendix for complete route metrics.

### Baskets of Routes.

Routes were organized and allocated into five major “baskets,” or groups of routes, having similar characteristics: East, Tip-Top South, East-Central, West-Central, and BREC. There are also many routing possibilities which cross over from basket to basket; these “cross over” routes are evaluated within their own Cross Over Routes basket. The baskets of routes used here are intended to be comprehensive and to consist of all possible routes that will work electrically with an emphasis on existing corridors.

### Weighting Routes.

The top routes within each basket of routes were determined by placing all routes assigned to a particular basket into an *Analysis and Evaluation* model.

As with the EPRI *Methodology*, the criteria by which routes are analyzed and evaluated are grouped into three perspectives: Built Environment, Natural Environment, and Engineering Concerns. As described earlier, emphasis is placed on each of these perspectives by weighting the perspectives, each in turn, at five times the value of the other two. This determines which routes are statistically better from each of the perspectives without disregarding any perspective. All three perspectives are then considered to be equally important, resulting in a Simple Composite ranking.

After the routes within each basket of routes are evaluated, the top five routes for each of these four categories for all baskets of routes will graduate to the beginning of an expert judgment phase. As will be seen, a total of forty-nine “Top Fives” routes results from this harvesting (some routes appear in more than one top five list).

### Expert Judgment and Evaluation.

At this point in the evaluation process, a reasonable number of routes will have been identified which will be thoroughly and efficiently evaluated by expert judgment. Successive “cuts” will be made until two reasonable routes remain.

## **2.0 Routes Considered**

As described previously, the KPSC order of September 8, 2005 denied the application for issuance of a CPCN for the proposed route of the Mill Creek – Hardin County 345 kV Transmission Line. The objections of the KPSC were two-fold:

- material submitted in support of the preferred route does not constitute a “comprehensive study and does not constitute substantial evidence to support a final decision on the location of a major transmission line (Order, page 9); and
- “the applicant must comprehensively consider existing corridors and utility lines when it applies for a transmission line CPCN.”

The LG&E/KU project team looked for all possible routes that will work electrically, with emphasis on collocation with existing electric transmission lines, gas transmission lines, and road corridors. At the end of this route identification process, the team identified 156 *route segments* that can be combined to form some 1,203 routes.

Route Segments. For purposes of this study, a route segment is any section of a route that begins where two or more routing opportunities diverge or is formed where two or more routing opportunities merge. Each of the 1,203 routes identified can be defined as a series of *segments* (e.g., in this study, Route A is composed of Segments 1, 3, 5, 8, 10, 12, 16, 24, 31, 32, and 36, while Route B is composed of Segments 1, 3, 5, 8, 10, 12, 16, 24, 31, 32, 35, and 37). Table 2.0 in the digital appendix shows the route segments which combine to form the 1,203 routes which were analyzed and evaluated for this report.

Figure 2.0(a) shows a high-level overview of all 1,203 routes that were comprehensively analyzed and evaluated for this project. The routes are initially organized into five baskets of routes, or major routing “themes,” as shown in Figure 2.0(b) and described in the following sections. Figure 2.0(c) shows the baskets of routes overlaid on available collocation opportunities. Finally, a “cross over routes” basket is created which captures all routing alternatives which “cross over” between baskets.

## **2.1 East Routes**

The East basket of routes consists of routes which leave Mill Creek Generating Station and proceed around the east side of Fort Knox Army Reservation towards Hardin County Substation. Figure 2.1 shows the East routes.

### **2.1.1 Collocation Opportunities**

Collocation opportunities within the East basket of routes include:

- Line 4532 and Line 4531 (two existing 345 kV transmission lines that run between Mill Creek Generating Station and Blue Lick Substation)
- LG&E's Lines 5401 and 5402 (two existing 161 kV transmission lines that run southeast from Blue Lick Substation, turn south towards Lebanon Junction, and pass to the east of Elizabethtown)
- Interstate 65 south of Shepherdsville to southeast of Elizabethtown
- various natural gas transmission lines
- eastern boundary of Fort Knox (collocation with a major jurisdictional change)
- KU's Elizabethtown – Bardstown 161 kV Transmission Line
- EKPC's Bardstown – Elizabethtown 69 kV Transmission Line
- KU's Hardin County – Brown 345 kV Transmission Line

### 2.1.2 Route Metrics

There are twenty routing alternatives within the East basket of routes. The first two tables describe the range of impacts to the Built and Natural Environments within the East basket of routes. The routes are also scored against Engineering Considerations.

Built	Residences within ROW	Proximity to Residences (within 300')	Proposed Developments	Proximity Commercial Buildings (within 300')	Proximity Industrial Buildings (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
Minimum	11	135	0	0	7	0	0
Maximum	155	676	6	130	154	4	8
Average	84	397	2	46	63	2	3

Natural	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
Minimum	428.34	60	2.79	146.86
Maximum	563.22	93	6.17	289.89
Average	495.86	74.7	3.48	198.04

Engineering	Length (Miles)	Percent of Route Rebuilt with Existing T/L	Percent of Route of Colocated with Existing Utilities*	Percent of Route Colocated with Roads*	Total Project Cost
Minimum	37.83	0.00%	42.74%	0.00%	60,685,362
Maximum	54.39	0.00%	93.39%	33.79%	81,498,224
Average	45.11	0.00%	68.61%	9.16%	72,266,647

## 2.2 Tip Top South Routes

All other baskets of routes leave Mill Creek Generating Station and proceed west and south, paralleling existing transmission lines and natural gas pipelines near West Point and/or through the northern portion of Fort Knox Army Reservation to areas near the existing Tip Top Substation, located south of U.S. Highway 60 and west of U.S. Highway 31W. The Tip Top South routes proceed south from the area near the Tip Top Substation, paralleling either a natural gas pipeline or U.S. Highway 31W, leaving the Fort Knox Reservation and proceeding through the towns of Radcliffe and Vine Grove. The Tip Top South routes parallel various electric transmission lines, natural gas pipelines, and roads south through Elizabethtown to the Hardin County Substation. Figure 2.2 shows the Tip Top South basket of routes.

### 2.2.1 Collocation Opportunities

Collocation opportunities within the Tip Top South basket of routes include:

- KU's Rogersville – Radcliffe 69 kV Transmission Line
- KU's Elizabethtown – Rogersville 69 kV Transmission Line
- EKPC's Vine Grove – Radcliffe 69 kV Transmission Line
- EKPC's Elizabethtown – Vine Grove 69 kV Transmission Line
- KU's Rogersville – Hardin County 138 kV Transmission Line
- EKPC's Elizabethtown – Stephensburg 69 kV Transmission Line
- U.S. 31W (aka Dixie Highway)
- several natural gas transmission lines

### 2.2.2 Route Metrics

There are 83 routes within the Tip Top South basket of routes. The first two tables describe the range of impacts to the Built and Natural Environments

within the Tip Top South routes. The routes are also scored against Engineering Considerations.

<b>Built</b>		Residences within ROW	Proximity to Residences (within 300')	Proposed Developments	Proximity Commercial Buildings(within 300')	Proximity Industrial Buildings(within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
<b>Minimum</b>	4	67	0	1	9	1	1	
<b>Maximum</b>	129	779	1	338	234	7	10	
<b>Average</b>	41.0	254.3	0.1	55.4	43.9	2.1	6.0	

<b>Natural</b>		Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
<b>Minimum</b>	173.60	32	7.37	105.42	
<b>Maximum</b>	394.91	64	19.17	185.97	
<b>Average</b>	306.25	49.7	14.67	150.57	

<b>Engineering</b>		Length (Miles)	Percent of Route Rebuilt with Existing T/L*	Percent of Route of Co-located with Existing Utilities*	Percent of Route Co-located with Roads*	Total Project Cost
<b>Minimum</b>	31.68	0.00%	17.84%	0.99%	49,615,438	
<b>Maximum</b>	35.84	1.50%	81.75%	77.09%	82,597,365	
<b>Average</b>	33.6	0.89%	63.84%	20.23%	58,216,418	

### 2.3 East-Central Routes

The first part of the East-Central basket of routes leaves Mill Creek Generating Station in the same fashion as the Tip Top South routes. That is, these routes proceed west and south, paralleling existing transmission lines and natural gas pipelines near West Point and/or through the northern portion of Fort Knox Army Reservation to areas near the existing Tip Top Substation, located south of

U.S. Highway 60 and west of U.S. Highway 31W. The East-Central routes then proceed west from the area near the Tip Top Substation, paralleling the Tip Top – Cloverport 138 kV Transmission Line, leaves the Fort Knox Reservation, and proceeds south-southeast towards Hardin County Substation. Portions of the routes that make up the East-Central basket parallel natural gas pipelines, Rineyville Road, or pick their way cross country through rural residential land uses. Figure 2.3 shows the East-Central routes.

### 2.3.1 Collocation Opportunities

Collocation opportunities within the East-Central basket of routes include:

- Tip Top – Cloverport 138 kV Transmission Line
- natural gas transmission lines
- Rineyville Road
- KU’s Hardinsburg – Hardin County 138 kV Transmission Line

### 2.3.2 Route Metrics

There are 348 routing alternatives within the East-Central basket of routes. The first two tables describe the range of impacts to the Built and Natural Environments within the East-Central routes. The routes are also scored against Engineering Considerations.

<b>Built</b>	Residences within ROW	Proximity to Residences (within 300')	Proposed Developments	Proximity Commercial Buildings (within 300')	Proximity Industrial Buildings (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
Minimum	4	64	0	0	2	0	1
Maximum	81	327	1	18	39	4	12
Average	32.3	171.9	0.8	6.6	18.3	1.7	7.5

<b>Natural</b>	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
Minimum	230.72	32	11.934	105.727
Maximum	384.10	66	20.237	175.37
Average	285.24	47.9	14.89	145.45

Engineering	Length (Miles)	Percent of Route Rebuilt with Existing T/L*	Percent of Route of Co-located with Existing Utilities*	Percent of Route Co-located with Roads*	Total Project Cost
Minimum	35.22	0.00%	35.04%	2.37%	54,764,303
Maximum	42.84	10.97%	71.68%	36.27%	74,523,635
Average	38.70	2.63%	49.75%	14.84%	65,031,982

## 2.4 West-Central Routes

The first part of the West-Central basket of routes leaves Mill Creek Generating Station in the same fashion as the Tip Top South routes. That is, these routes proceed west and south, paralleling existing transmission lines and natural gas pipelines near West Point and/or through the northern portion of Fort Knox Army Reservation to areas near the existing Tip Top Substation, located south of U.S. Highway 60 and west of U.S. Highway 31W.

The West-Central basket of routes then proceeds west from the area near the Tip Top Substation, rebuilding the Tip Top – Cloverport 138 kV Transmission Line, and continues paralleling that transmission line for another two to three miles after it leaves the Fort Knox Reservation. The West-Central routes then proceed south-southeast towards Hardin County Substation, generally in a cross-country fashion. Portions of the routes that make up the West-Central basket parallel natural gas pipelines, local county roads, or pick their way cross country through rural residential land uses. The West-Central routes parallel KU's Hardinsburg – Hardin County 138 kV Transmission Line on the final approach to Hardin County Substation. Figure 2.4 shows the West-Central routes.

### 2.4.1 Collocation Opportunities

Collocation opportunities within the West-Central basket of routes include:

- KU's Tip Top – Cloverport 138 kV Transmission Line
- KU's Hardinsburg – Hardin County 138 kV Transmission Line
- Rineyville Road
- Berrytown Road
- several natural gas transmission lines

### 2.4.2 Route Metrics

There are eighteen routes within the West-Central basket. The first two tables describe the range of impacts to the Built and Natural Environments within the West-Central basket of routes. The routes are also scored against Engineering Considerations.

<b>Built</b>		Residences within ROW	Proximity to Residences (within 300')	Proposed Developments	Proximity Commercial Buildings(within 300')	Proximity Industrial Buildings(within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
Minimum	0	12	1	0	3	0	2	
Maximum	40	195	1	21	24	0	13	
Average	14.3	88.2	1.0	7.3	10.3	0.0	8.7	

<b>Natural</b>		Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
Minimum	263.33	27	11.93	104.61	
Maximum	439.57	56	20.50	161.77	
Average	343.14	38.8	15.76	139.69	

<b>Engineering</b>		Length (Miles)	Percent of Route Rebuilt with Existing T/L*	Percent of Route of Co-located with Existing Utilities*	Percent of Route Co-located with Roads*	Total Project Cost
Minimum	38.81	9.31%	31.78%	1.35%	56,533,166	
Maximum	44.35	30.61%	39.89%	16.36%	63,174,947	
Average	41.19	17.92%	35.50%	6.27%	60,201,744	

## 2.5 BRREC Routes

The first part of the BRREC routes leaves Mill Creek Generating Station in the same fashion as the Tip Top South routes. That is, these routes proceed west and south, paralleling existing transmission lines and natural gas pipelines near West



Point and/or through the northern portion of Fort Knox Army Reservation to areas near the existing Tip Top Substation, located south of U.S. Highway 60 and west of U.S. Highway 31W.

The BREC routes then proceed west from the area near the Tip Top Substation, paralleling the Tip Top – Cloverport 138 kV Transmission Line and rebuilding that transmission line for another four to five and one-half miles after it leaves the Fort Knox Reservation. The BREC routes are focused on paralleling a Big Rivers Electric Corporation (BREC) 69 kV transmission line which runs roughly northeast to southwest in eastern Meade County and western Breckinridge County, an area served by Meade County Rural Electric Cooperative. This BREC line is a collocation (parallel) opportunity connecting KU's Tip Top – Cloverport 138 kV Transmission Line with KU's Hardinsburg – Hardin County 138 kV Transmission Line. Portions of the routes that make up the BREC basket of routes parallel natural gas pipelines, local county roads, or pick their way cross-country through rural residential land uses. The BREC routes parallel KU's Hardinsburg – Hardin County 138 kV Transmission Line on the final approach to Hardin County Substation. Figure 2.5 shows the BREC basket of routes.

### **2.5.1 Collocation Opportunities**

Collocation opportunities within the BREC basket of routes include:

- KU's Tip Top – Cloverport 138 kV Transmission Line
- KU's Hardinsburg – Hardin County 138 kV Transmission Line
- BREC 69 kV Transmission Line
- Big Spring Road
- several natural gas transmission lines

### **2.5.2 Route Metrics**

There are 54 routing alternatives within the BREC basket of routes. The first two tables describe the range of impacts to the Built and Natural Environments within the BREC basket of routes. The routes are also scored against Engineering Considerations.

Built	Residences within ROW	Proximity to Residences (within 300')	Proposed Developments	Proximity Commercial Buildings (within 300')	Proximity Industrial Buildings (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
Minimum	0	17	0	0	1	0	1
Maximum	21	141	0	1	4	0	10
Average	10.6	80.2	0.0	0.7	2.3	0.0	6.7

Natural	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
Minimum	312.09	23	11.93	103.14
Maximum	544.89	51	19.41	155.60
Average	418.03	34.1	15.17	135.46

Engineering	Length (Miles)	Percent of Route Rebuilt with Existing T/L	Percent of Route of Collocated with Existing Utilities	Percent of Route Collocated with Roads	Total Project Cost
Minimum	49.62	25.26%	29.61%	0.00%	69,640,630
Maximum	56.99	42.13%	60.75%	4.27%	76,022,034
Average	52.87	33.11%	47.16%	1.24%	72,252,865

## 2.6 Cross Over Routes

Routes within the baskets of routes were analyzed within their peer groups to mitigate the adverse effects on the model resulting from outlier values stretching data normalization. This allows the best routes within each basket to be more confidently identified and compared to top routes in the other baskets. There are, however, a great number of routing alternatives which “cross over” from one basket to another. We wanted to continue to analyze and evaluate such routes, but we chose to analyze and evaluate them separately from the “purer” baskets of routes by putting them in their own basket of “Cross Over Routes.”

## **2.6.1 Collocation Opportunities**

Collocation opportunities among the Cross Over Routes are essentially the same as the sum of the cross over opportunities among the five baskets of routes.

## **2.6.2 Route Metrics**

Because these cross over routes originate within one basket and cross over to another or to several others, they are as varied as all five baskets taken together, which is to say they are characteristic of the study area in general. They share *nothing more in common*, and are assembled into this group simply to ensure that all practicable routes are analyzed, evaluated, and given an opportunity to move on to the expert judgment phase of the route selection process.

## **3.0 Routes Eliminated from Further Consideration**

### **3.1 Routes Incompatible with Fort Knox**

Fort Knox Army Reservation determined that routes which follow Tip Top – Cloverport 138 kV Transmission Line west from Tip Top Substation (Segment 47) are preferable to the Tip Top South routes. All Tip Top South routes parallel either a natural gas pipeline (Segment 62) or U.S. 31W (Segment 72) south from the area around Tip Top Substation. Both of these segments come close to Godman Army Air Field and to Van Voorhis Manor base housing, as well as to an elementary school which serves Van Voorhis Manor children. Locating the line along the west side of US 31W would eliminate tree buffers between housing units and the highway and army air field. See letter to LG&E from the Garrison Commander, Fort Knox in the section 10.0 appendix to this report.

This eliminated some 138 routing alternatives from further consideration. Note that routes which cross over from the East basket or the East-Central basket to utilize segments of the Tip Top South routes *after* they leave Fort Knox are not eliminated; only routing alternatives which utilize Segments 62 or 72 are eliminated at this point. This cut leaves 1,066 routes (Figure 3.1) which may be considered to be practicable routes, the term “practicable” in this case meaning simply “capable of being done.”

### **3.2 Routes Compatible with Fort Knox**

#### **3.2.1 Least Cost Practicable Route**

The least cost practicable route was identified at this point. This is Route AQV, shown in Figure 3.2.1, which is estimated to cost approximately \$54,764,303.

#### **3.2.2 Range of Metrics for all Practicable Routes**

Table 3.1 in the digital appendix shows the metrics for the remaining 1,066 Mill Creek – Hardin County alternatives which are compatible with Fort Knox. These constitute the universe of practicable routes. Table 3.1(a) in the digital appendix shows additional route metrics (estimated number of parcels and approximate acres of new easement required) for the routes which are compatible with Fort Knox. The first two tables below describe the range of impacts to the Built and Natural Environments for all practicable routes. All practicable routes are also scored against Engineering Considerations.

<b>Built</b>	Residences within ROW	Proximity to Residences (within 300')	Proposed Developments	Proximity Commercial Buildings (within 300')	Proximity Industrial Buildings (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of ROW)
Minimum	0	12	0	0	1	0	0
Maximum	155	676	6	130	154	4	13
Average	33.3	164.2	0.5	10.3	20.9	1.7	7.5

<b>Natural</b>	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
Minimum	230.72	23	2.33	103.14
Maximum	563.22	93	24.64	290.64
Average	337.26	49.1	14.71	147.59

<b>Engineering</b>	Length (Miles)	Percent of Route Rebuilt with Existing T/L*	Percent of Route of Co-located with Existing Utilities*	Percent of Route Co-located with Roads*	Total Collocation Percentage	Total Project Cost
Minimum	35.22	0.00%	29.61%	0.00%	44.01%	54,764,303
Maximum	56.99	42.13%	93.39%	46.75%	98.85%	83,132,539
Average	43.19	7.54%	51.64%	13.52%	72.69%	66,655,620

### 3.2.3 Collocation Routes

All available collocation opportunities which work electrically were analyzed and evaluated and then ranked by percent collocation. The top fifty routes which maximize collocation are shown in Figure 3.2.3.

Metrics from the top fifty maximum collocation routes considered are presented below. The first two tables describe the range of impacts to the Built and Natural Environments for the top fifty maximum collocation routes. The top fifty maximum collocation routes are also scored against Engineering Considerations.

<b>Built</b>	Residences within ROW	Proximity to Residences (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
<b>Least</b>	2	21	0	0
<b>Most</b>	155	676	4	10
<b>Average</b>	55.0	236.4	1.9	5.2

<b>Natural</b>	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
<b>Least</b>	241.10	23	2.33	103.14
<b>Most</b>	543.37	88	19.41	289.51
<b>Average</b>	387.44	47.8	11.68	158.46

<b>Engineering</b>	Length (Miles)	Percent of Route Rebuilt with Existing T/L*	Percent of Route of Co-located with Existing Utilities*	Percent of Route Co-located with Roads*	Total Collocation Percentage	Total Project Cost
<b>Least</b>	37.76	0.00%	37.45%	0.00%	87.27%	66,139,802
<b>Most</b>	56.99	42.13%	93.39%	46.75%	98.85%	80,545,031
<b>Average</b>	46.26	15.47%	58.39%	17.25%	91.11%	71,613,063

## **4.0 Analysis and Evaluation Model Application**

As described in Section 1.3.7, all routes were analyzed and evaluated first by comparison to their peer routes within each basket of routes or within the cross over basket. The following sections identify the routes within each basket of routes (or within the cross over basket) which emerged as a “top five” route through application of the Analysis and Evaluation Model. Information about these “Top Fives” routes is provided in Tables 4.1 through 4.5 in the digital appendix.

### **4.1 East Routes**

#### **4.1.1 Built Environment Perspective**

As discussed in Section 1.3.1, the Built Environment perspective considers impacts to the built environment to be more important than impacts to the natural environment and more important than engineering considerations. The Built Environment perspective accomplishes this preference by assigning a weight to the built environment module that is five times that assigned to the Natural Environment or Engineering Considerations modules.

The top routing alternatives for the Built Environment perspective within the East basket of routes were Routes AVD, AVC, AVE, AVF, and AUT. These are among the top East routes shown in Figure 4.1. Data for the top five Built Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.1 in the digital appendix.

#### **4.1.2 Natural Environment Perspective**

As discussed in Section 1.3.2, the Natural Environment perspective considers impacts to the natural environment to be more important than impacts to the built environment and more important than engineering considerations. The Natural Environment perspective accomplishes this preference by assigning a weight to the natural environment module that is five times that assigned to the Built Environment or Engineering Considerations modules.

The top routing alternatives for the Natural Environment perspective within the East basket of routes were Routes AUD, AUL, AUT, AUP, and ATZ. These are among the top East routes shown in Figure 4.1. Data for the top five Natural Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.1 in the digital appendix.

#### **4.1.3 Engineering Considerations**

As discussed in Section 1.3.3, the Engineering Considerations perspective considers engineering and technical criteria to be more important than impacts to the built environment or to the natural environment. The Engineering Considerations perspective accomplishes this preference by assigning a weight to the engineering considerations module that is five times that assigned to the Built Environment or Natural Environment modules.

The top routing alternatives for the Engineering Considerations perspective within the East basket of routes were Routes AVC, AUL, AUP, AVF, and AUX. These are among the top East routes shown in Figure 4.1. Data for the top five Engineering Considerations routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.1 in the digital appendix.

#### 4.1.4 Simple Composite

As discussed in Section 1.3.4, the Simple Composite perspective considers impacts to the built environment, impacts to the natural environment, and engineering considerations to be equally important. The Simple Composite accomplishes this by assigning equal weights to each of the three perspectives.

The top routing alternatives for the Simple Composite perspective within the East basket of routes were Routes AVC, AVD, AUP, AUT, and AUD. These are among the top East routes shown in Figure 4.1. Data for the top five Simple Composite routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.1 in the digital appendix.

#### 4.1.5 “Top Fives” East Routes

As can be seen from this table, even though there are twenty individual slots in the East basket of routes “Top Fives” matrix, there are only ten different routes among the “Top Fives” finalists. This is because some routes appear more than once in the rankings by perspective and/or in the simple composite.

East Basket			
Built	Engineering	Natural	Simple
ROUTE AVD	ROUTE AVC	ROUTE AUD	ROUTE AVC
ROUTE AVC	ROUTE AUL	ROUTE AUL	ROUTE AVD
ROUTE AVE	ROUTE AUP	ROUTE AUT	ROUTE AUP
ROUTE AVF	ROUTE AVF	ROUTE AUP	ROUTE AUT
ROUTE AUT	ROUTE AUX	ROUTE ATZ	ROUTE AUD

## 4.2 East-Central Routes

### 4.2.1 Built Environment Perspective

As discussed in Section 1.3.1, the Built Environment perspective considers impacts to the built environment to be more important than impacts to the natural environment and more important than engineering considerations. The Built Environment perspective accomplishes this preference by assigning a weight to the built environment module that is five times that assigned to the Natural Environment or Engineering Considerations modules.

The top routing alternatives for the Built Environment perspective within the East-Central basket of routes were Routes ALE, AQL, AME, ANE, and QI. These are among the top East-Central routes shown in Figure 4.2. Data for the top five Built Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.2 in the digital appendix.

#### **4.2.2 Natural Environment Perspective**

As discussed in Section 1.3.2, the Natural Environment perspective considers impacts to the natural environment to be more important than impacts to the built environment and more important than engineering considerations. The Natural Environment perspective accomplishes this preference by assigning a weight to the natural environment module that is five times that assigned to the Built Environment or Engineering Considerations modules.

The top routing alternatives for the Natural Environment perspective within the East-Central basket of routes were Routes YB, QE, QA, SE, and QI. These are among the top East-Central routes shown in Figure 4.2. Data for the top five Natural Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.2 in the digital appendix.

#### **4.2.3 Engineering Considerations**

As discussed in Section 1.3.3, the Engineering Considerations perspective considers engineering and technical criteria to be more important than impacts to the built environment or to the natural environment. The Engineering Considerations perspective accomplishes this preference by assigning a weight to the engineering considerations module that is five times that assigned to the Built Environment or Natural Environment modules.

The top routing alternatives for the Engineering Considerations perspective within the East-Central basket of routes were Routes QI, ALE, QG, SI, and AME. These are among the top East-Central routes shown in Figure 4.2. Data for the top five Engineering Considerations routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.2 in the digital appendix.

#### **4.2.4 Simple Composite**



As discussed in Section 1.3.4, the Simple Composite perspective considers impacts to the built environment, impacts to the natural environment, and engineering considerations to be equally important. The Simple Composite accomplishes this by assigning equal weights to each of the three perspectives.

The top routing alternatives for the Simple Composite perspective within the East-Central basket of routes were Routes AQL, ALE, QI, YB, AME. These are among the top East-Central routes shown in Figure 4.2. Data for the top five Simple Composite routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.0 in the digital appendix.

#### 4.2.5 “Top Fives” East-Central Routes

As can be seen from this table, even though there are twenty individual slots in the East-Central basket of routes “Top Fives” matrix, there are only eleven different routes among the “Top Fives” finalists. This is because some routes appear more than once in the rankings by perspective and/or in the simple composite.

<b>East-Central Basket</b>			
<b>Built</b>	<b>Engineering</b>	<b>Natural</b>	<b>Simple</b>
ROUTE ALE	ROUTE QI	ROUTE YB	ROUTE AQL
ROUTE AQL	ROUTE ALE	ROUTE QE	ROUTE ALE
ROUTE AME	ROUTE QG	ROUTE QA	ROUTE QI
ROUTE ANE	ROUTE SI	ROUTE SE	ROUTE YB
ROUTE QI	ROUTE AME	ROUTE QI	ROUTE AME

### 4.3 West-Central Routes

#### 4.3.1 Built Environment Perspective

As discussed in Section 1.3.1, the Built Environment perspective considers impacts to the built environment to be more important than impacts to the natural environment and more important than engineering considerations. The Built Environment perspective accomplishes this preference by assigning a weight to the built environment module that is five times that assigned to the Natural Environment or Engineering Considerations modules.

The top routing alternatives for the Built Environment perspective within the West-Central basket of routes were Routes AJW, AJU, KY, AJX, and KW. These are among the top West-Central routes shown in Figure 4.3. Data for the top five Built Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.3 in the digital appendix.

#### 4.3.2 Natural Environment Perspective

As discussed in Section 1.3.2, the Natural Environment perspective considers impacts to the natural environment to be more important than impacts to the built environment and more important than engineering considerations. The Natural Environment perspective accomplishes this preference by assigning a weight to the natural environment module that is five times that assigned to the Built Environment or Engineering Considerations modules.

The top routing alternatives for the Natural Environment perspective within the West-Central basket of routes were Routes KY, AJW, KW, KZ, and AJX. These are among the top West-Central routes shown in Figure 4.3. Data for the top five Natural Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.3 in the digital appendix.

#### **4.3.3 Engineering Considerations**

As discussed in Section 1.3.3, the Engineering Considerations perspective considers engineering and technical criteria to be more important than impacts to the built environment or to the natural environment. The Engineering Considerations perspective accomplishes this preference by assigning a weight to the engineering considerations module that is five times that assigned to the Built Environment or Natural Environment modules.

The top routing alternatives for the Engineering Considerations perspective within the West-Central basket of routes were Routes AJW, KY, KW, AJX, and AJU. These are among the top West-Central routes shown in Figure 4.3. Data for the top five Engineering Considerations routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.3 in the digital appendix.

#### **4.3.4 Simple Composite**

As discussed in Section 1.3.4, the Simple Composite perspective considers impacts to the built environment, impacts to the natural environment, and engineering considerations to be equally important. The Simple Composite accomplishes this by assigning equal weights to each of the three perspectives.

The top routing alternatives for the Simple Composite perspective within the West-Central basket of routes were Routes AJW, KY, KW, AJX, AJU. These are among the top West-Central routes shown in Figure 4.3. Data for the top five Simple Composite routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.3 in the digital appendix.

#### **4.3.5 “Top Fives” West-Central Routes**

As can be seen from this table, even though there are twenty individual slots in the West-Central basket of routes “Top Fives” matrix, there are only six different

routes among the “Top Fives” finalists. This is because some routes appear more than once in the rankings by perspective or in the simple composite.

<b>West-Central Basket</b>			
<b>Built</b>	<b>Engineering</b>	<b>Natural</b>	<b>Simple</b>
ROUTE AJW	ROUTE AJW	ROUTE KY	ROUTE AJW
ROUTE AJU	ROUTE KY	ROUTE AJW	ROUTE KY
ROUTE KY	ROUTE KW	ROUTE KW	ROUTE KW
ROUTE AJX	ROUTE AJX	ROUTE KZ	ROUTE AJX
ROUTE KW	ROUTE AJU	ROUTE AJX	ROUTE AJU

#### **4.4 BREC Routes**

##### **4.4.1 Built Environment Perspective**

As discussed in Section 1.3.1, the Built Environment perspective considers impacts to the built environment to be more important than impacts to the natural environment and more important than engineering considerations. The Built Environment perspective accomplishes this preference by assigning a weight to the built environment module that is five times that assigned to the Natural Environment or Engineering Considerations modules.

The top routing alternatives for the Built Environment perspective within the BREC basket of routes were Routes ADC, ACQ, AGW, ADS, and ACU. These are among the top BREC routes shown in Figure 4.4. Data for the top five Built Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.4 in the digital appendix.

##### **4.4.2 Natural Environment Perspective**

As discussed in Section 1.3.2, the Natural Environment perspective considers impacts to the natural environment to be more important than impacts to the built environment and more important than engineering considerations. The Natural Environment perspective accomplishes this preference by assigning a weight to the natural environment module that is five times that assigned to the Built Environment or Engineering Considerations modules.

The top routing alternatives for the Natural Environment perspective within the BREC basket of routes were Routes HS, G, AGW, BK, and ACQ. These are among the top BREC routes shown in Figure 4.4. Data for the top five Natural Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.4 in the digital appendix.

##### **4.4.3 Engineering Considerations**

As discussed in Section 1.3.3, the Engineering Considerations perspective considers engineering and technical criteria to be more important than impacts to the built environment or to the natural environment. The Engineering Considerations perspective accomplishes this preference by assigning a weight to the engineering considerations module that is five times that assigned to the Built Environment or Natural Environment modules.

The top routing alternatives for the Engineering Considerations perspective within the BREC basket of routes were Routes G, ACQ, E, HS, and AGW. These are among the top BREC routes shown in Figure 4.4. Data for the top five Engineering Considerations routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.4 in the digital appendix.

#### 4.4.4 Simple Composite

As discussed in Section 1.3.4, the Simple Composite perspective considers impacts to the built environment, impacts to the natural environment, and engineering considerations to be equally important. The Simple Composite accomplishes this by assigning equal weights to each of the three perspectives.

The top routing alternatives for the Simple Composite perspective within the BREC basket of routes were Routes ACQ, G, AGW, ADC, and HS. These are among the top BREC routes shown in Figure 4.4. Data for the top five Simple Composite routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.4 in the digital appendix.

#### 4.4.5 “Top Fives” BREC Routes

As can be seen from this table, even though there are twenty individual slots in the BREC basket of routes “Top Fives” matrix, there are only nine different routes among the “Top Fives” finalists. This is because some routes appear more than once in the rankings by perspective or in the simple composite.

<b>BREC Basket</b>			
<b>Built</b>	<b>Engineering</b>	<b>Natural</b>	<b>Simple</b>
ROUTE ADC	ROUTE G	ROUTE HS	ROUTE ACQ
ROUTE ACQ	ROUTE ACQ	ROUTE G	ROUTE G
ROUTE AGW	ROUTE E	ROUTE AGW	ROUTE AGW
ROUTE ADS	ROUTE HS	ROUTE BK	ROUTE ADC
ROUTE ACU	ROUTE AGW	ROUTE ACQ	ROUTE HS

### 4.5 Cross Over Routes

#### 4.5.1 Built Environment Perspective

As discussed in Section 1.3.1, the Built Environment perspective considers impacts to the built environment to be more important than impacts to the natural environment and more important than engineering considerations. The Built Environment perspective accomplishes this preference by assigning a weight to the built environment module that is five times that assigned to the Natural Environment or Engineering Considerations modules.

The top routing alternatives for the Built Environment perspective within the Cross Over Routes basket of routes were Routes AVD, AVC, AVE, AVF, and AUT. These are among the top Cross Over routes shown in Figure 4.5. Data for the top five Built Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.5 in the digital appendix.

#### **4.5.2 Natural Environment Perspective**

As discussed in Section 1.3.2, the Natural Environment perspective considers impacts to the natural environment to be more important than impacts to the built environment and more important than engineering considerations. The Natural Environment perspective accomplishes this preference by assigning a weight to the natural environment module that is five times that assigned to the Built Environment or Engineering Considerations modules.

The top routing alternatives for the Natural Environment perspective within the Cross Over Routes basket of routes were Routes AUD, AUL, AUT, AUP, and ATZ. These are among the top Cross Over routes shown in Figure 4.5. Data for the top five Natural Environment routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.5 in the digital appendix.

#### **4.5.3 Engineering Considerations**

As discussed in Section 1.3.3, the Engineering Considerations perspective considers engineering and technical criteria to be more important than impacts to the built environment or to the natural environment. The Engineering Considerations perspective accomplishes this preference by assigning a weight to the engineering considerations module that is five times that assigned to the Built Environment or Natural Environment modules.

The top routing alternatives for the Engineering Considerations perspective within the Cross Over Routes basket of routes were Routes AVC, AUL, AUP, AVF, and AUX. These are among the top Cross Over routes shown in Figure 4.5. Data for the top five Engineering Considerations routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.0 in the digital appendix.

#### **4.5.4 Simple Composite**

As discussed in Section 1.3.4, the Simple Composite perspective considers impacts to the built environment, impacts to the natural environment, and engineering considerations to be equally important. The Simple Composite accomplishes this by assigning equal weights to each of the three perspectives.

The top routing alternatives for the Simple Composite perspective within the Cross Over Routes basket of routes were Routes AVC, AVD, AUP, AUT, and AUD. These are among the top Cross Over routes shown in Figure 4.5. Data for the top five Simple Composite routes, taken from the *Analysis and Evaluation* model, is provided in Table 4.5 in the digital appendix.

#### 4.5.5 “Top Fives” Cross Over Routes

As can be seen from this table, even though there are twenty individual slots in the Cross Over basket of routes “Top Fives” matrix, there are only thirteen different routes among the “Top Fives” finalists. This is because some routes appear more than once in the rankings by perspective or in the simple composite.

Cross Over Routes Basket			
Built	Engineering	Natural	Simple
ROUTE AIK	ROUTE KU	ROUTE HW	ROUTE AIK
ROUTE AGU	ROUTE AIK	ROUTE KU	ROUTE KU
ROUTE ADK	ROUTE KS	ROUTE IA	ROUTE AGU
ROUTE AHA	ROUTE HO	ROUTE BS	ROUTE AGY
ROUTE ADG	ROUTE AM	ROUTE HO	ROUTE AHA

#### 5.0 “Top Fives” Routes

Within each basket of routes, the top five routes in each of the three perspectives and in the simple composite are the routing alternatives which will be considered next as semi-finalist routes in an expert judgment phase. There are forty-nine (49) such “Top Fives” routes which graduate to further consideration.

All forty-nine “Top Fives” routes are further evaluated within decision matrices based on the Built Environment (Section 5.1), Natural Environment (Section 5.2), and Engineering Considerations (Section 5.3).

#### 5.1 Built Environment

Table 5.1 shows all forty-nine of the “Top Fives” routes from the five baskets of routes ranked against significant built environment criteria.

For all forty-nine “Top Fives” routes, minimum and maximum values are identified and averages (statistical mean) and standard deviations (STD DEV) are calculated. The standard deviation is added to the minimum value under each Built Environment criterion to establish a cautionary threshold.

**Table 5.1 Built Environment Screening**

Built Environment Perspective	Residences within ROW	Proximity to Residences (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of ROW)
ROUTE ACQ	2	23	0	1
ROUTE ACU	2	21	0	1
ROUTE ADC	0	17	0	1
ROUTE ADS	2	22	0	1
ROUTE AGW	3	18	0	1
ROUTE AJU	0	12	0	4
ROUTE AJW	0	13	0	2
ROUTE AJX	2	50	0	4
ROUTE ALE	10	75	0	3
ROUTE AME	9	71	0	3
ROUTE ANE	7	64	0	3
ROUTE AQL	5	75	0	2
<b>ROUTE ATZ</b>	<b>98</b>	<b>531</b>	<b>4</b>	<b>0</b>
<b>ROUTE AUD</b>	<b>98</b>	<b>538</b>	<b>4</b>	<b>0</b>
<b>ROUTE AUL</b>	<b>155</b>	<b>676</b>	<b>2</b>	<b>0</b>
<b>ROUTE AUP</b>	<b>34</b>	<b>144</b>	<b>1</b>	<b>8</b>
<b>ROUTE AUT</b>	<b>32</b>	<b>147</b>	<b>1</b>	<b>8</b>
<b>ROUTE AUX</b>	<b>82</b>	<b>284</b>	<b>1</b>	<b>7</b>
<b>ROUTE AVC</b>	<b>36</b>	<b>199</b>	<b>0</b>	<b>1</b>
<b>ROUTE AVD</b>	<b>11</b>	<b>165</b>	<b>0</b>	<b>1</b>
<b>ROUTE AVE</b>	<b>18</b>	<b>135</b>	<b>0</b>	<b>4</b>
<b>ROUTE AVF</b>	<b>35</b>	<b>152</b>	<b>0</b>	<b>4</b>
ROUTE BK	4	48	0	8
ROUTE E	5	54	0	8
ROUTE G	4	49	0	8
ROUTE HS	5	44	0	8
ROUTE KW	3	44	0	9
ROUTE KY	2	39	0	9
ROUTE KZ	4	76	0	11
<b>ROUTE QA</b>	<b>41</b>	<b>156</b>	<b>2</b>	<b>10</b>
<b>ROUTE QE</b>	<b>49</b>	<b>207</b>	<b>2</b>	<b>10</b>
ROUTE QG	13	106	0	10
ROUTE QI	12	101	0	10
<b>ROUTE SE</b>	<b>48</b>	<b>203</b>	<b>2</b>	<b>10</b>
ROUTE SI	11	97	0	10
ROUTE YB	7	101	0	9
ROUTE ADG	3	27	1	1
ROUTE ADK	0	22	1	1
ROUTE AGU	0	19	0	2
ROUTE AGY	6	28	1	1
ROUTE AHA	3	23	1	1
ROUTE AIK	1	15	0	2
<b>ROUTE AM</b>	<b>5</b>	<b>53</b>	<b>1</b>	<b>8</b>
<b>ROUTE BS</b>	<b>7</b>	<b>58</b>	<b>1</b>	<b>8</b>
ROUTE HO	2	45	0	9
<b>ROUTE HW</b>	<b>8</b>	<b>54</b>	<b>1</b>	<b>8</b>
<b>ROUTE IA</b>	<b>5</b>	<b>49</b>	<b>1</b>	<b>8</b>
ROUTE KS	4	46	0	9
ROUTE KU	3	41	0	9
AVERAGE	18.3	106.9	0.6	5.2
MINIMUM	0.0	12.0	0.0	0.0
MAXIMUM	155.0	676.0	4.0	11.0
STD DEV	30.7	136.6	0.9	3.7
Threshold	<b>30.7</b>	<b>148.6</b>	<b>0.9</b>	<b>3.7</b>

For purposes of further analyzing the forty-nine “Top Fives” routes for impacts to the Built Environment, the analysis first eliminated considerations pertaining to proposed developments, proximity to commercial buildings, and proximity to industrial buildings. These criteria are simply not as significant as, for example, residences within the proposed right-of-way or building through heavily residential areas (higher number of homes within 300 feet of the right-of-way).

For routes that have a value beyond one standard deviation in either “residences within right-of-way” or “proximity to residences (within 300 feet),” those routes are considered to exceed a cautionary threshold for impacts to the built environment.

Two other criteria for the built environment are (1) school, church, cemetery, and park parcels crossed and (2) National Register of Historic Places-listed Structures and Districts within 3,000 feet of the centerline. These are potentially significant issues but we are not sure that they automatically rise to the level of directly affecting residences and crossing through residential neighborhoods. However, for routes that have a value beyond one standard deviation in both of these criteria, those routes are considered to exceed a cautionary threshold for impacts to the built environment.

In Table 5.1, the standard deviation and threshold values are provided along the bottom rows of the table. Where those values are exceeded under the various criteria considered, those values are bolded. If a route’s values across the criteria exceed the threshold values in the manner identified above, the route names themselves are bolded, and those routes will be considered to exceed a cautionary threshold for impacts to the built environment.

## **5.2 Natural Environment**

Table 5.2 shows all forty-nine of the “Top Fives” routes from the five baskets of routes ranked against significant natural environment criteria.

For all forty-nine “Top Fives” routes further evaluated, minimum and maximum values are identified and averages (statistical mean) and standard deviations are calculated. The standard deviation (SD) is added to the minimum value under each Natural Environment criterion to establish a cautionary threshold.

For purposes of further analyzing the forty-nine “Top Fives” routes for impacts to the Natural Environment, this analysis considers all four natural environment criteria to be equally significant. All routes exceed the cautionary threshold in either two or three respects. Therefore, for routes that have a value beyond one



standard deviation in three of the four criteria, those routes are considered to exceed a cautionary threshold for impacts to the natural environment.

In Table 5.2, the standard deviation and threshold values are provided along the bottom rows of the table. Where those threshold values are exceeded under the various criteria considered, those values are **bolded**. If a route's values across the criteria exceed the threshold values in the manner identified above, that is, by falling above the standard deviation in three or more criteria, the routes themselves are **bolded**, and they will be considered to have exceeded the cautionary threshold for impacts to the natural environment.

Table 5.2 / Natural Environment Screening				
Natural Environment Perspective	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
ROUTE ACQ	445.50	40	12.15	103.14
ROUTE ACU	523.07	46	12.15	103.14
ROUTE ADC	458.70	42	11.93	103.14
ROUTE ADS	459.11	40	11.93	103.14
ROUTE AGW	397.61	39	11.93	103.14
ROUTE AJU	429.82	43	14.15	108.73
ROUTE AJW	402.88	40	11.93	104.61
ROUTE AJX	412.63	45	11.93	106.79
ROUTE ALE	327.92	57	12.44	106.79
ROUTE AME	328.06	57	12.81	106.79
ROUTE ANE	333.70	57	12.75	106.79
ROUTE AQL	326.55	53	12.05	107.07
ROUTE ATZ	476.42	65	2.94	289.89
ROUTE AUD	492.83	61	2.79	246.37
ROUTE AUL	452.51	60	3.14	246.00
ROUTE AUP	540.36	74	2.97	162.70
ROUTE AUT	561.06	72	2.86	155.58
ROUTE AUX	507.52	75	3.25	149.76
ROUTE AVC	515.55	80	3.25	151.80
ROUTE AVD	563.22	83	3.15	148.90
ROUTE AVE	562.59	93	6.07	159.12
ROUTE AVF	512.19	88	6.17	162.02
ROUTE BK	373.59	27	12.62	146.00
ROUTE E	364.26	28	14.95	151.75
ROUTE G	359.98	27	12.83	146.00
ROUTE HS	312.09	26	12.62	146.00
ROUTE KW	321.64	28	14.74	153.22
ROUTE KY	317.36	27	12.62	147.47
ROUTE KZ	327.11	32	12.62	149.65
ROUTE QA	240.94	39	12.78	150.03
ROUTE QE	237.45	37	12.62	148.59
ROUTE QG	246.68	45	15.24	155.41
ROUTE QI	242.40	44	13.12	149.66
ROUTE SE	237.58	37	12.99	148.59
ROUTE SI	242.53	44	13.49	149.66
ROUTE YB	241.03	40	12.74	149.93
ROUTE ADG	466.93	46	11.93	105.53
ROUTE ADK	467.77	47	11.93	104.61
ROUTE AGU	464.23	44	12.82	104.61
ROUTE AGY	405.84	43	11.93	105.53
ROUTE AHA	406.68	44	11.93	104.61
ROUTE AIK	402.73	43	12.82	104.61
ROUTE AM	381.40	33	12.62	148.39
ROUTE BS	381.81	31	12.62	148.39
ROUTE HO	378.71	31	13.51	147.47
ROUTE HW	320.32	30	12.62	148.39
ROUTE IA	321.16	31	12.62	147.47
ROUTE KS	321.49	31	15.63	153.22
ROUTE KU	317.21	30	13.51	147.47
AVERAGE	390	46	11	141
MINIMUM	237	26	3	103
MAXIMUM	563	93	16	290
STD DEV	94.8	17.1	3.8	38.0
Threshold	332.3	43.1	6.6	141.1

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### 5.3 Engineering Considerations

Table 5.3 shows all forty-nine of the “Top Fives” routes from the five baskets of routes ranked against engineering and technical criteria.

For all forty-nine “Top Fives” routes, minimum and maximum values are identified and averages (statistical mean) and standard deviations are calculated. The standard deviation (SD) is added to the minimum value under each Engineering Considerations criterion to establish a cautionary threshold.

For purposes of further analyzing the forty-nine “Top Fives” routes for impacts to Engineering Considerations, this analysis considers first of all that routes estimated to cost greater than 125% of the estimated cost of the least cost practicable route (Route AQV, estimated to cost approximately \$54,764,303) are not cost effective. Furthermore, routes should be considered to fail for impacts to engineering considerations when other of three criteria (length of line, number of landowners affected, acres of new right-of-way required) also exceed their standard deviation-based thresholds in specific ways.

It is at least arguable that some combination of these criteria should merit consideration as a restraint on the requirement for collocation, since the longer a transmission line is forced to collocate rather than take a more direct approach to its termination, the more expensive the line, the more land taken from citizens of the Commonwealth as right-of-way, and the greater number of property owners it is likely to impact. In fact, no Kentucky landowner already having a transmission line cross his property could view with equanimity the prospect of new transmission lines coming at him, unconstrained by cost, length, amount of parcels affected, or acres of new right-of-way required so long as collocation is maximized at the expense of these other considerations.

We concur with the KPSC that all “electrically equivalent” transmission line routes should be evaluated, and with this study of alternatives, they are indeed analyzed and evaluated. In this analysis, a “Top Fives” route will be considered a poor route for engineering considerations reasons if

- (1) a route exceeds 125% of the estimated cost of the least cost practicable route (Route AQV at \$54,764,303). This would affect routes estimated to cost more than \$68,455,379, or \$13,691,076 more than Route AQV);
- (2) a route exceeds the standard deviation-based threshold for total estimated cost and also exceeds the standard deviation-based threshold for (a) length of line, (b) number of parcels affected, or (c) acres of new easement required;

- (3) a route exceeds the standard deviation-based threshold for all three of the standard deviation-based thresholds for (a) length of line, (b) number of parcels affected, and (c) acres of new easement required.

In Table 5.3, the standard deviation and threshold values are provided along the bottom rows of the table. Where those values are exceeded under the various criteria considered, those values are bolded. If a route's values across the criteria exceed the threshold values in the manner identified above, that is, by falling above the standard deviation in three or more criteria, the routes themselves are bolded, and they will be considered to have failed the first cut in the engineering considerations evaluation.

**Table 5.3 / Engineering Considerations Screening**

Engineering Considerations Perspective	Length (Miles)	Percent of Route Rebuilt with Existing T/L	Percent of Route Collocated with Existing Utilities	Percent Rebuild or Parallel Utilities	Total Project Costs	Percent Over Least Cost Route (A/JW)	Estimated No. of Parcels	Approx. Acres of New Easement
ROUTE ACQ	56.52	40.69%	57.09%	97.79%	\$74,588,719	36.2%	116	812.61
ROUTE ACU	55.53	35.15%	51.85%	87.00%	\$73,144,888	33.6%	126	872.97
ROUTE ADC	54.05	36.11%	46.46%	82.57%	\$71,488,948	30.5%	116	837.09
ROUTE ADS	54.13	36.06%	42.66%	78.72%	\$72,272,345	32.0%	121	839.03
ROUTE AGW	51.55	37.87%	34.14%	72.01%	\$69,836,908	27.5%	108	776.48
ROUTE AJU	41.87	17.05%	38.81%	55.86%	\$56,742,836	3.6%	110	841.94
ROUTE AJW	43.88	29.26%	37.03%	66.29%	\$60,973,719	11.3%	104	752.48
ROUTE AJX	44.35	21.74%	36.64%	58.38%	\$60,786,966	11.0%	161	841.45
ROUTE ALE	40.34	10.29%	44.92%	55.21%	\$63,018,945	15.1%	198	877.33
ROUTE AME	40.87	10.15%	44.73%	54.88%	\$66,172,832	20.8%	200	890.18
ROUTE ANE	40.41	7.92%	44.32%	52.24%	\$64,056,129	17.0%	180	902.06
ROUTE AQL	38.49	8.31%	55.11%	63.42%	\$59,063,247	7.8%	175	855.52
ROUTE ATZ	44.01	0.00%	76.98%	76.98%	\$78,488,555	43.3%	739	1066.91
ROUTE AUD	44.60	0.00%	83.50%	83.50%	\$80,545,031	47.1%	751	1081.21
ROUTE AUL	40.72	0.00%	93.39%	93.39%	\$75,661,706	38.2%	681	987.15
ROUTE AUP	45.70	0.00%	50.11%	50.11%	\$65,275,814	19.2%	398	1107.88
ROUTE AUT	46.07	0.00%	42.74%	42.74%	\$68,433,328	25.0%	406	1116.85
ROUTE AUX	46.78	0.00%	73.22%	73.22%	\$67,137,000	22.6%	510	1134.06
ROUTE AVC	46.58	0.00%	81.67%	81.67%	\$60,685,362	10.8%	398	1129.21
ROUTE AVD	48.06	0.00%	56.26%	56.26%	\$69,636,782	27.2%	368	1165.09
ROUTE AVE	54.39	0.00%	74.54%	74.54%	\$73,856,378	34.9%	397	1318.55
ROUTE AVF	53.43	0.00%	91.13%	91.13%	\$66,271,710	21.0%	405	1295.27
ROUTE BK	52.20	37.39%	38.93%	76.32%	\$72,402,291	32.2%	143	792.24
ROUTE E	54.82	41.96%	55.02%	96.97%	\$76,022,034	38.8%	160	771.39
ROUTE G	54.59	42.13%	54.04%	96.17%	\$74,724,438	36.4%	138	765.82
ROUTE HS	49.62	39.34%	29.89%	69.23%	\$69,981,206	27.8%	131	729.70
ROUTE KW	42.18	30.44%	33.52%	63.96%	\$62,443,199	14.0%	148	711.27
ROUTE KY	41.95	30.61%	32.13%	62.74%	\$61,124,054	11.6%	126	705.70
ROUTE KZ	42.42	22.73%	31.78%	54.50%	\$60,870,262	11.1%	183	794.67
ROUTE QA	38.39	10.81%	36.08%	46.89%	\$66,522,120	21.5%	279	830.06
ROUTE QE	37.83	10.97%	36.61%	47.58%	\$66,515,994	21.5%	346	816.48
ROUTE QG	38.64	10.74%	41.43%	52.17%	\$64,376,228	17.6%	242	836.12
ROUTE QI	38.41	10.80%	39.96%	50.77%	\$63,067,687	15.2%	220	830.55
ROUTE SE	38.36	10.82%	36.52%	47.34%	\$69,649,272	27.2%	348	829.33
ROUTE SI	38.94	10.66%	39.83%	50.49%	\$66,219,303	20.9%	222	843.39
ROUTE YB	36.56	8.75%	50.44%	59.19%	\$59,138,791	8.0%	197	808.73
ROUTE ADG	52.11	24.64%	53.50%	78.14%	\$68,983,012	26.0%	141	952.0
ROUTE ADK	50.95	25.20%	49.28%	74.48%	\$67,838,885	23.9%	140	923.9
ROUTE AGU	50.04	25.66%	46.14%	71.80%	\$66,872,241	22.1%	128	901.8
ROUTE AGY	49.61	25.88%	41.06%	66.94%	\$67,325,163	22.9%	133	891.4
ROUTE AHA	48.45	26.50%	36.33%	62.83%	\$66,185,518	20.9%	132	863.3
ROUTE AIK	47.46	27.05%	37.08%	64.14%	\$64,431,826	17.7%	115	839.3
ROUTE AM	50.18	25.59%	50.04%	75.63%	\$69,096,945	26.2%	163	905.2
ROUTE BS	50.26	25.55%	45.94%	71.49%	\$69,870,924	27.6%	167	907.2
ROUTE HO	48.11	26.69%	42.24%	68.93%	\$66,997,119	22.3%	150	855.0
ROUTE HW	47.68	26.93%	36.91%	63.84%	\$67,444,235	23.2%	155	844.6
ROUTE IA	46.52	27.60%	31.88%	59.48%	\$66,303,710	21.1%	154	816.5
ROUTE KS	45.76	28.06%	33.85%	61.91%	\$65,855,714	20.3%	159	798.1
ROUTE KU	45.53	28.20%	32.57%	60.77%	\$64,568,932	17.9%	137	792.5
AVERAGE	46	19.44%	47.97%	67.40%	\$67,407,536		235	895
MINIMUM	37	0.00%	29.89%	42.74%	\$56,742,836		104	706
MAXIMUM	57	42.13%	93.39%	97.79%	\$80,545,031		751	1319
STD DEV	5.6	13.64%	15.87%	14.20%	\$5,147,249		160.5	140.6
Threshold	42.12	28.49%	77.53%	83.59%	\$61,890,085	25%	264.5	846.3

## 5.4 Routes Screened Against All Three Perspectives

Following the individual perspective screenings as described in Sections 5.1 through 5.3, the routes were then ranked in a simple matrix with either an “X” indicating that the route failed the first cut in the evaluation by that perspective, or with no mark, indicating that the route fell within the range of acceptable levels of impact as defined for that perspective. The results are shown in Table 5.4, Screening Against All Three Criteria.

As can be seen in Table 5.4, once the “Top Five” routes were ranked in competition with this smaller subset of better routes, the evaluation concluded that

- eleven of the “Top Five” routes performed poorly in all three perspectives;
- sixteen “Top Five” routes performed poorly in two of the three perspectives;
- sixteen “Top Five” routes performed poorly in one of the three perspectives; and,
- six “top Fives” routes performed well enough in each perspective to rank among the better routes in all three perspectives.

These six “top Fives” routes which performed well in all three perspectives are considered to be semi-finalist routes which will be evaluated in a manner similar to that in which the original field of forty-nine “Top Fives” routes was winnowed down to these six semi-finalist routes.

Table 5.4 Screening Against All Three Criteria				
	Built	Natural	Engineering	Composite
ROUTE ACQ			X	1
ROUTE ACU		X	X	2
ROUTE ADC			X	1
ROUTE ADS			X	1
ROUTE AGW			X	1
ROUTE AJU				0
ROUTE AJW				0
ROUTE AJX		X		1
ROUTE ALE			X	1
ROUTE AME			X	1
ROUTE ANE		X	X	2
ROUTE AQL				0
ROUTE ATZ	X	X	X	3
ROUTE AUD	X	X	X	3
ROUTE AUL	X	X	X	3
ROUTE AUP	X	X	X	3
ROUTE AUT	X	X	X	3
ROUTE AUX	X	X	X	3
ROUTE AVC	X	X	X	3
ROUTE AVD	X	X	X	3
ROUTE AVE		X	X	2
ROUTE AVF	X	X	X	3
ROUTE BK		X	X	2
ROUTE E		X	X	2
ROUTE G		X	X	2
ROUTE HS			X	1
ROUTE KW			X	1
ROUTE KY				0
ROUTE KZ				0
ROUTE QA	X		X	2
ROUTE QE	X		X	2
ROUTE QG		X		1
ROUTE QI		X		1
ROUTE SE	X		X	2
ROUTE SI		X		1
ROUTE YB				0
ROUTE ADG		X	X	2
ROUTE ADK		X	X	2
ROUTE AGU		X	X	2
ROUTE AGY			X	1
ROUTE AHA		X	X	2
ROUTE AIK			X	1
ROUTE AM	X	X	X	3
ROUTE BS	X	X	X	3
ROUTE HO		X	X	2
ROUTE HW	X		X	2
ROUTE IA	X		X	2
ROUTE KS			X	1
ROUTE KU			X	1

## 6.0 Semi-Finalist and Finalist Routes Evaluated

### 6.1 Built Environment

Table 6.1 shows the six semi-finalist routes again ranked against significant built environment criteria.

For all six semi-finalist routes, minimum and maximum values are again identified and averaged (statistical mean) and standard deviations are calculated. As before, the standard deviation (STD DEV) is added to the minimum value under each Built Environment criterion to establish a cautionary threshold.

As before, for routes that have a value beyond one standard deviation in either “residences within right-of-way” or “proximity to residences (within 300 feet),” those routes are considered to exceed a cautionary threshold for impacts to the built environment.

In Table 6.1, the standard deviation and threshold values are provided along the bottom rows of the table. Where those values are exceeded under the various criteria considered, those values are bolded. If a route’s values across the criteria exceed the threshold values in the manner identified above, the routes themselves are bolded, and they will be considered to exceed a cautionary threshold for impacts to the built environment.

Built Environment Perspective	Residences within ROW	Proximity to Residences (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of R/W)
ROUTE AJU	0	12	0	4
ROUTE AJW	0	13	0	2
<b>ROUTE AQL</b>	<b>5</b>	<b>75</b>	0	2
ROUTE KY	2	39	0	<b>9</b>
<b>ROUTE KZ</b>	<b>4</b>	<b>76</b>	0	<b>11</b>
<b>ROUTE YB</b>	<b>7</b>	<b>101</b>	0	<b>9</b>
Average	3	53	0	6
Minimum	0	12	0	2
Maximum	7	101	0	11
STD DEV	2.6	33.6	0.0	3.6
Threshold	<b>2.6</b>	<b>45.6</b>	<b>0.0</b>	<b>5.6</b>



Three of the six routes (AQL, KZ, and YB) exceed both significant cautionary thresholds; Route KY exceeds the NRHP-listed resources threshold.

## 6.2 Natural Environment

Table 6.2 shows the six semi-finalist routes again ranked against significant natural environment criteria.

For all six semi-finalist routes, minimum and maximum values are again identified and averaged (statistical mean) and standard deviations are calculated. As before, the standard deviation (STD DEV) is added to the minimum value under each Natural Environment criterion to establish a cautionary threshold.

As before, those routes which have a value beyond one standard deviation in three of the four criteria are considered to exceed a cautionary threshold for impacts to the natural environment.

In Table 6.2, the standard deviation and threshold values are provided along the bottom rows of the table. Where those values are exceeded under the various criteria considered, those values are bolded. If a route's values across the criteria exceed the threshold values in the manner identified above, the routes themselves are bolded, and they will be considered to exceed a cautionary threshold for impacts to the natural environment.

Natural Environment Perspective	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
<b>ROUTE AJU</b>	<b>429.82</b>	<b>43</b>	<b>14.15</b>	108.73
ROUTE AJW	<b>402.88</b>	<b>40</b>	11.93	104.61
ROUTE AQL	<b>326.55</b>	<b>53</b>	12.05	107.07
ROUTE KY	<b>317.36</b>	27	12.62	<b>147.47</b>
ROUTE KZ	<b>327.11</b>	32	12.62	<b>149.65</b>
<b>ROUTE YB</b>	241.03	<b>40</b>	<b>12.74</b>	<b>149.93</b>
Average	340.79	39.2	12.69	127.91
Minimum	241.03	27	11.93	104.61
Maximum	429.82	53	14.15	149.93
STD DEV	61.47	8.2	0.72	21.16
Threshold	<b>302.50</b>	<b>35.2</b>	<b>12.66</b>	<b>125.77</b>

Two of the six routes (AJU and YB) exceed three of the four natural environment criteria.

### 6.3 Engineering Considerations

Table 6.3 shows the six semi-finalist routes again ranked against significant engineering criteria.

For all six semi-finalist routes, minimum and maximum values are once again identified and averaged (statistical mean) and standard deviations are calculated. As before, the standard deviation (STD DEV) is added to the minimum value under each Engineering Considerations criterion to establish a cautionary threshold.

In Table 6.3, the standard deviation and threshold values are provided along the bottom rows of the table. Where those values are exceeded under the various criteria considered, those values are bolded. If a route's values across the criteria exceed the threshold values in the manner identified above, the routes themselves are bolded, and they will be considered to exceed a cautionary threshold for impacts to the natural environment.

Engineering Considerations Perspective	Length (Miles)	Percent of Route Rebuilt with Existing T/L	Percent of Route Collocated with Existing Utilities	Percent Rebuild or Collocate with utilities	Percent of Route Collocated with Roads	Total Project Costs	Estimated No. of Parcels	Approx. Acres of New Easement
ROUTE AJU	41.87	17.05%	38.81%	<b>55.86%</b>	1.43%	\$56,742,836	110	<b>841.94</b>
ROUTE AJW	43.88	29.26%	37.03%	66.29%	1.37%	<b>\$60,973,719</b>	104	752.48
<b>ROUTE AQL</b>	38.49	8.31%	55.11%	63.42%	3.35%	<b>\$59,063,247</b>	<b>175</b>	<b>855.52</b>
ROUTE KY	41.95	30.61%	32.13%	62.74%	3.00%	<b>\$61,124,054</b>	126	705.70
<b>ROUTE KZ</b>	42.42	22.73%	31.78%	<b>54.50%</b>	2.97%	<b>\$60,870,262</b>	<b>183</b>	<b>794.67</b>
<b>ROUTE YB</b>	36.56	8.75%	50.44%	<b>59.19%</b>	5.33%	<b>\$59,138,791</b>	<b>197</b>	<b>808.73</b>
Average	40.86	19.45%	40.88%	60.34%	2.91%	\$59,652,152	149.2	793.17
Minimum	36.56	8.31%	31.78%	54.50%	1.37%	\$56,742,836	104.0	705.70
Maximum	43.88	30.61%	55.11%	66.29%	5.33%	\$61,124,054	197.0	855.52
STD DEV	2.51	8.90%	8.87%	4.21%	1.33%	\$1,553,024	37.0	51.34
Threshold	<b>39.07</b>	<b>21.70%</b>	<b>46.23%</b>	<b>62.09%</b>	<b>4.00%</b>	<b>\$58,295,859</b>	<b>141.0</b>	<b>757.04</b>

Five of the six routes exceed the total project costs threshold. Three of those five routes also exceed both the number of parcels affected and the acres of new easement cautionary thresholds, and are therefore considered to be poorer routes than the other three with respect to engineering considerations.

## 6.4 Semi-finalist Routes Screened Against All Three Perspectives

Following the re-screenings against the three perspectives as described in Sections 6.1 through 6.3, the routes were again ranked in a simple matrix with either an “X” indicating that the route exceeded the cautionary threshold for that perspective, or with no mark, which indicates that the route fell within the range of acceptable levels of impact as defined for that perspective. The results are shown in Table 6.4, Screening Against All Three Criteria.

	Built	Natural	Engineering	Composite
ROUTE AJU		X		1
ROUTE AJW				0
ROUTE AQL	X		X	2
ROUTE KY				0
ROUTE KZ	X		X	2
ROUTE YB	X	X	X	3

As can be seen in Table 6.4, once the semi-finalist routes are ranked in competition with one another, the evaluation concludes that

- one semi-finalist route, Route YB, exceeded the cautionary threshold in all three perspectives;
- two of the semi-finalist routes, Routes AQL and KZ, exceeded the cautionary threshold in two of the three perspectives;
- one semi-finalist route, Route AJU, exceeded the cautionary threshold in only one of the three perspectives; and,
- two semi-finalist routes, Route AJW and Route KY, did not exceed the cautionary threshold in any of the three perspectives.

The semi-finalist routes which exceeded the cautionary threshold in two or three of the screenings were eliminated from further consideration. The other three routes are considered to be finalist routes.

## 6.5 Finalist Routes Discussion

These three finalist routes are very closely related, being three different variations on the same route. Nevertheless, there are important distinctions to be made regarding the three routes and the decision to build one of them.

### 6.5.1 Built Environment

Table 6.5.1 shows the three finalist routes compared with respect to impacts on the built environment.

Built Environment Perspective	Residences within ROW	Proximity to Residences (within 300')	School, Church, Cemetery, and Park Parcels Crossed	NRHP Listed Structures and Districts (3000' from edge of ROW)
ROUTE AJU	0	12	0	4
ROUTE AJW	0	13	0	2
<b>ROUTE KY</b>	<b>2</b>	<b>39</b>	0	<b>9</b>
Average	1	21	0	5
Minimum	0	12	0	2
Maximum	2	39	0	9
SD	0.9	12.5	0.0	2.9
Threshold	<b>0.9</b>	<b>24.5</b>	<b>0.0</b>	<b>4.9</b>

With one minor exception, Route AJU [Figure 6.5.1(a)] is the route originally proposed to KPSC as the preferred route for this project; the exception is a route change which avoids a pond where a whooping crane was previously observed. Route AJW [Figure 6.5.1(b)] is identical to Route AJU except that, after crossing Salt River Road, it continues in a more or less southerly direction for 4.34 miles, passing to the east of Mays Run and arriving at the Hardinsburg – Hardin County 138 kV Transmission Line. In contrast, after crossing Salt River Road, Route AJU turns roughly southeast, taking a more direct cross-country route for 8.0 miles towards Hardin County Substation. These different route segments account for the differences between Route AJU and AJW which can be seen in the tables that follow.

Like Route AJW, Route KY [Figure 6.5.1(c)] is yet another version of Route AJU. Along the southern portion of the route, Route KY is identical to Route AJW, proceeding in a more or less southerly direction after crossing Salt River Road, passing to the east of Mays Run, and arriving at the Hardinsburg – Hardin County 138 kV Transmission Line. However, Route KY differs from both Routes AJU and AJW at the northern end of the project area, where it follows gas pipelines and Dixie Highway (U.S. 31W) southeast towards the town of West Point after leaving Mill Creek Generating Station. It is in these segments that Route KY picks up greater impacts to residential land uses, a greater number of properties, historic resources around the town of West Point, and floodplains.

Table 6.5.1 shows that Route KY requires two relocations and comes within 300 feet of three times as many homes as Route AJU and AJW. Route KY also comes closer to the West Point historic district as well as the individual resources located there. In the built environment perspective, Routes AJU and AJW avoid residences, community-oriented land uses, and potentially affect fewer National Register-listed historic resources.

On balance, Route KY appears to be the least desirable finalist route from a built environment perspective, while Routes AJU and AJW appear to do an equally good job at avoiding impacts to the built environment.

### 6.5.2 Natural Environment

Table 6.5.2 shows the three finalist routes compared with respect to impacts on the natural environment.

Natural Environment Perspective	Natural Forests (Acres)	Stream/River Crossings	Wetland Areas (Acres)	Floodplain Areas (Acres)
<b>ROUTE AJU</b>	<b>429.82</b>	<b>43</b>	<b>14.15</b>	108.73
ROUTE AJW	<b>402.88</b>	<b>40</b>	11.93	104.61
ROUTE KY	317.36	27	12.62	<b>147.47</b>
Average	383.35	36.7	12.90	120.27
Minimum	317.36	27	11.93	104.61
Maximum	429.82	43	14.15	147.47
SD	47.95	6.9	0.93	19.31
Threshold	<b>365.30</b>	<b>33.9</b>	<b>12.86</b>	<b>123.92</b>

In the natural environment, Route AJU picks up additional impacts to wetlands and stream crossings in its last cross county turn towards Hardinsburg – Hardin County Transmission Line and Hardin County Substation. This would be especially true after the route crosses St. John Road and passes to the south of West Rhudes Creek. The other two routes score somewhat better in the natural environment category because they continue south after crossing Salt River Road, generally staying on higher ground.

Route KY affects about 100 acres less of forested lands due to its paralleling gas pipelines through a more intensively developed area in the northern part of the project area. Where all three routes leave Mill Creek Generating Station, Routes AJU and AJW go farther south than Route KY before turning west, where they cross more undeveloped, forested areas. The existing transmission line which Routes AJU and AJW parallel through this area crosses near or over Cow Branch, Knob Creek, Salt River, and various minor tributary streams, driving up the counts for natural forest acres affected and stream crossings. On the other hand, Route KY crosses significantly greater areas of floodplain than do Routes AJU or AJW.

On balance, Route AJU appears to be a somewhat less desirable finalist route from a natural environment perspective, while Route KY appears to do a better job at avoiding impacts to the natural environment.

### 6.5.3 Engineering Considerations

Table 6.5.3 shows the three finalist routes compared with respect to Engineering Considerations.

Engineering Considerations Perspective	Length (Miles)	Percent of Route Rebuilt with Existing T/L	Percent of Route Collocated with Existing Utilities	Percent Rebuild/Collocate with utilities	Percent of Route Co-located with Roads	Total Project Costs	Estimated No. of Parcels	Approx. Acres of New Easement
ROUTE AJU	41.87	17.05%	38.81%	55.86%	1.43%	\$56,742,836	110	<b>841.94</b>
ROUTE AJW	43.88	29.26%	37.03%	66.29%	1.37%	<b>\$60,973,719</b>	104	752.48
<b>ROUTE KY</b>	41.95	30.61%	32.13%	62.74%	3.00%	<b>\$61,124,054</b>	<b>126</b>	705.70
Average	42.57	25.64%	35.99%	61.63%	1.93%	\$59,613,536	113.3	766.71
Minimum	41.87	17.05%	32.13%	55.86%	1.37%	\$56,742,836	104.0	705.70
Maximum	43.88	30.61%	38.81%	66.29%	3.00%	\$61,124,054	126.0	841.94
SD	0.93	6.10%	2.82%	4.33%	0.76%	\$2,030,820	9.3	56.52
Threshold	<b>42.80</b>	<b>24.51%</b>	<b>35.99%</b>	<b>61.96%</b>	<b>2.25%</b>	<b>\$58,773,655</b>	<b>113.3</b>	<b>762.22</b>

Route AJU rebuilds less of the Hardinsburg – Hardin County 138 kV Transmission Line, resulting in a greater number of acres of new right-of-way required (841.94 acres) and the least percentage of rebuild/paralleling (55.9%) of the three finalist routes. However, at an estimated cost of \$56,742,836, it is about \$4.23 million less expensive than Route AJW and affects fewer property owners than Route KY.

Route AJW is the route having the greatest percentage of collocation (66.3%) of the three finalist routes. However, it is about two miles longer and is estimated to cost \$60,973,719, or about \$4,231,000 more than the most cost-effective finalist route, Route AJU.

Route KY is the most expensive of the three finalist routes (\$61,124,054) and affects the greatest number of property owners (126). At 62.74% rebuild or paralleling existing utilities, it has better collocation than Route AJU but not as good as Route AJW.

On balance, Route AJU appears to be the most cost-effective route from an engineering considerations perspective. Route AJW is more expensive, but achieves a greater percentage of collocation and requires less new easement. Route KY appears to be the most expensive of the finalist routes and its alignment affects the most property owners.

#### **6.5.4 Findings**

The difference among the three finalist routes is largely a difference between a route which appears to minimize environmental impacts (Route KY) and routes which appear to minimize impacts to the built environment (Routes AJU and AJW).

Routes AJU and AJW affect larger areas of forested lands and a greater number of stream crossings. These are not negligible effects; however, the impacts to these resources can be mitigated through sensitive land clearing techniques, establishment of buffer areas, and standard long-term vegetation management practices. Impacts to residences and communities of the kind created by Route KY are more difficult to ameliorate.

On balance, with greater impacts to residences within the right-of-way, residences within 300 feet, and historic properties listed on the National Register, as well as greater estimated cost and greater estimated number of properties affected, Route KY is the least reasonable of the three finalist routes.

Routes AJU and AJW are reasonable routes which are clearly superior to Route KY in terms of the built environment and engineering considerations. Route AJW is about two miles (5%) longer and \$4,231,000 (7%) more expensive. For that extra two miles in length and additional four and a quarter million dollars, Route AJW buys an additional ten percent of collocation over Route AJU.

Proposed Routes. This analysis and evaluation report validates and confirms LG&E/KU's conclusion that Route AJU is a reasonable route which meets the goals of the project while avoiding a wasteful duplication of facilities.

Alternatively, for a better collocation ratio and somewhat improved natural environment metrics, this analysis and evaluation report validates and confirms LG&E/KU's conclusion that Route AJW is a reasonable and acceptable alternative.

#### **7.0 Conclusion**

This report represents a reasoned and good faith effort to validate and confirm LG&E/KU's conclusions regarding the reasonableness of Routes AJU and AJW as routing alternatives. This conclusion is based on analyzing and documenting with careful consideration the same routes and the same metrics available to LG&E/KU.

At 55.86% collocation, Route AJU appears to comply with KPSC's statutory requirement for identifying and seriously evaluating collocation wherever

collocated lines are electrically equivalent. Route AJU's more expensive sister route, Route AJW, is a reasonable and acceptable alternative, should KPSC wish to achieve greater collocation at higher cost.



## **8.0 Figures**

**Figure 1.0** Project Area

**Figure 1.2** Existing Electric Power and Natural Gas Lines

**Figure 2.0(a)** All Routes Evaluated – the “spider web”

**Figure 2.0(b)** Overview of Baskets

**Figure 2.0(c)** Overview of Baskets and Collocation Opportunities

**Figure 2.1** East Basket

**Figure 2.2** Tip Top South Basket

**Figure 2.3** East-Central Basket

**Figure 2.4** West-Central Basket

**Figure 2.5** BREC Basket

**Figure 3.1** All Routes Compatible with Fort Knox

**Figure 3.2.1** Least Cost Practicable Route

**Figure 3.2.3** Top Fifty Routes with Maximum Collocation

**Figure 4.1** Top East Routes

**Figure 4.2** Top East-Central Routes

**Figure 4.3** Top West-Central Routes

**Figure 4.4** Top BREC Routes

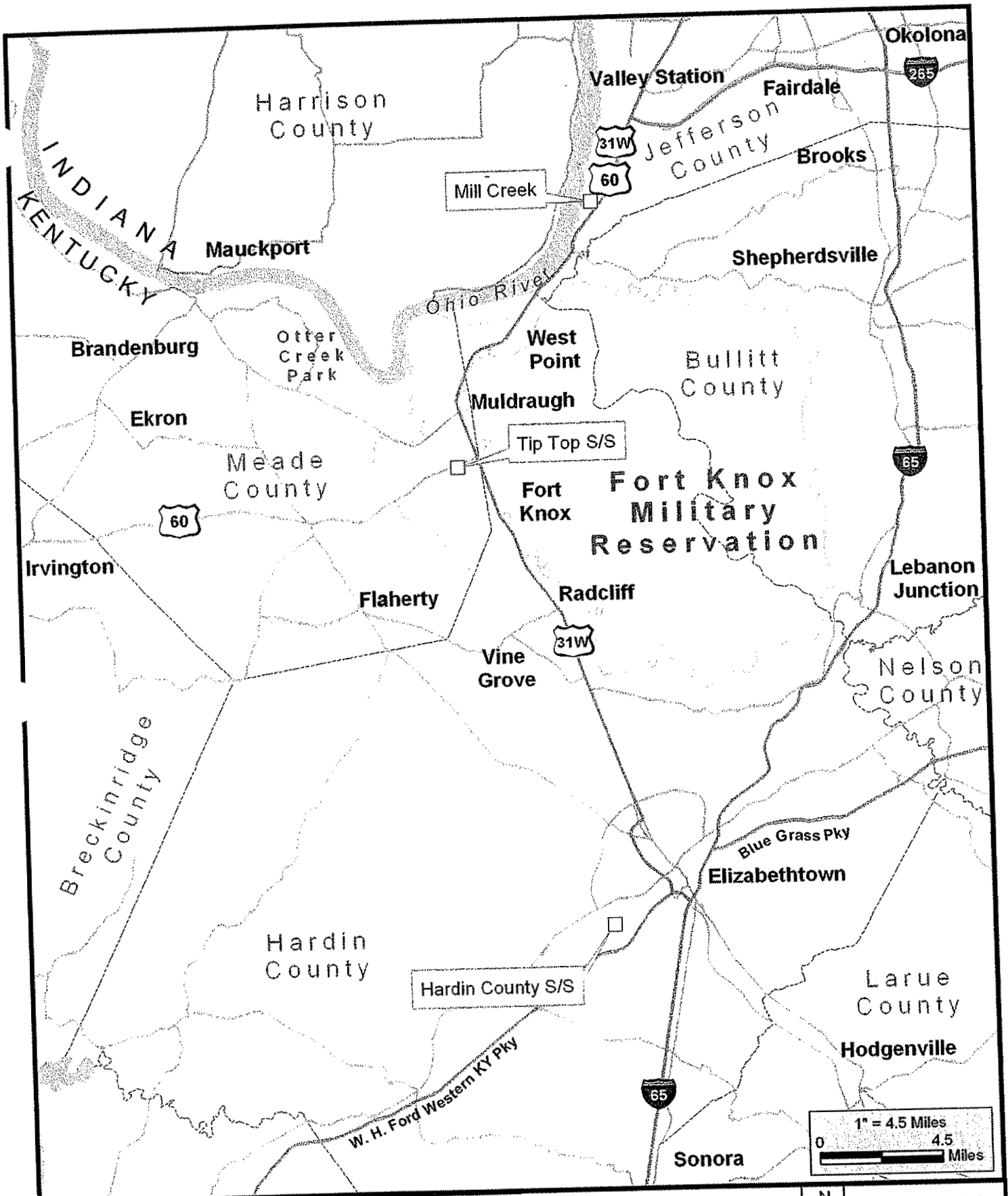
**Figure 4.5** Top Crossover Routes

**Figure 6.5.1(a)** Route AJU

**Figure 6.5.1(b)** Route AJW

**Figure 6.5.1(c)** Route KY

**Figure 1.0 Project Area**



**Project Area**

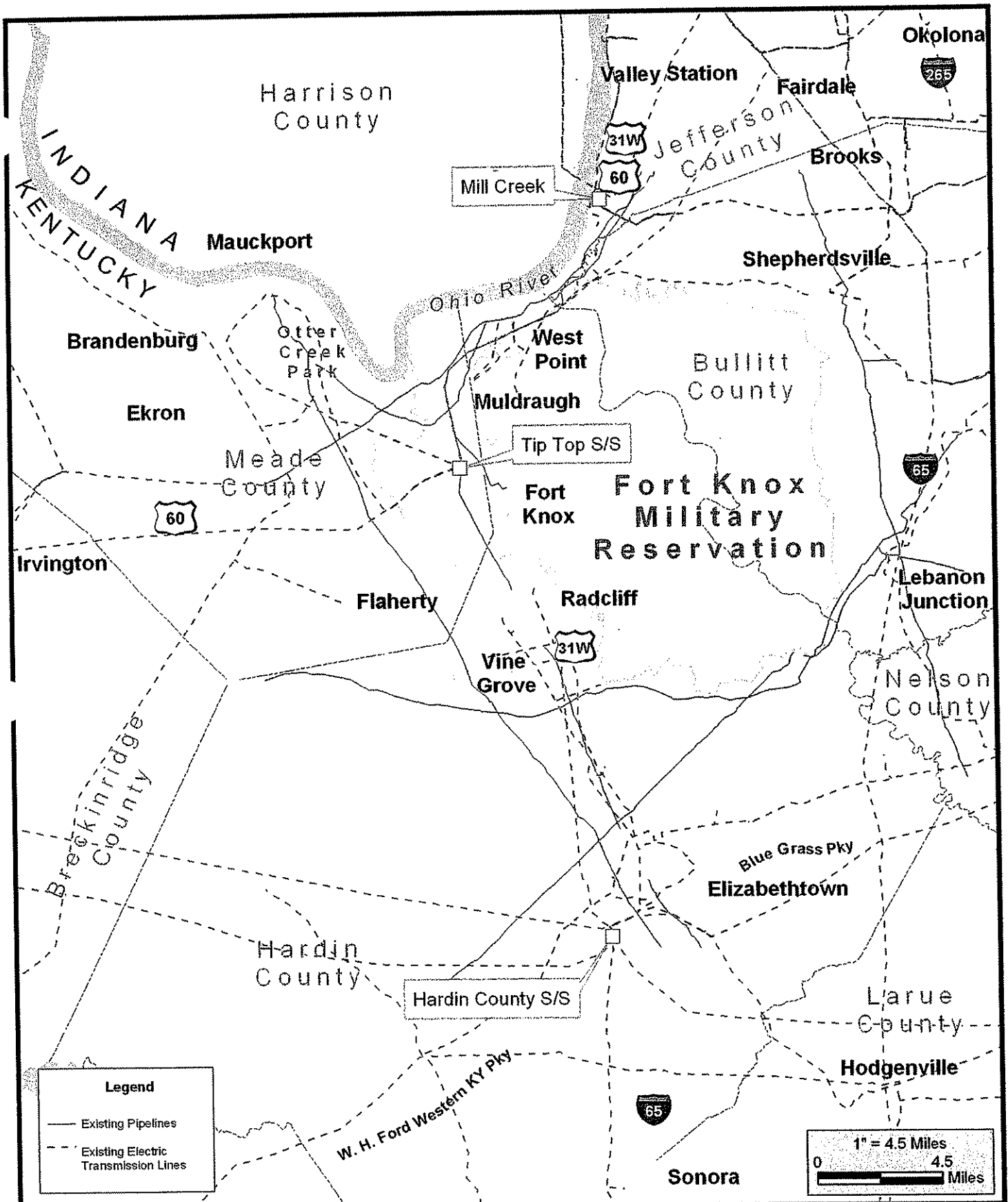
**Mill Creek - Hardin County**  
 345 kV Transmission Line

**KU** **LGE**

**FIGURE 1.0**

PHOTO SCIENCE  
Geographic Solutions

**Figure 1.2 Existing Electric Power and Natural Gas Lines**



**Existing Electric Power  
and Natural Gas Lines**

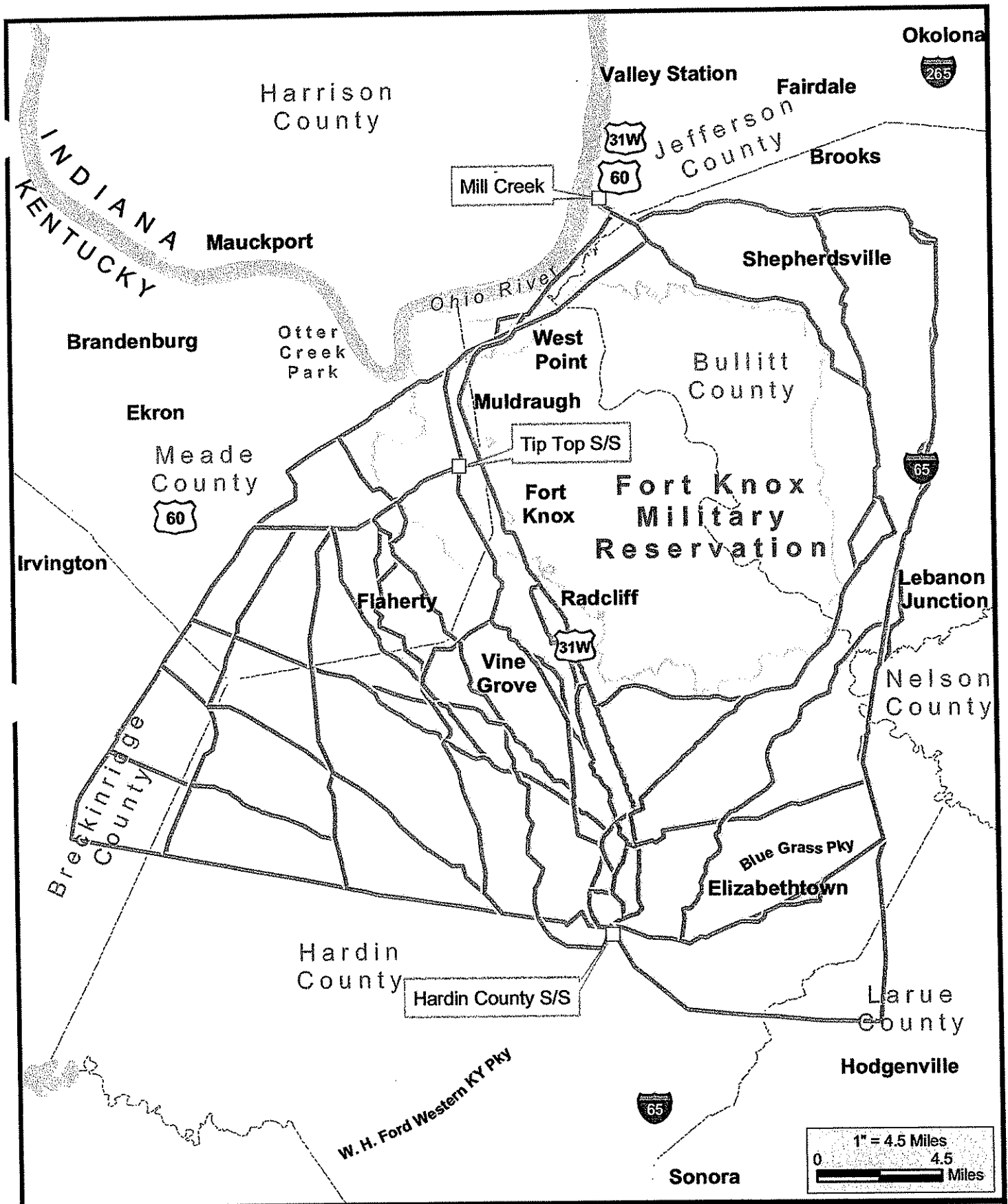
**Mill Creek - Hardin County  
345 kV Transmission Line**

**KU IGE**

**FIGURE 1.2**

**PHOTO SCIENCE**  
Technical Systems

## Figure 2.0(a) All Routes Evaluated



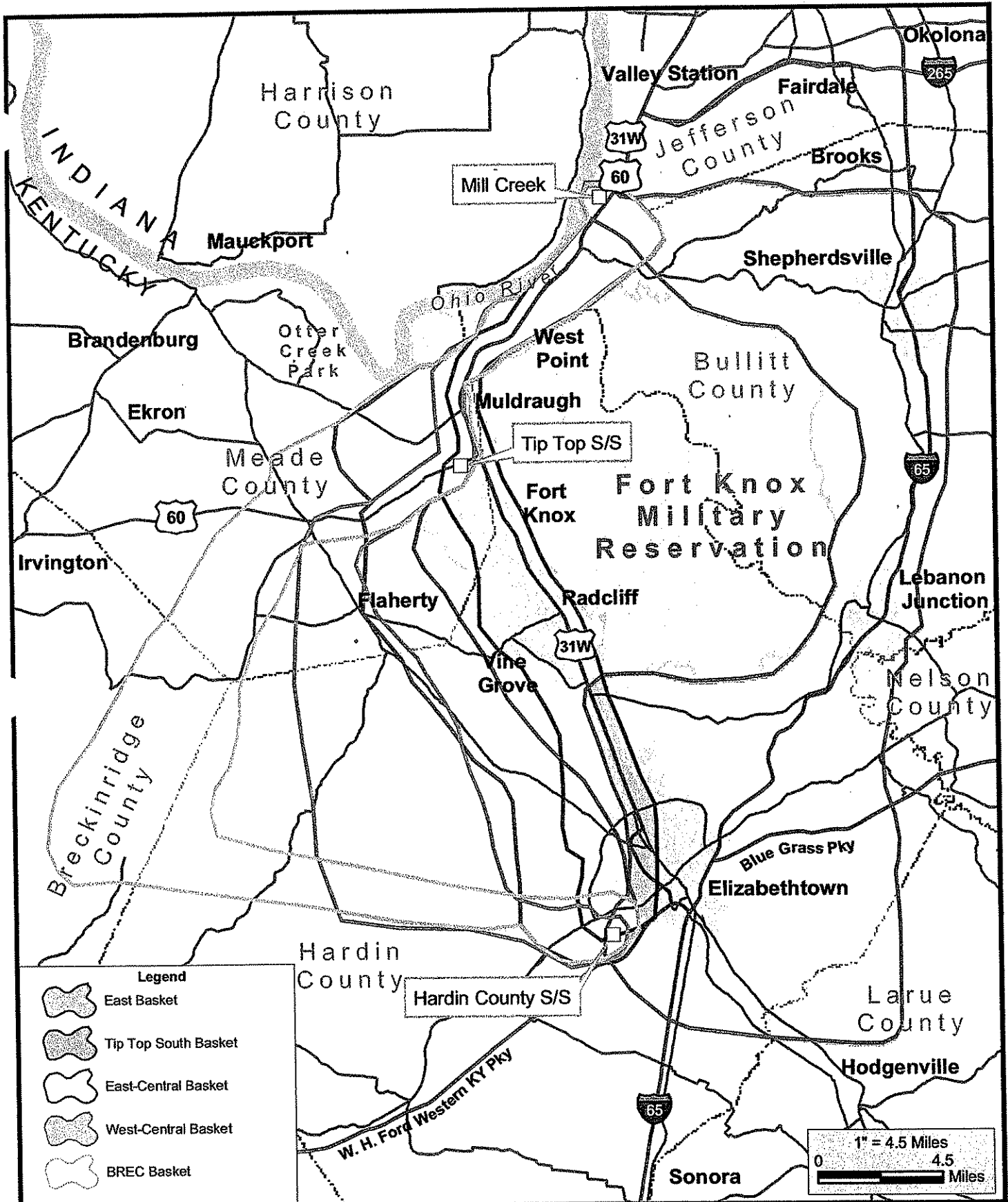
**All Routes  
Evaluated**

**Mill Creek - Hardin County**  
345 kV Transmission Line

**FIGURE 2.0(a)**

## Figure 2.0(b) Overview of Baskets





**Overview  
of Baskets**

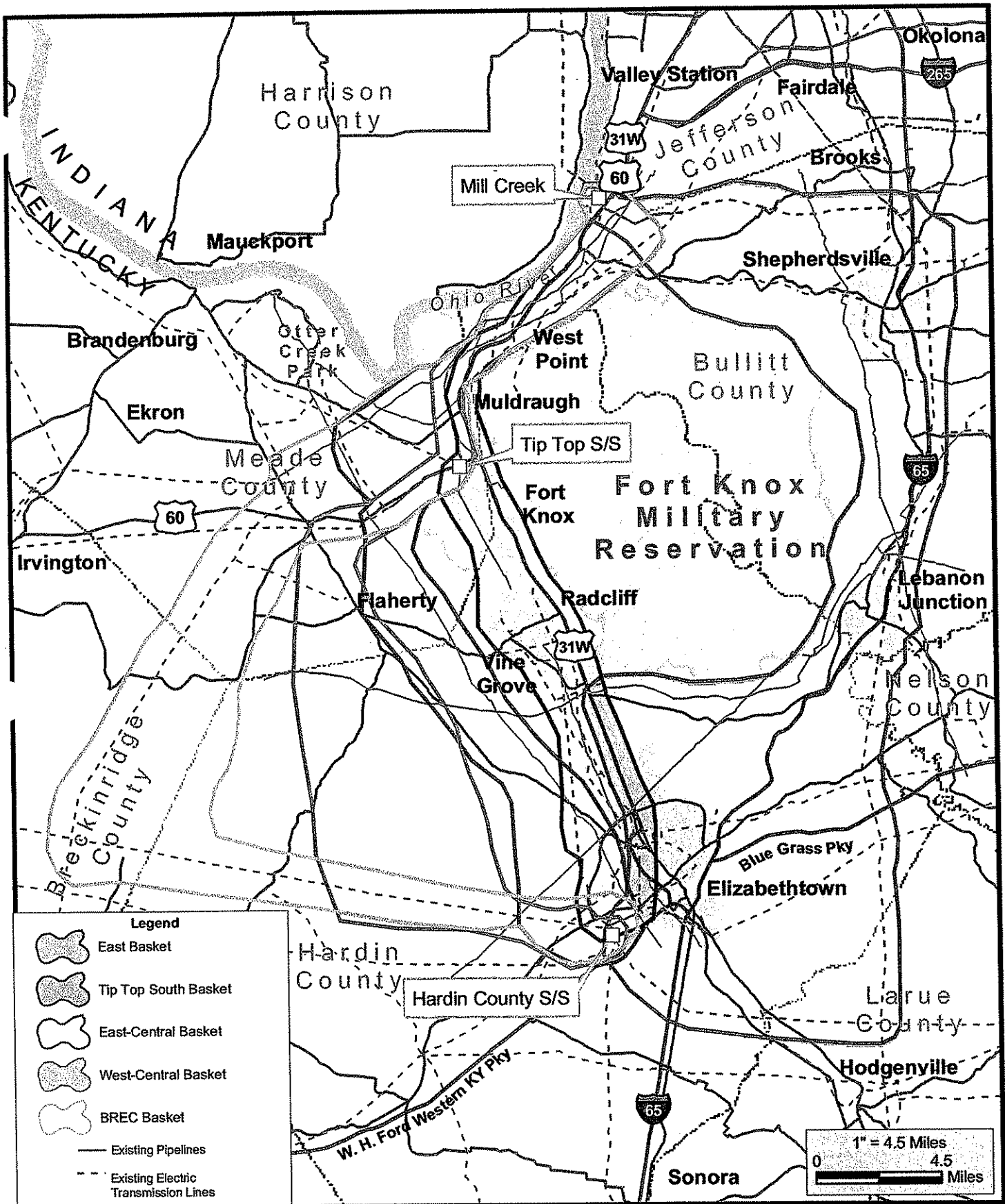
**Mill Creek - Hardin County  
345 kV Transmission Line**



**FIGURE 2.0(b)**



## **Figure 2.0(c) Overview of Baskets and Collocation Opportunities**



**Overview of Baskets and Collocation Opportunities**

**Mill Creek - Hardin County**  
345 kV Transmission Line

**KU** **IG&E**

**FIGURE 2.0(c)**

PHOTO SCIENCE  
Original Source

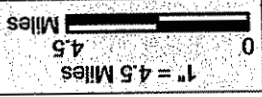
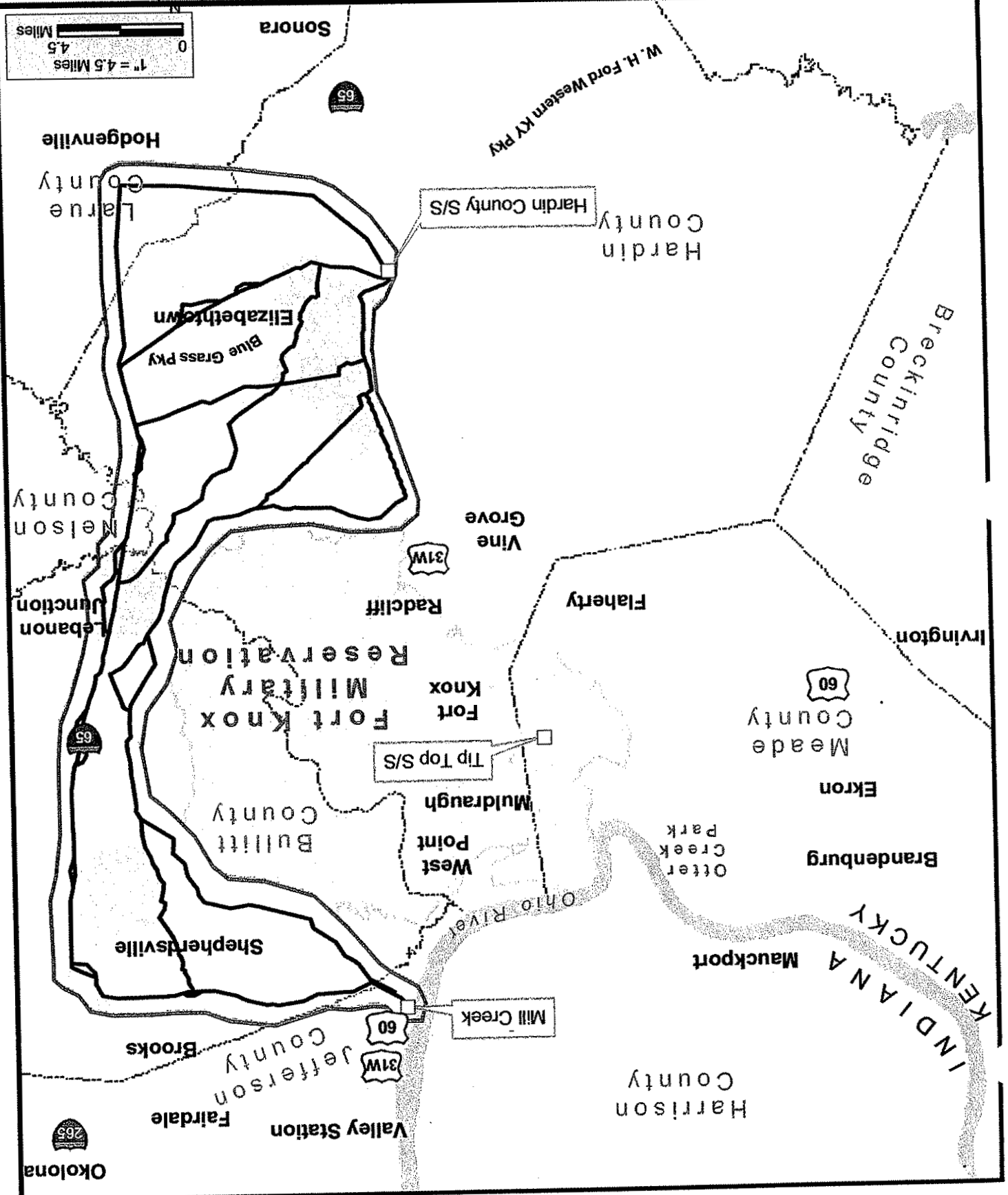
**Figure 2.1 East Basket**

East Basket

**KU**  
345 KV Transmission Line  
**LGE**  
**Mill Creek - Hardin County**

PHOTO SCIENCE

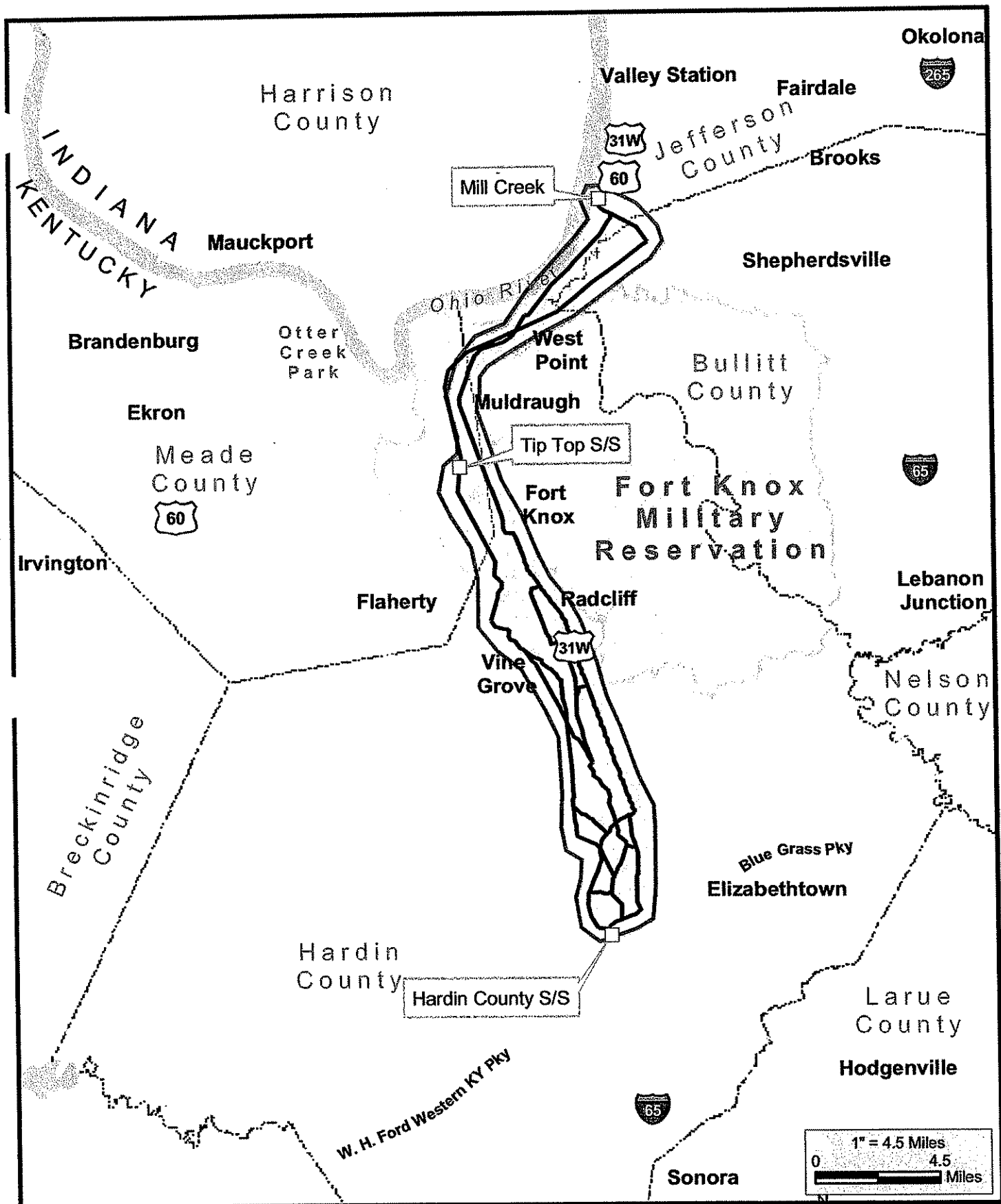
FIGURE 2.1



Okolona

INDIANA  
KENTUCKY

**Figure 2.2 Tip Top South Basket**



**Tip Top South  
Basket**

**Mill Creek - Hardin County  
345 kV Transmission Line**

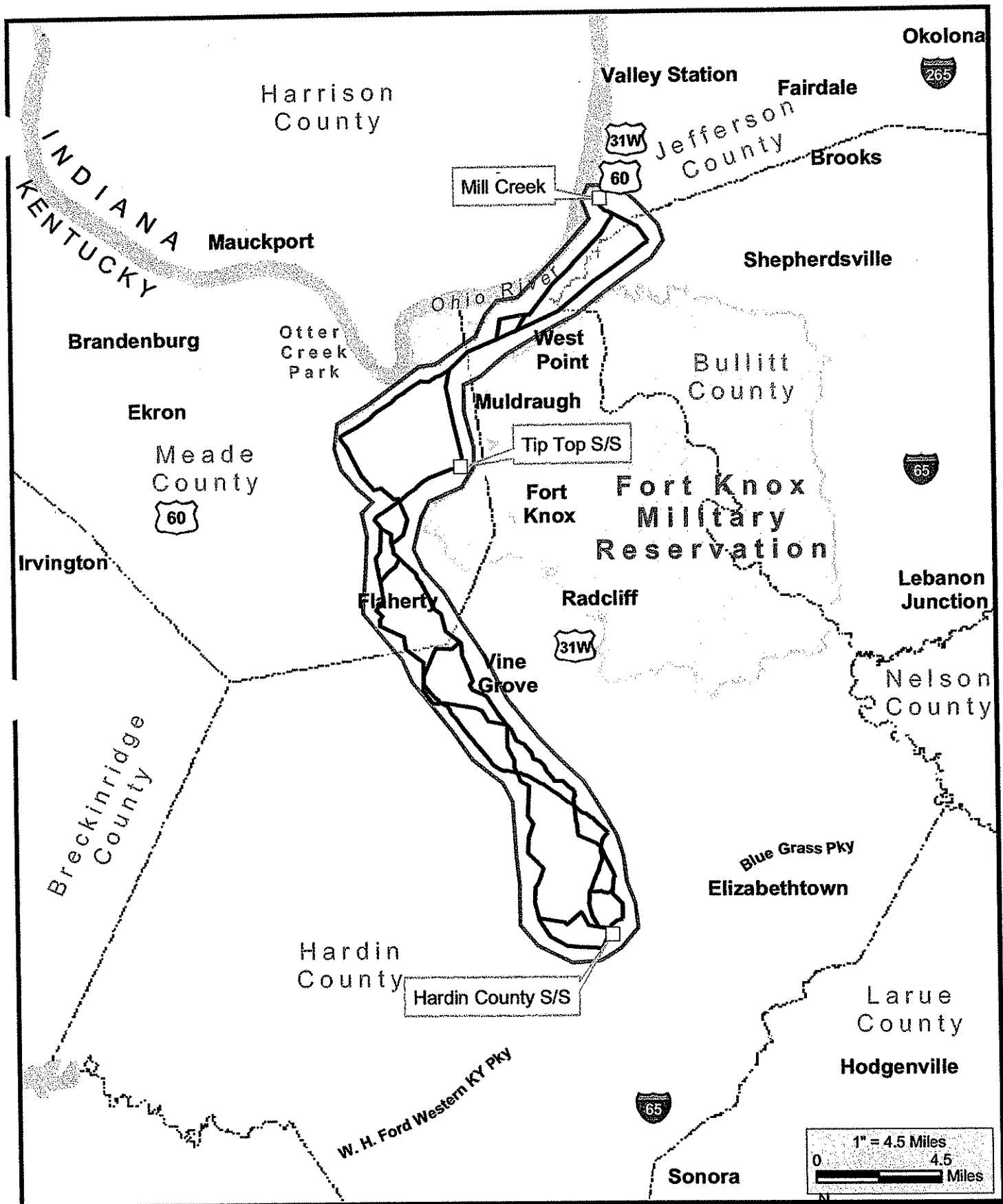
**KU** **LGE**

**FIGURE 2.2**

**PHOTO SCIENCE**  
A Transient Solutions Company

**Figure 2.3 East-Central Basket**





**East-Central  
Basket**

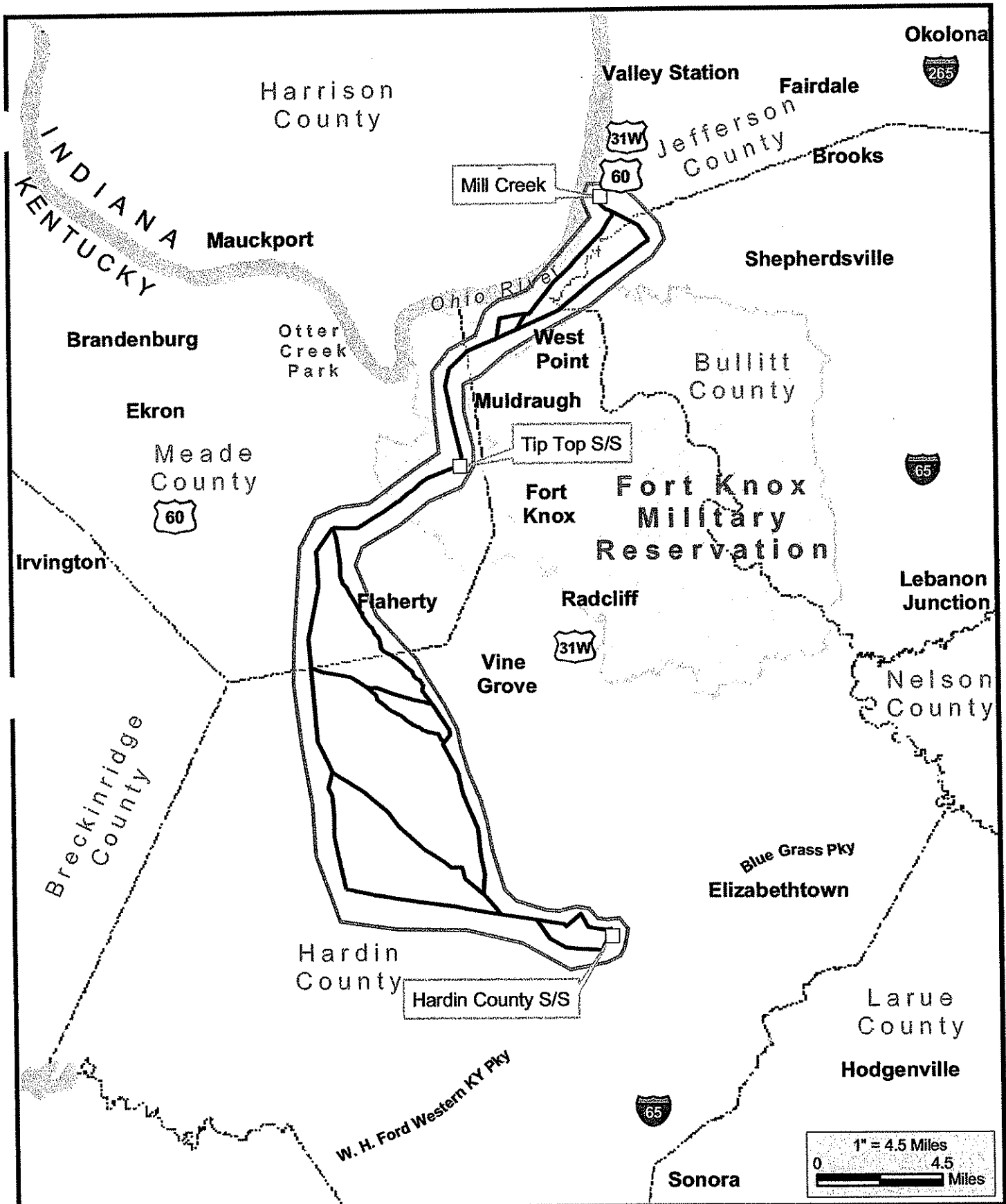
**Mill Creek - Hardin County**  
345 kV Transmission Line

**KU** **LGE**

**FIGURE 2.3**

PHOTO SCIENCE  
A TRANSPORT SOLUTIONS COMPANY

**Figure 2.4 West-Central Basket**



**West-Central  
Basket**

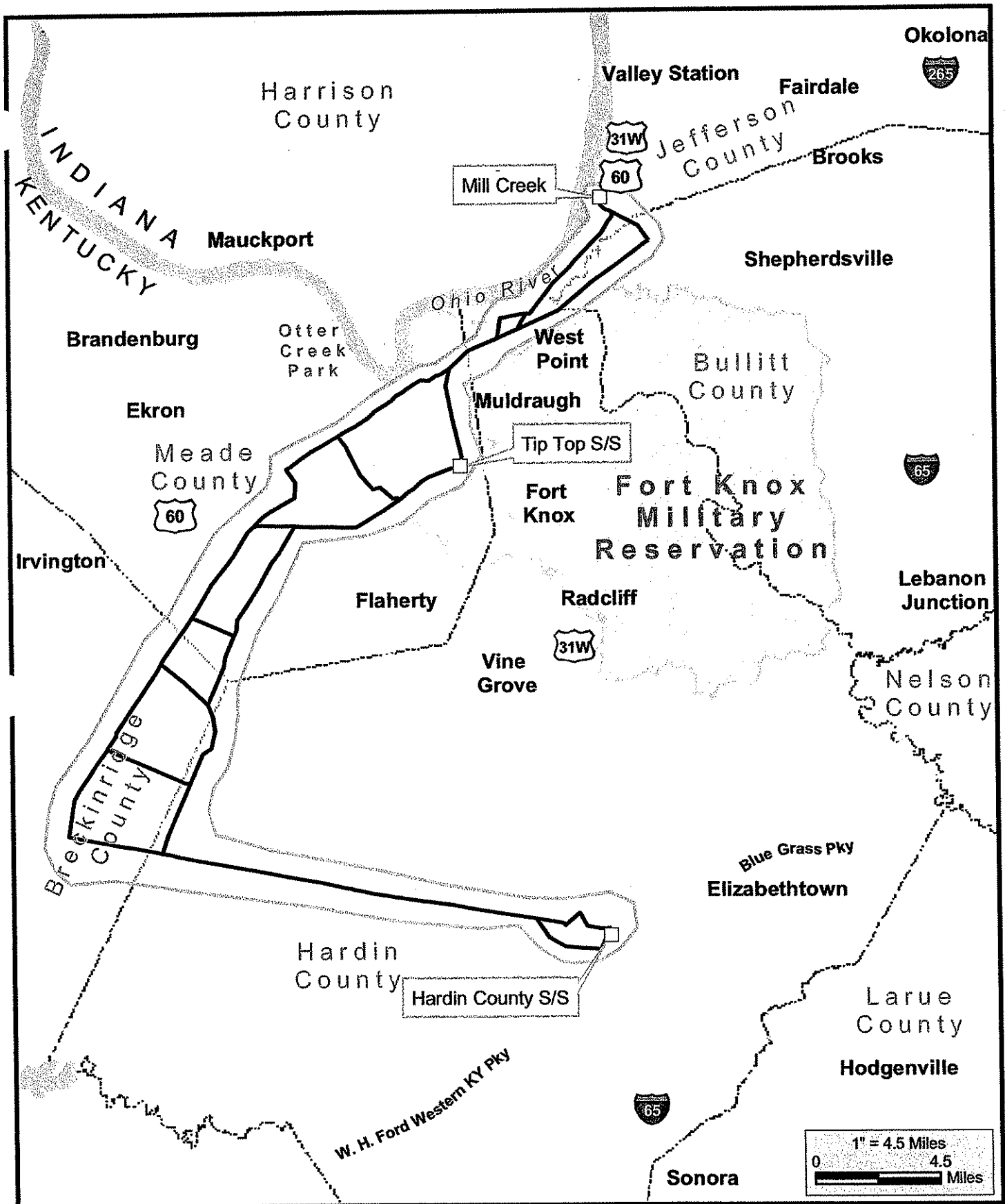
**Mill Creek - Hardin County**  
345 kV Transmission Line

**KU** **LGE**

**FIGURE 2.4**

PHOTO SCIENCE  
Geographic Information Systems

**Figure 2.5 BREC Basket**



**BREC Basket**

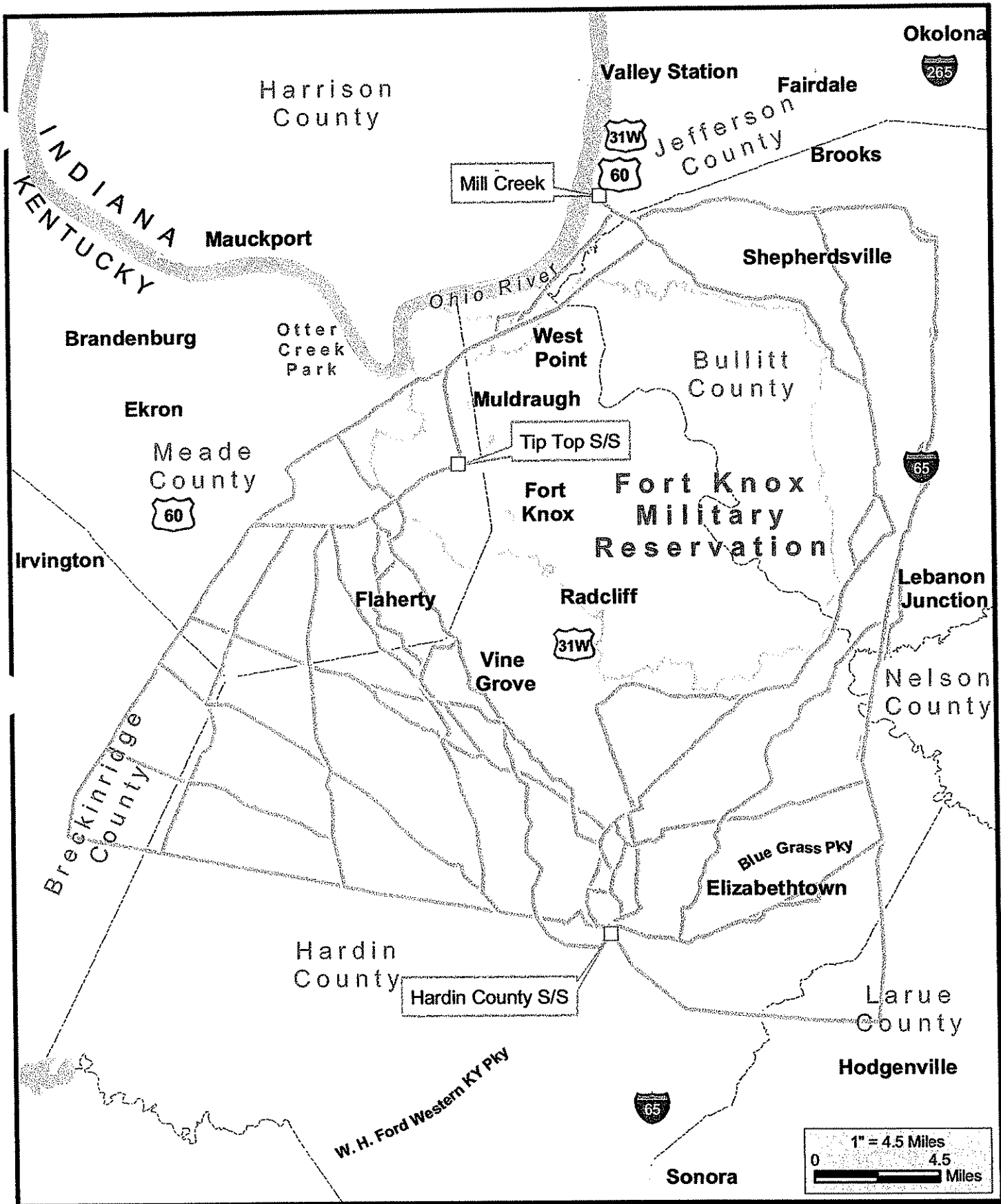
**Mill Creek - Hardin County**  
 345 kV Transmission Line

**KU** **IG&E**

**FIGURE 2.5**

PHOTO SCIENCE  
 Geographical Solutions

**Figure 3.1 All Routes Compatible with Fort Knox**



**All Routes  
Compatible with  
Fort Knox**

**Mill Creek - Hardin County**  
345 kV Transmission Line

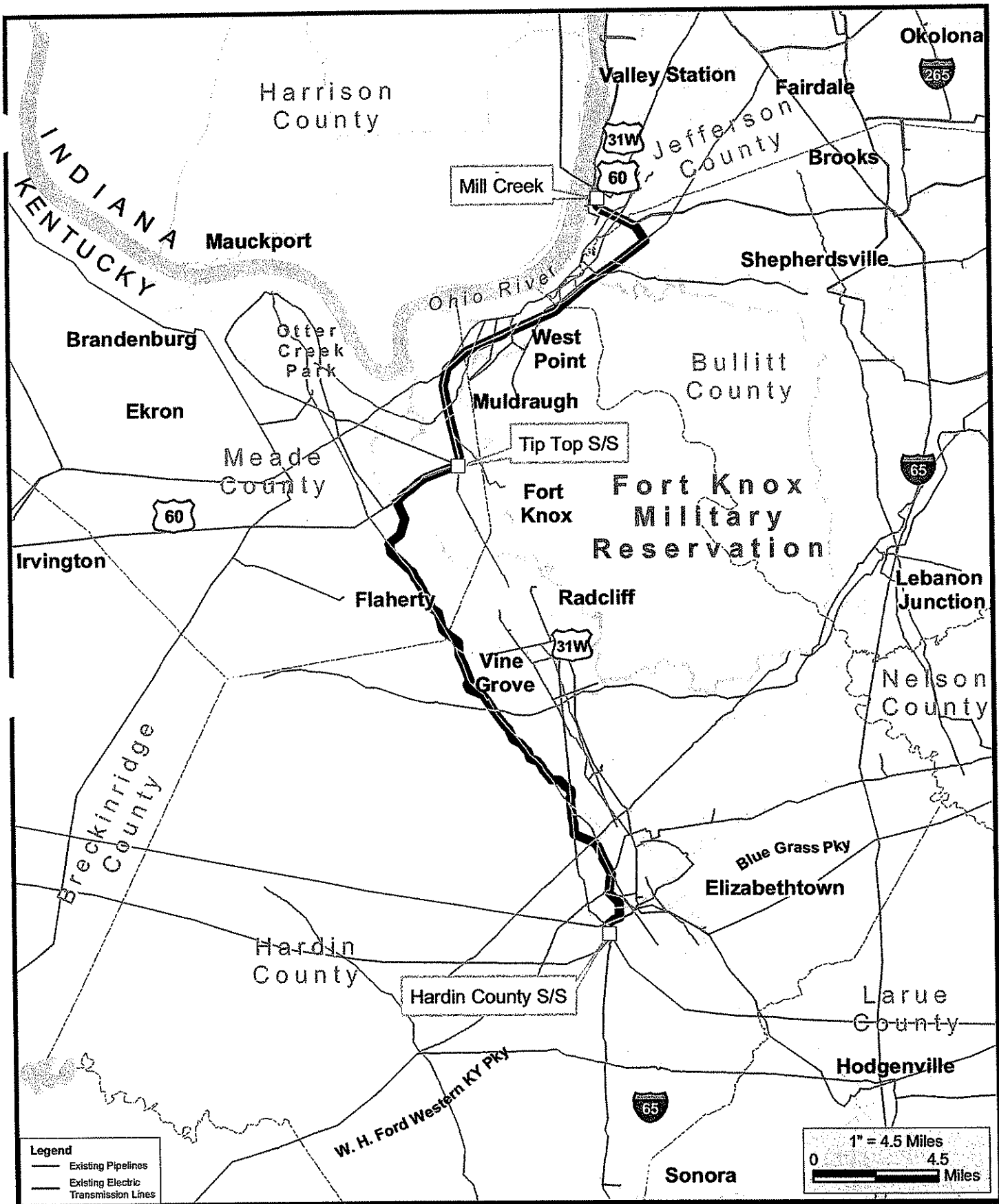
**KU** **LGE**

**FIGURE 3.1**

PHOTO SCIENCE

**Figure 3.2.1 Least Cost Practicable Route**





**Least Cost  
Practicable Route:  
Route A-Q-V**

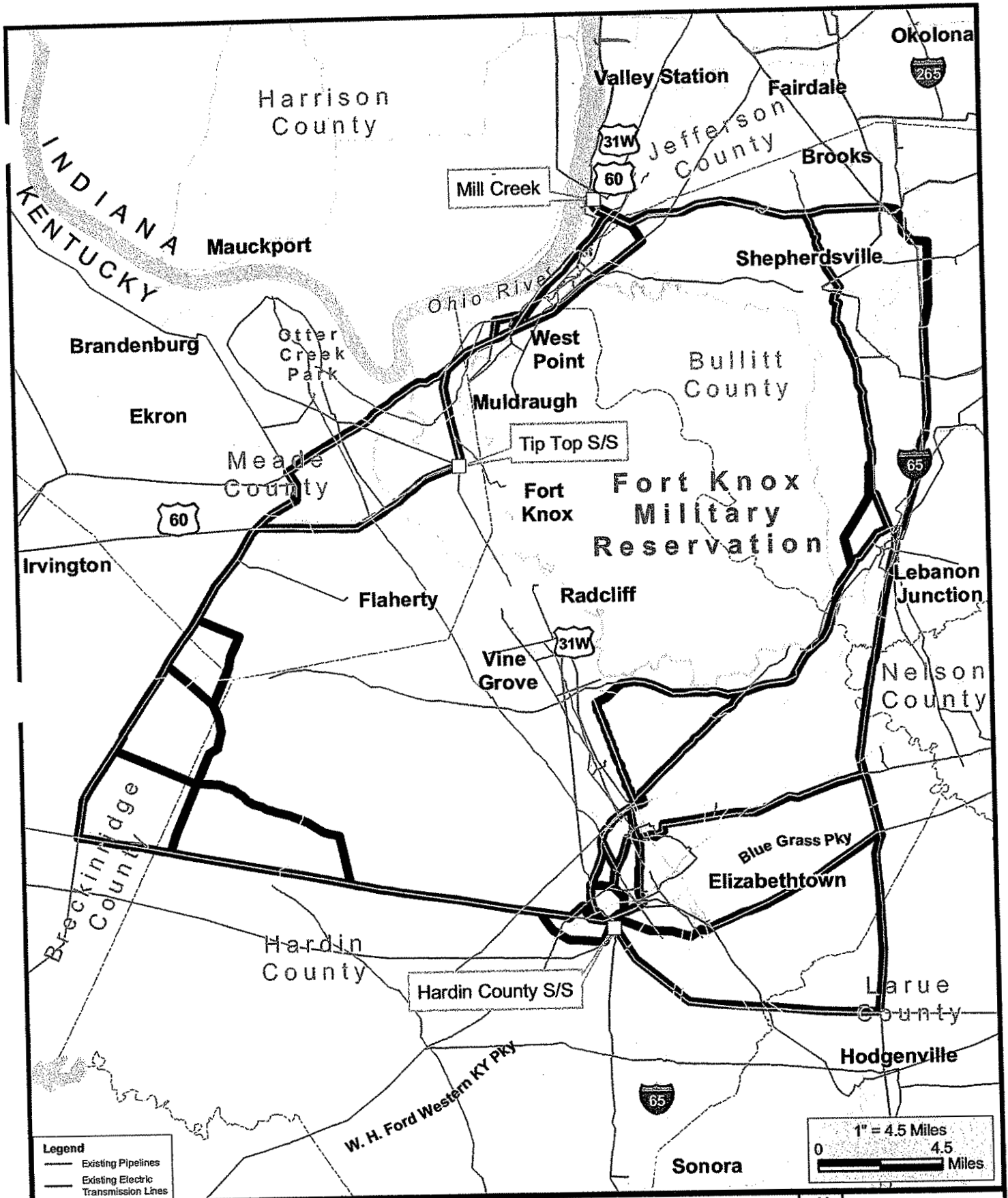
**Mill Creek - Hardin County  
345 kV Transmission Line**



**FIGURE 3.2.1**



### **Figure 3.2.3 Top Fifty Routes with Maximum Collocation**



**Top Fifty Routes  
with Maximum  
Collocation**

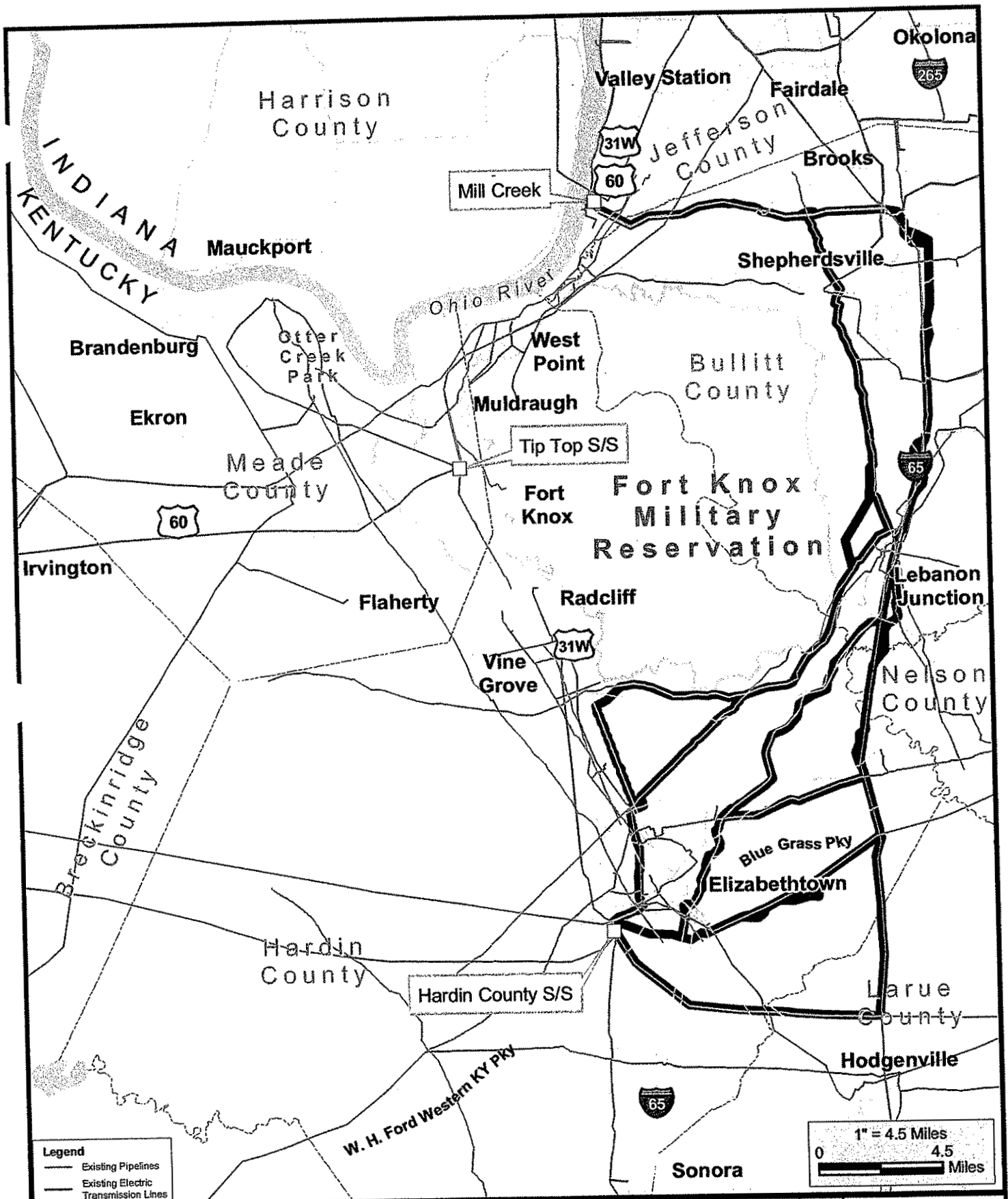
**Mill Creek - Hardin County  
345 kV Transmission Line**



**FIGURE 3.2.3**



**Figure 4.1 Top East Routes**



**Legend**  
 — Existing Pipelines  
 - - - Existing Electric Transmission Lines

1" = 4.5 Miles  
 0 4.5 Miles

**Top East Routes**

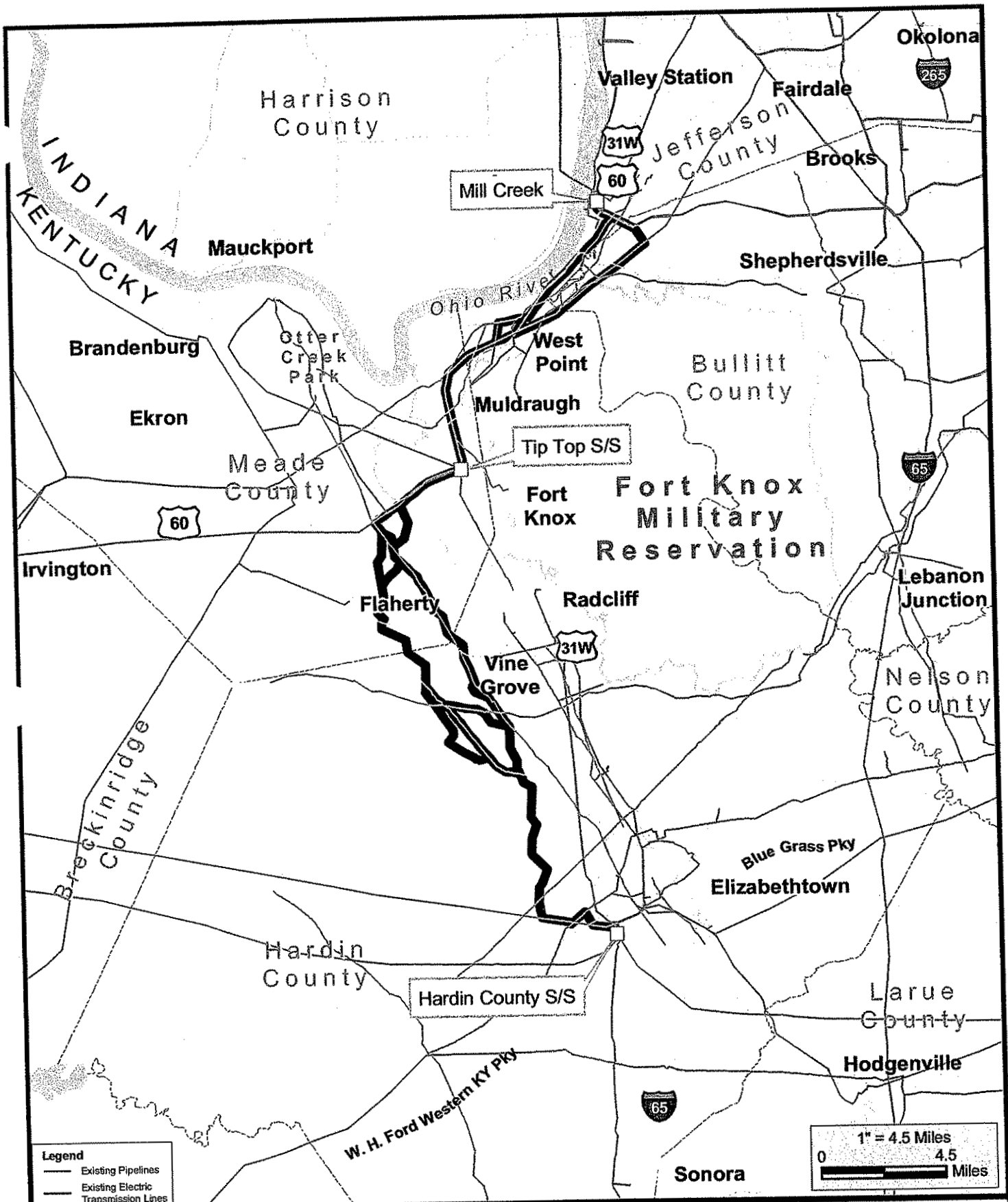
**Mill Creek - Hardin County  
 345 kV Transmission Line**



**FIGURE 4.1**

PHOTO SCIENCE  
 CONSULTANTS

## Figure 4.2 Top East-Central Routes



**Top East-Central  
Routes**

**Mill Creek - Hardin County  
345 kV Transmission Line**

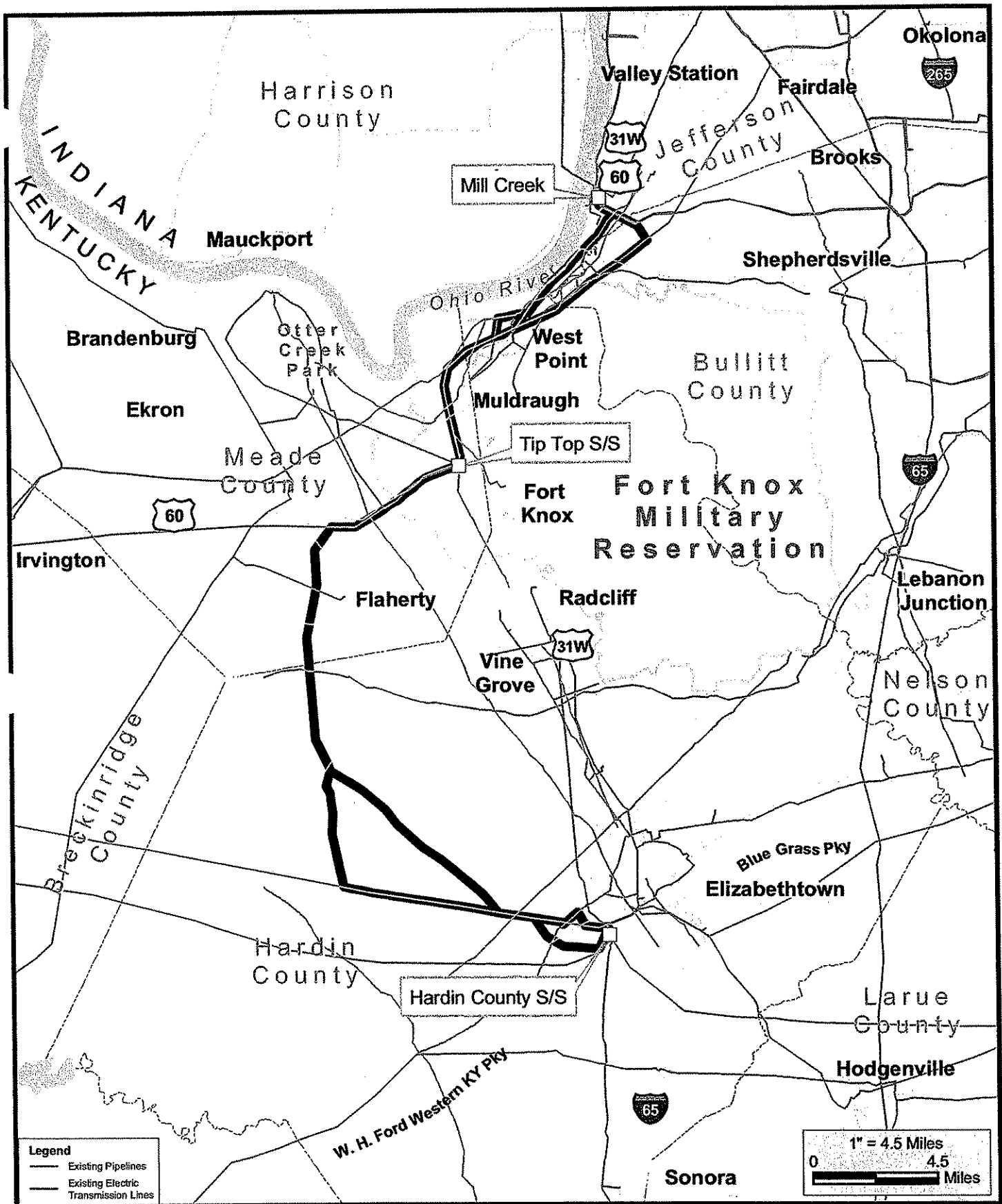


**FIGURE 4.2**



### **Figure 4.3 Top West-Central Routes**





**Top West-Central Routes**

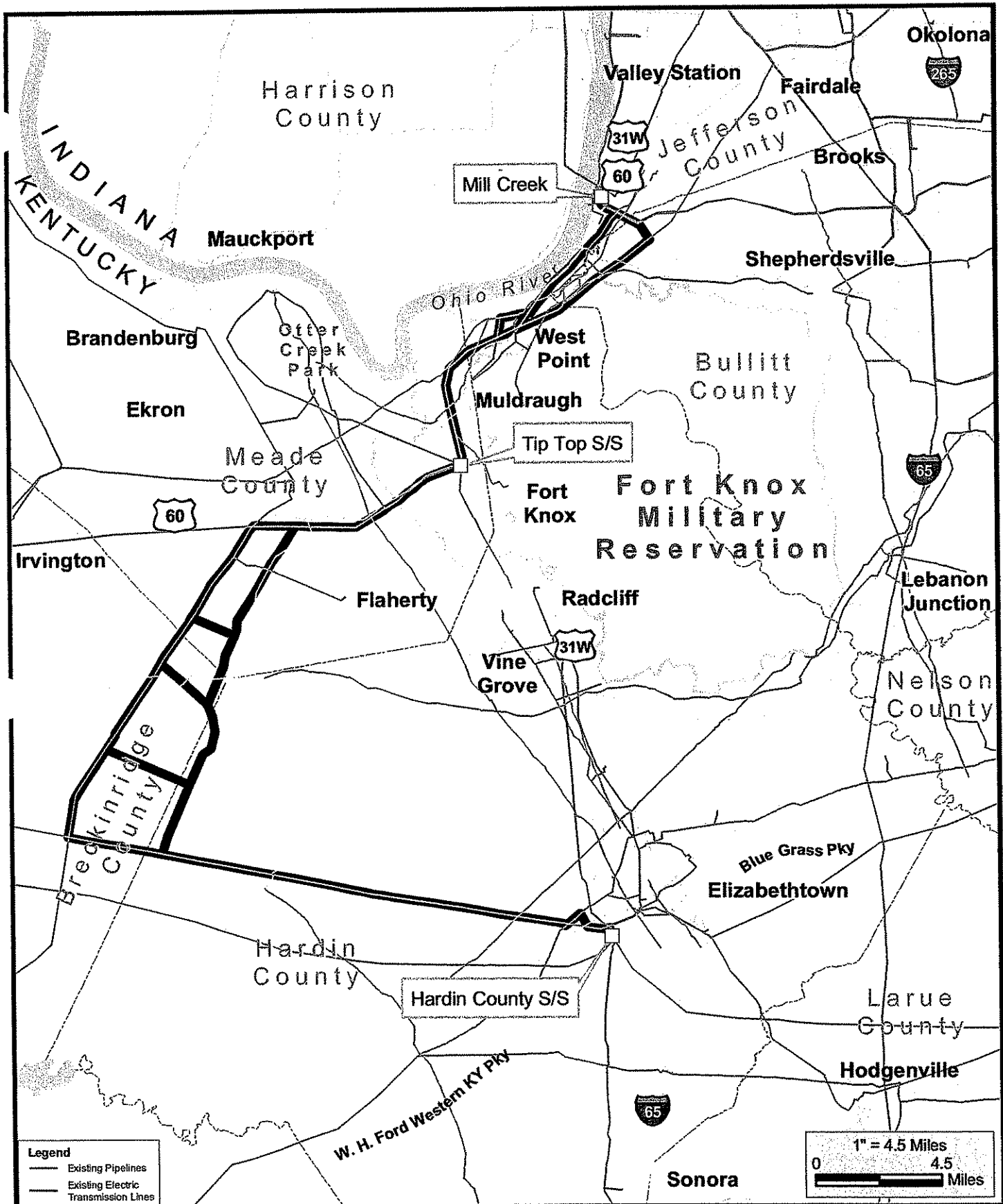
**Mill Creek - Hardin County**  
 345 kV Transmission Line

**KU** **IG&E**

**FIGURE 4.3**

PHOTO SCIENCE  
 CONSULTANTS

## Figure 4.4 Top BREC Routes



**Legend**  
 — Existing Pipelines  
 — Existing Electric Transmission Lines

1" = 4.5 Miles  
 0 4.5 Miles

**Top BREC Routes**

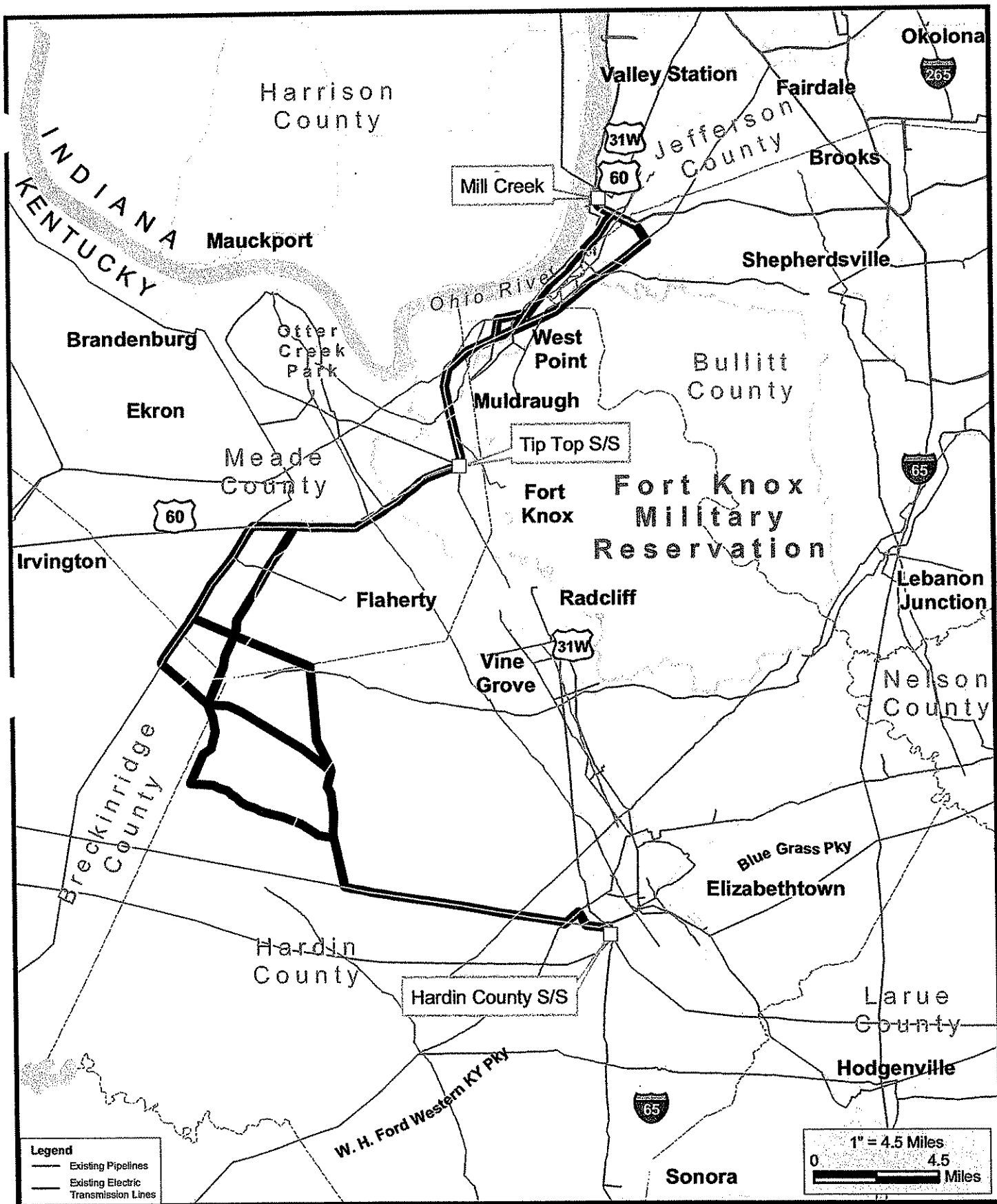
**Mill Creek - Hardin County**  
 345 kV Transmission Line

**KU** **LGE**

**FIGURE 4.4**

**PHOTO SCIENCE**  
 Geomatics Division

## Figure 4.5 Top Crossover Routes



**Legend**  
 - Existing Pipelines  
 - Existing Electric Transmission Lines

1" = 4.5 Miles  
 0 4.5 Miles

**Top Crossover Routes**

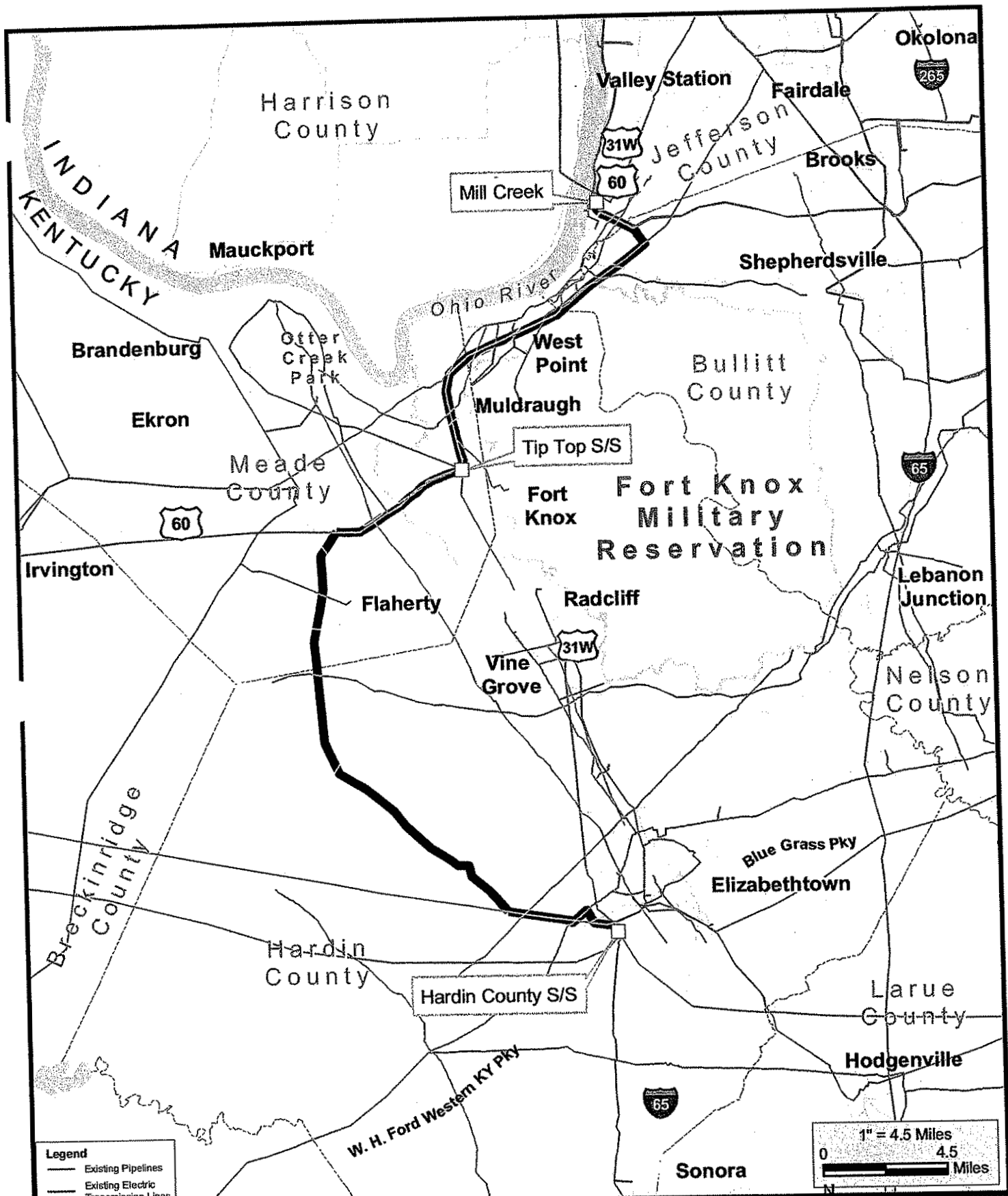
**Mill Creek - Hardin County**  
 345 kV Transmission Line

**KU** **LGE**

**FIGURE 4.5**

PHOTO SCIENCE

**Figure 6.5.1(a) Route AJU**



**Route AJU**

**Mill Creek - Hardin County  
345 kV Transmission Line**

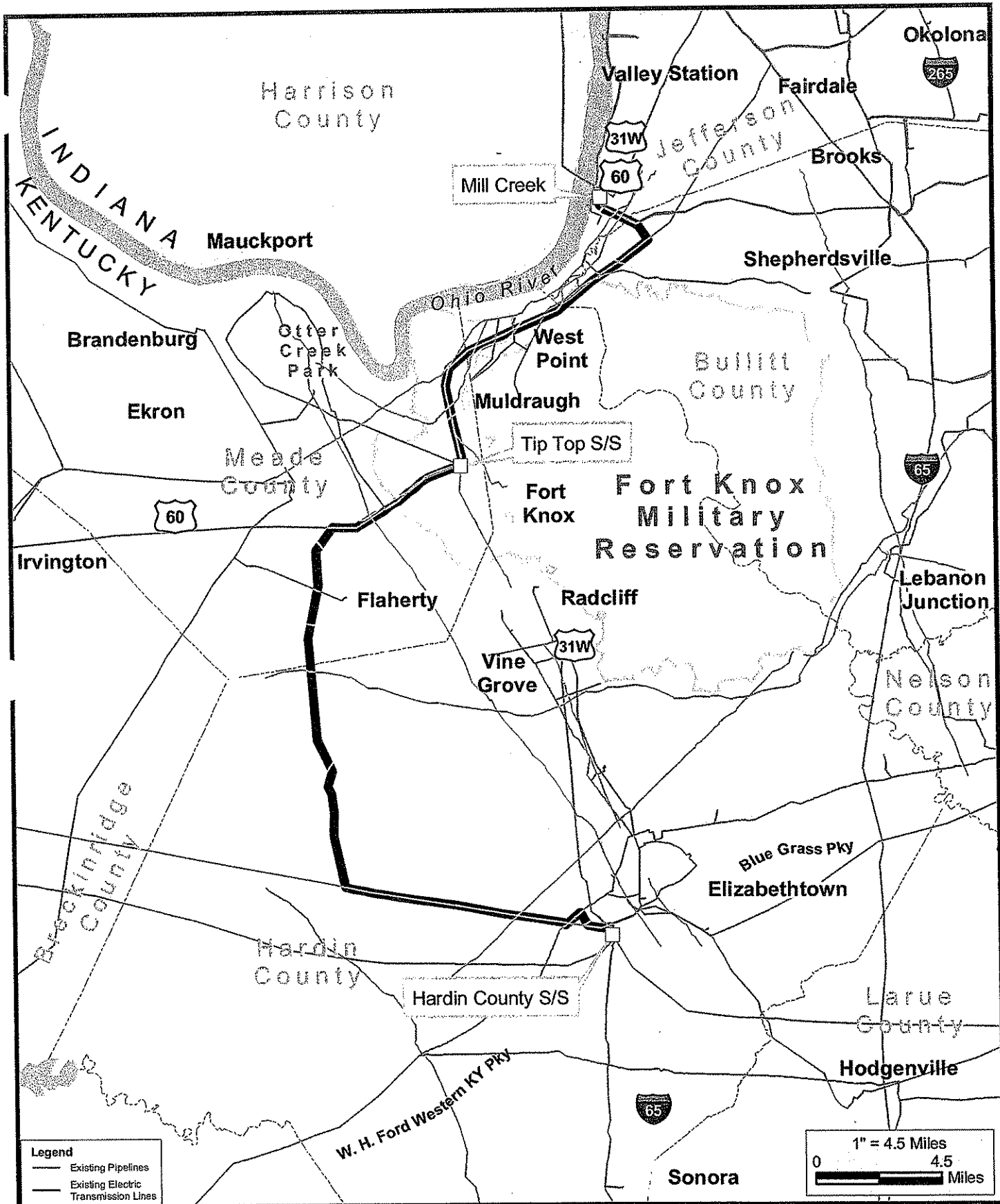


**FIGURE 6.5.1(a)**



**Figure 6.5.1(b) Route AJW**



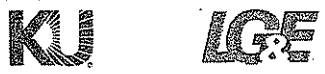


**Legend**  
 — Existing Pipelines  
 — Existing Electric Transmission Lines

1" = 4.5 Miles  
 0 4.5 Miles

**Route AJW**

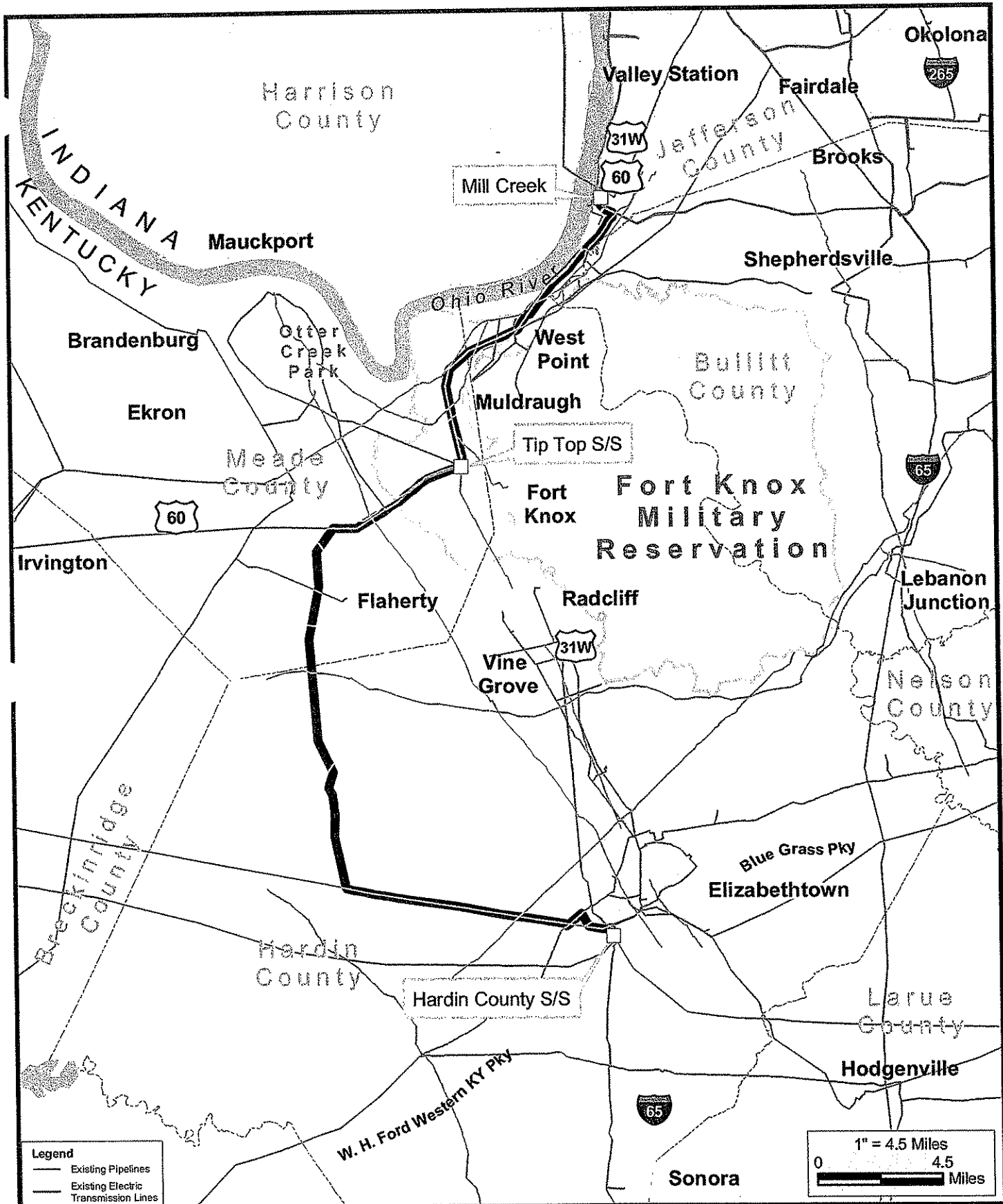
**Mill Creek - Hardin County**  
 345 kV Transmission Line



**FIGURE 6.5.1(b)**



**Figure 6.5.1(c) Route KY**



**Legend**  
 — Existing Pipelines  
 — Existing Electric Transmission Lines

1" = 4.5 Miles  
 0 4.5 Miles

**Route KY**

**Mill Creek - Hardin County**  
 345 kV Transmission Line



**FIGURE 6.5.1(c)**



## **9.0 List of Digital Tables**

These are very large tables of data. All tables referenced here are available on CD in a digital appendix.

**Table 2.0** Route Segments  
(digital appendix)

**Table 3.1** Routes by Segments  
(All routes compatible with Fort Knox)  
(digital appendix)

**Table 3.1(a)** Additional Route Metrics  
(digital appendix)

**Table 3.2.3** Top 50 Routes for Maximum Collocation  
(All Routes Compatible with Fort Knox)  
(digital appendix)

**Table 4.1** Metrics for East Routes  
(digital appendix)

**Table 4.2** Metrics for East-Central Routes  
(digital appendix)

**Table 4.3** Metrics for West-Central Routes  
(digital appendix)

**Table 4.4** Metrics for BREC Routes  
(digital appendix)

**Table 4.5** Metrics for Cross Over Routes  
(digital appendix)

## 10.0 Appendix: Correspondence from Ft. Knox

## **11.0 Appendix: Metadata**

### **Built Environment**

#### *Residences within ROW*

Centroids of houses were identified and heads up digitized using ArcGIS from 2004 aerial photography created by USDA-FSA Aerial Photography Field Office. Houses that fell inside of the approximate ROW needed were counted for each segment.

#### *Proximity to Residences (within 300 feet)*

Centroids of houses were identified and heads up digitized using ArcGIS from 2004 aerial photography created by USDA-FSA Aerial Photography Field Office. Houses that fell within 300 feet of the edge of right-of-way were counted for each segment.

#### *Proposed Developments*

Boundaries for Proposed Developments were identified and heads up digitized using ArcGIS from 2004 aerial photography created by USDA-FSA Aerial Photography Field Office and parcel data acquired from the county PVA offices. Areas that were identified as being under construction from the photography; or areas that had parcels subdivided from the PVA data, where construction hadn't yet occurred, were included. Proposed Developments were counted for each segment where the approximate easement crossed.

#### *Proximity to Commercial Buildings within 300 feet*

Centroids of Commercial Buildings were identified and heads up digitized using ArcGIS from 2004 aerial photography created by USDA-FSA Aerial Photography Field Office. Commercial Buildings that fell within 300 feet of the edge of right-of-way were counted for each segment.

#### *Proximity to Industrial Buildings within 300 feet*

Centroids of Industrial Buildings were identified and heads up digitized using ArcGIS from 2004 aerial photography created by USDA-FSA Aerial Photography Field Office. Industrial Buildings that fell within 300 feet of the edge of right-of-way were counted for each alternative segment.

#### *Schools, Churches, Cemeteries, and Parks Crossed*

Schools, Churches, Cemeteries, and Parks were identified using map layers from ESRI's Data and Maps Media Kit, as well as photo interpretation from the 2004

USDA-FSA Aerial Photography Field Office Photography and PVA data from individual counties. Schools, Churches, Cemeteries, and Parks were counted for each alternative segment that's approximate easement crossed.

#### *NRHP Listed Structures and Districts (3000 feet from edge of R/W)*

NRHP Listed Structures and Districts map layers were downloaded from the National Park Service National Register Information System. Resources that fell within 3000' of the approx. easement were counted for each alternative segment.

### **Natural Environment**

#### *Natural Forests*

Forested Areas were identified and heads up digitized using ArcGIS from 2004 aerial photography created by USDA-FSA Aerial Photography Field Office. Acres of natural forested areas were calculated for each alternative segment within the approximate easement area.

#### *Stream and River Crossings*

Streams and Rivers map layers were downloaded from the University of Kentucky, Kentucky Geological Survey, Maps and GIS webpage (NHD 24k Streams of Kentucky). Streams and Rivers were counted for each alternative segment.

#### *Wetland Areas*

Wetland map layers were downloaded from the Kentucky Natural Resources & Environmental Protection Cabinet (Kentucky's Wetlands). Ponds, Lakes, and Rivers were removed from the layer to leave only wetlands. Acres of wetlands areas were calculated for each alternative segment within the approximate easement area.

#### *Floodplain*

Floodplain map layers were downloaded from the Kentucky Division of Geographic Information Systems (FEMA Q3 Data). Acres of floodplain were calculated for each alternative segment within the approximate easement area.

### **Engineering Considerations**

#### *Percent of Routes Rebuilt with Existing T/L*

Existing Transmission Lines were acquired from the Kentucky Public Service Commission ("eline" shape file). Also, more detailed alignments were obtained

from LG&E/KU. Sections of the alternative segments that were identified as rebuild opportunities by LG&E/KU were classified as rebuild sections. Lengths were calculated for these sections.

#### *Percent of Routes Parallel with Existing Utilities*

Existing Transmission Lines were acquired from the Kentucky Public Service Commission (eline). Existing gas pipelines were identified from USGS 7.5 min Quadrangles and from the Pennwell MapSearch transmission pipeline map layer. The location of the gas pipelines were verified with the aerial photography created by USDA-FSA Aerial Photography Field Office. Sections of the alternative segments that paralleled these existing utilities were classified as utility parallel sections. Lengths were calculated for these sections.

#### *Percent of Routes Parallel with Roads*

Roads were acquired from the Kentucky Division of Geographic Information Systems (transportation). Sections of the alternative segments that paralleled roads were classified as road parallel sections. Lengths were calculated for these sections.

#### *Total Project Costs*

Total project cost was calculated for each route based on unit price information from LG&E/KU. These costs were based on information calculated such as length, length of rebuild sections, length of single pole sections, length across Fort Knox, easement amount on Fort Knox, number and degree of angles, number of parcels, and acreage to be cleared. Also property values were estimated based on the Fair Market Value from the PVA's.



**12.0 Appendix: Resume of Principal Investigator**

# CLAYTON M DOHERTY

**LINEAR PROJECTS, INC.**  
608 Herb River Drive  
Savannah, GA 31406

912.354.7565  
Cell: 912.224.5988  
e-mail: [linearprojects@bellsouth.net](mailto:linearprojects@bellsouth.net)

## **Experience**

*Environmental & Regulatory Coordinator*, electric transmission line and substation projects (1986-2001; 2005 – present). Manage land planning and environmental and regulatory compliance activities on over one hundred thirty significant electric utility projects (\$300,000 - \$56,000,000). Conduct land use analysis; identify regulatory requirements; siting and routing studies; obtain local, state, and federal approvals. Prepare environmental reports and environmental assessments. Public scoping meetings, public officials briefings, agency coordination, expert witness testimony.

*Senior Planner, City of Key West*: zoning and land use, variance analysis, and development plan review. Prepare staff reports to planning board and city commission. Update City of Key West 2004 Statistical Abstract. State and federal emergency management training and exercises. Migrate planning department GIS software from ArcView 3.3 to ArcGIS 8.2.

## **Expertise**

Prepare alternatives analyses and site/route selection documentation. Identify federal, state, and local government regulatory requirements. Initiate and manage contracts for environmental, cultural resource, and special needs surveys. Present land use and environmental considerations in project team meetings, public meetings, elected officials briefings, and government agency consultations. Develop and implement strategies for resolving complex regulatory compliance issues. Prepare environmental reports, environmental assessments and regulatory permit applications. Technical editing of complex environmental and planning documents. Analyze zoning and land use issues. Research and apply land development regulations. Determine project consistency with local government comprehensive plans.

## **Policy Groups**

Secretary-Treasurer and Board Member, *The National Wetlands Coalition*.  
Board Member, *National Endangered Species Act Reform Coalition*.  
Policy Committee and Section 404 Task Force, *Utility Water Act Group*.  
Corporate Liaison, *National Rural Electric Environmental Association*.

## **Employment**

Linear Projects, Inc. Savannah, GA 31406. 2005 - present.  
City of Key West Planning Department. Key West, FL 33040. 2003 - 2004.  
Georgia Transmission Corporation. Tucker, GA 30084. 1986 - 2001.  
Park-Land Planners, Ltd. Atlanta, GA. 1985 - 1986.  
Takeda Landscape Design. Seattle, WA. 1984 - 1985.

## **Education**

Master of Landscape Architecture, 1983. School of Environmental Design, University of Georgia. Thesis passed with distinction. Graduate electives in Land Planning and Historic Preservation.

Bachelor of Arts, English, with General Honors, 1971. College of Arts and Sciences, University of Georgia.

Benedictine Military School. Savannah, GA. 1967.

## **Training**

Federal Wetland Regulation. Wetland Training Institute [1990].

National Environmental Policy Act. Hunton & Williams [1990].

Wetland Functions and Values. Wetland Training Institute [1992].

Advanced Wetland Delineation. Wetland Training Institute [1993].

Medusa (Unix-based CAD) Rev. 13. [1994].

Total Quality Management. Qualtec Institute for Competitive Advantage [1994].

The Role of Environmental Audits and Site Assessments in Property Transfers. Georgia Tech [1994].

Introduction to Federal Projects and Historic Preservation Law. GSA Interagency Training [1995].

Advanced Seminar on Preparing Agreement Documents (NHPA Section 106). GSA Interagency Training [1997].

Introduction to ArcView GIS. ESRI [1999].

Community Emergency Response Team (CERT) - Train the Trainer. Florida Dept. of Community Affairs [2003].

Governor's Hurricane Conference. Florida Dept. of Community Affairs and Florida Emergency Preparedness Association [2003].

National Interagency Incident Management System (NIIMS) Incident Command System (ICS). U.S. Coast Guard [2003].

Introduction to ArcGIS. Photo Science, Inc. / ESRI [2004].

PC Training. Excel; Word; Access; PowerPoint; Desktop Publishing.

Corporate Culture Training. Team Building; Conflict Management; Giving and Receiving Feedback; Negotiating; Writing Goals and Objectives; Essentials of Project Management; Tools and Concepts for Continuous Improvement.

## **Community**

*Rotary International.* Community Service Committee Member and Fundraising Event Treasurer, Savannah Sunrise Rotary, 2004-present. Sunrise Rotary Club of the Conch Republic (Key West), 2003 - 2004.

*Martin des Porres Society.* Volunteer, 2004 - present.

*Habitat for Humanity.* Board Member and Chair, Site Selection Committee, Habitat for Humanity of Key West and the Lower Florida Keys [2002-2004].