Macro-Corridor Report
Blackberry – Chouteau 345-kV Transmission Project

Prepared for the

Rural Utilities Service

JUNE 2007

Burns & McDonnell
SINCE 1898

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45061

JUNE 2007

Prepared by:

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Kansas City, Missouri

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1.1 OVERVIEW

KAMO Power (KAMO) proposes to build a new 345-kV electrical transmission line from a point near the Kansas-Missouri border west of Jasper, Missouri in Jasper County to a substation near Chouteau, Oklahoma in Mayes County (Figure 1-1). These electrical transmission lines would ensure continued reliable electric service for KAMO's customers. The proposed 345-kV line would connect KAMO's new Blackberry Substation in western Jasper County to the new Chouteau 345/161-kV Substation and on to the existing Grand River Dam Authority (GRDA) Coal-Fired Complex. A new single circuit 161-kV line would also connect the Chouteau Substation to the existing Associated Electric Cooperative, Incorporated (AECI) Chouteau Gas Plant west of the new Chouteau 345/161-kV Substation.

1.2 DESCRIPTION OF THE PROJECT

The project described in this report is the construction of approximately 100 miles of 345-kV electric transmission line and approximately 2 miles of single circuit 161-kV electric transmission line that would be owned and operated by KAMO. The 345-kV transmission line facilities would be constructed from KAMO's new Blackberry Substation to the new Chouteau 345/161-kV Substation and on to the GRDA Coal-Fired Complex. The single circuit 161-kV transmission line would be constructed from KAMO's new Chouteau Substation to AECI's Chouteau Gas Plant. The 345-kV portion of the project would be constructed using weathering steel H-frame structures (Figure 1-2). The single circuit 161-kV portion of the project would be constructed using weathering steel H-frame structures (Figure 1-2). Both the 345 and 161-kV lines would also contain fiber optic cables. Fiber optic cables would primarily be used for internal utility communications and protective relaying. Secondary, surplus fiber capacity, if any, would be offered to other parties for commercial telecommunications purposes.

1.2.1 Location

The study area is located in southeastern Kansas, southwestern Missouri and northeastern Oklahoma (Figure 1-1). The study area includes portions of Cherokee and Crawford counties in Kansas; portions of Jasper, Newton, and McDonald counties in Missouri; and portions of

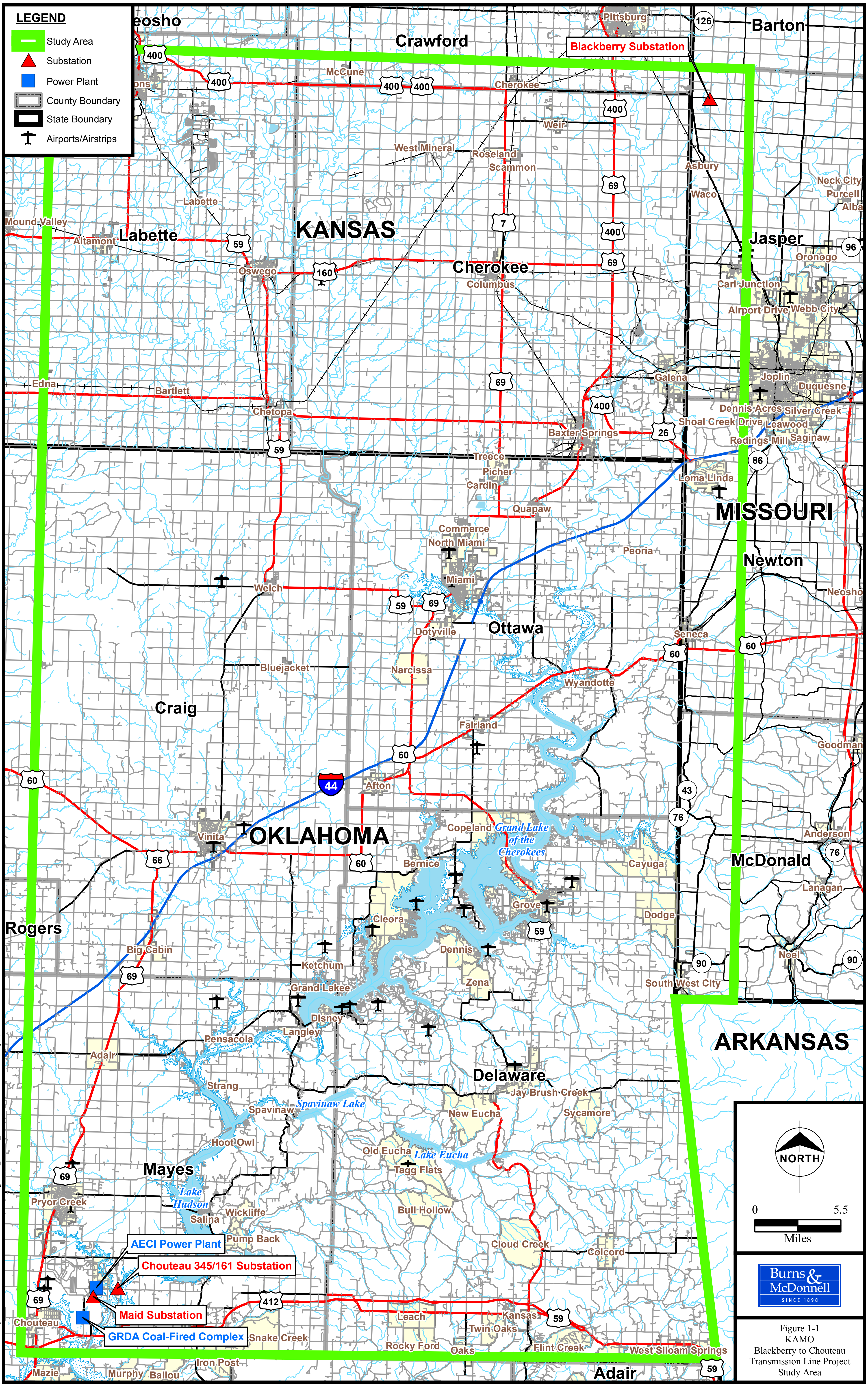

Figure 1-1
KAMO
Blackberry to Chouteau
Transmission Line Project
Study Area

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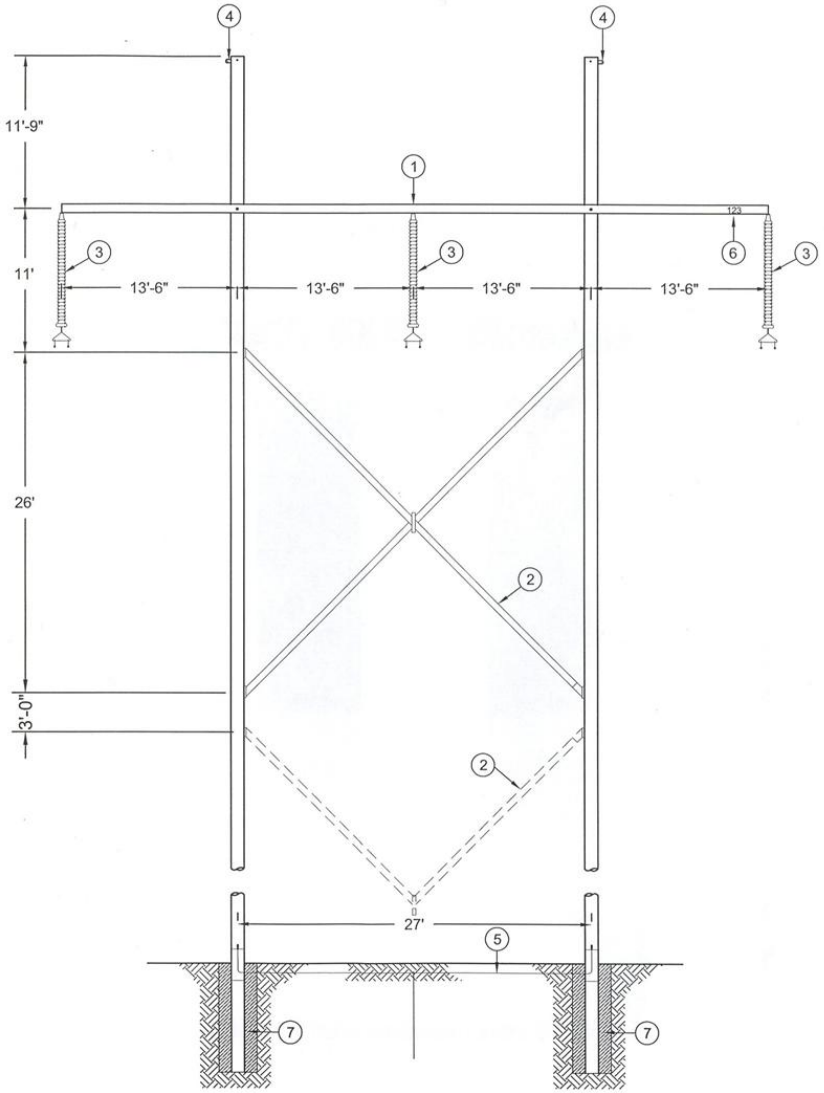
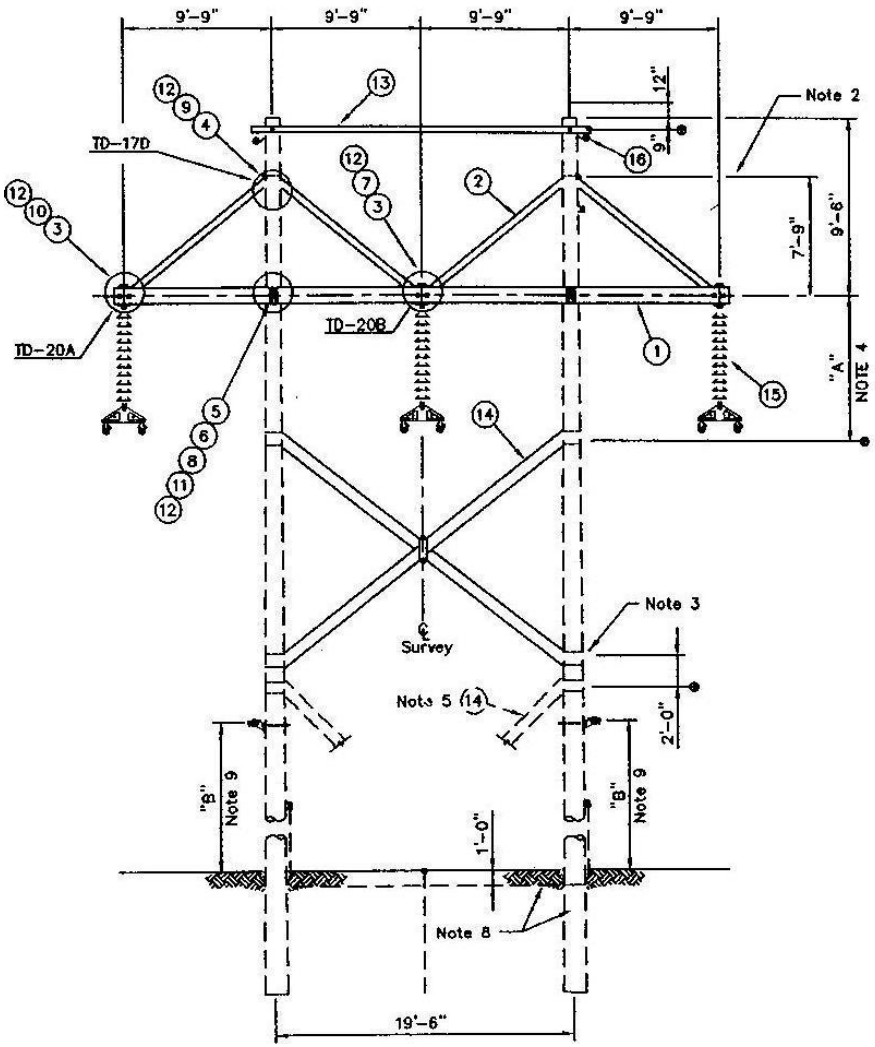


345-kV Weathering Steel H-Frame Structure



161-kV Weathering Steel H-Frame Structure

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Figure 1-2

Blackberry to Chouteau
Transmission Line Project
Proposed Structures

Ottawa, Delaware, Craig, and Mayes counties in Oklahoma (Figure 1-1). Communities within the study area include Parsons, Oswego, Columbus, Galena, Baxter Springs, and Chetopa in Kansas; Asbury, and Waco in Missouri; and portions of Picher, Miami, Narcissa, Afton, Vinita, Cayuga, Big Cabin, Ketchum, Pryor Creek, Lake Eucha and Grand Lake of the Cherokees in Oklahoma.

The origin of the new 345-kV transmission line would be the new Blackberry Substation located 3.5 miles north of Asbury, Missouri in western Jasper County. The terminus of the new 345-kV line would be the GRDA Coal-Fired Complex, located east of the City of Chouteau. The origin of the new single circuit 161-kV line would be the new 345/161-kV Chouteau Substation approximately two miles east of the gas plant. The terminus of the new single circuit 161-kV line would be at AECI's Chouteau Gas Plant.

1.2.2 Structures

Weathering steel H-Frame structures are proposed for the new 345-kV transmission line (Figure 1-2). The new 161-kV transmission line would use H-frame structures made of wood or wood equivalent weathering steel poles (Figure 1-2). The anticipated pole height for the 345-kV and 161-kV lines range from 65 to 115 feet above ground elevation, with an average pole height of 80 to 85 feet above elevation. The average span for the 345-kV line would be 850 feet and the average span for the 161-kV line would be 385 feet. The 345-kV structure would also contain two Optical Ground Wire (OPGW) fibers and the 161-kV structure would contain one OPGW with the primary purpose of communications and protective relaying. Surplus capacity will be offered for commercial communications. No more than four 0.5 acre regeneration sites would be located along the 345-kV right-of-way. These would be located in and along the right-of-way and likely near road crossings to eliminate construction of access roads.

1.2.3 Right-of-Way

The new 345-kV and the new 161-kV lines would both require 150 feet of new right-of-way. KAMO land agents would work individually with property owners to purchase easements for the new 345-kV and 161-kV lines once the Rural Utilities Service (RUS) approves a route. KAMO

would pay just compensation for easements, and landowners retain ownership of the property with some limitation on the use of the land in the right-of-way. The amount of just compensation for each tract would be determined in the manner prescribed by the particular statutes of the state in which that portion of the transmission line occurs. Under the agreement, property owners could not place any permanent structures within the corridor that would restrict complete access and maintenance of the line or right-of-way.

Given the terrain in the area, it is not anticipated that the construction of access roads outside of the 150-foot right-of-way would be required. If obstructions exist that are completely blocking ingress/egress along the 150-foot right-of-way corridor, such as flowing creeks, KAMO would utilize existing field roads, as arranged with landowners, to access the structure locations.

In addition to the right-of-way, up to four 0.5 acre regenerations sites would be purchased in and along the 345-kV right-of-way. These would be purchased in fee and separate from right-of-way easements. These sites would likely be located near road crossings to eliminate construction of access roads.

1.3 CONSTRUCTION, OPERATION, AND MAINTENANCE

Construction involves a number of steps, which are listed below:

- Detailed survey of the route alignment
- Right-of-way acquisition and clearing
- Construction of access roads where necessary
- Installation of structure foundations, if necessary
- Assembly and erection of new structures
- Stringing and tensioning of the conductors
- Final clean-up and land rehabilitation

All appropriate materials would be delivered and assembled at each structure location. Most structures would be directly imbedded into the ground, with a hole excavated for placement of the pole. Poles would be backfilled following placement. Excess soil from the holes would be evenly distributed at each pole and the soil stabilized. No poles are anticipated to be placed in wetlands. However, if necessary, in wetland areas, the method used for the installation of poles

would depend on the sub-surface conditions and excess soil would be removed to an upland site. If poor subsurface soil conditions are expected, concrete bearing plates may be necessary. Typical construction equipment would include hole diggers, cranes, wire-stringing rigs, tensioners, backhoes, and trucks.

The conductor, OPGW and Overhead Ground Wire (OHGW) will be installed under tension utilizing IEEE 524-2003, *IEEE Guide to the Installation of Overhead Transmission Line Conductors*. Stringing under tension would be used to assure the protection of the public, line construction workers and livestock. Particular attention would be given to railroad crossings, highway crossings, transmission line crossings, and distribution line crossings. Pulling under tension would also protect the conductor, OPGW and OHGW from physical damage. The Department of Transportation (DOT) for each state would be contacted for highway crossing permits. KAMO would comply with each of the individual state's DOT Permit requirements. A Traffic Control Plan would be developed for each highway crossing and the traffic control devices/methods would conform to the Manual of Uniform Traffic Control Devices (MUTCD).

Maintaining the right-of-way under the transmission lines is essential for the reliable operation of the line and public safety. Operation and maintenance of the line would consist of periodic inspections of the line and right-of-way, occasional replacement of hardware as necessary and periodic treatment of woody vegetation within the corridor. The periodic inspections would occur on a regular basis and utilize both aerial and walking patrols. Normal operation and maintenance would require only infrequent visits by KAMO or their contractors. Agricultural activities would be able to continue within the right-of-way.

Most right-of-way maintenance activities consist of selective, low-volume herbicide applications targeting only tree species on the right-of-way every three to five years, and the cutting of danger trees every three years. KAMO only uses herbicides on power line right-of-way that are approved by the U.S. Environmental Protection Agency (EPA).

1.4 PROJECT SCHEDULE

The construction of a transmission line involves several stages, all of which overlap to some degree. The approximate start schedule for the Blackberry to Chouteau 345-kV line and the 161-

kV line from the new Chouteau 345/161-kV substation to the Chouteau Gas Plant Transmission Line Project is described below:

- RUS Approval: Fall 2007
- Survey: Fall 2007
- Right-of-way Acquisition: Fall 2008
- Construction: Spring 2009
- In-Service Date: June 2010

2.0 PURPOSE AND NEED

2.1 OVERVIEW

KAMO Power (KAMO) is a not-for-profit generation and transmission (G&T) cooperative serving seventeen rural electric distribution cooperatives. KAMO exists to serve the needs of its member cooperatives by providing safe, low-cost, reliable power. KAMO accomplishes these goals through its transmission network, qualified and dedicated personnel, effective system operations, maintenance, planning, and long term rate stability.

KAMO has experienced strong electrical demand growth through out its entire service area. In order to meet the continued strong growth, KAMO's transmission system must be able to move greater amounts of power. Through the transmission planning process, a transmission bottleneck has been identified that can significantly impact the ability to move power from KAMO's generation resources to KAMO's load, as well as to other electric utilities in the region. This bottleneck is becoming progressively worse as the demand on the KAMO system increases.

The KAMO service territory encompasses southwest Missouri and northeast Oklahoma. Close to one-half of KAMO's approximate 1,500 mega watts (MW) of peak load is in each of the two states. Currently, transmission capacity between KAMO's Missouri system and KAMO's Oklahoma system is insufficient should any of the existing transmission line connections between the two systems be unavailable due to weather, maintenance, or other conditions or if generation resources in Oklahoma that are used to serve KAMO's load become unavailable. Transmission capacity is provided by two KAMO owned 69-kV lines and the 345-kV multi-owner Oklahoma, Arkansas, Missouri (OAM) line.

KAMO is at risk to serve its Oklahoma load should any of the above mentioned facilities be out of service. At such times, KAMO's only option is to rely on non-firm transmission capacity from the Southwest Power Pool (SPP). Non-firm transmission capacity is just that, non-firm and is not guaranteed to be available when needed. As such, transmission capacity may or may not be available to KAMO during times of need such as peak demand periods or loss of lines or

generation resources. KAMO's only other option under such conditions at this time would be to shed firm member load through measures such as rolling black-outs.

To eliminate the transmission bottleneck KAMO proposes to build a new 345-kV electrical transmission line from a point near the Kansas-Missouri border west of Jasper, Missouri in Jasper County to the GRDA Coal-Fired Complex near Chouteau, Oklahoma in Mayes County. This proposed electrical transmission line would significantly increase the transmission system capacity enabling KAMO to avoid blacking-out large numbers of consumers due to insufficient capacity in the high-voltage transmission system.

The proposed 345-kV line would connect KAMO's new Blackberry Substation in western Jasper County with its new Chouteau 345/161-kV Substation in Mayes County and then on to GRDA's Coal-Fired Complex. The proposed single circuit 161-kV, line would continue approximately two miles west from the new Chouteau 345/161-kV Substation to AECI's Chouteau Gas Plant. These new lines would provide the components necessary to create the needed transmission capacity within the KAMO system to address these emerging reliability issues.

2.2 ALTERNATIVES CONSIDERED

KAMO has considered a number of alternatives to address the current transmission system capacity needs. These alternatives are discussed below.

2.2.1 No-Action

Under the No-Action alternative, KAMO would continue to maintain and operate its existing system. Transmission capacity issues would continue to exist, preventing KAMO from bringing in needed power from the Missouri system during peak or storm outage periods or from transferring excess power from Oklahoma back to Missouri. Uncertainties with the availability of SPP transfer capacity and costs associated with SPP reliance would continue to exist. Under certain conditions, such as an outage of AECI's Chouteau Gas Plant or the OAM 345-kV transmission line, KAMO could not meet the new North American Electric Reliability Council (NERC) performance standards without blacking out large numbers of consumers. Additionally, during periods of low electrical load in Oklahoma, AECI's ability to move excess energy from the Chouteau Gas Plant is limited by the capacity of the KAMO transmission system. SPP

capacity is currently required. SPP capacity has often been unavailable to KAMO, resulting in available power being stranded in Oklahoma and unavailable for use elsewhere, including serving the other G&T members of AECI.

2.2.2 New 345-kV Line

KAMO has identified construction of approximately 100 miles of new 345-kV transmission line, over new right-of-way as a potential solution to its transmission capacity and reliability concerns. The proposed line would extend from a new substation, Blackberry, located along an existing AECI 345-kV transmission line in northwestern Jasper County, Missouri. The new line would extend south to the GRDA Coal-Fired Complex (to which KAMO has existing transmission connections and rights). Additionally, KAMO would construct the new Chouteau 345/161-kV Substation adjacent to existing GRDA transmission lines to facilitate connection of the proposed project to both GRDA's Coal-Fired Complex and to AECI's Chouteau Gas Plant.

2.2.3 New 161-kV Line

KAMO studied a new high capacity 161-kV line between existing locations in Oklahoma and Missouri to address transmission capacity issues. The new 161-kV line could be largely constructed within existing KAMO rights-of-way through the upgrading of existing 69-kV lines to either single-circuit 161-kV lines or double-circuit 161/69-kV lines. Such line construction would also require upgrades or conversions of several 69-kV substations by adding 161-kV equipment. Use of existing rights-of-way for this proposed alternative would be in close proximity to the existing OAM line, increasing the likelihood that both lines could be lost during a storm or weather event. The conductor used for this option, in an attempt to create substantial transmission capacity would not need to be a special, large diameter, high temperature conductor. The studies showed that this alternative would provide additional transmission capacity, but would also cause a number of problems. This solution would create much less additional capacity between the two systems compared to the 345-kV solution, allowing the bottleneck to redevelop in the future. The nature of the 161-kV improvement option would create a higher electrical impedance path, resulting in higher flows on KAMO's 69-kV system and on neighboring utilities systems. This situation would result in a number of facilities becoming overloaded under the 161-kV option.

2.2.4 Existing 69-kV System Upgrades

Upgrades to KAMO's existing 69-kV system would potentially provide some relief to the transfer capacity concerns. By upgrading 69-kV conductors, KAMO could increase the transmission capacity by 166 MW. This alternative, however, would not provide a direct connection to AECI's Chouteau Gas Plant and would therefore not improve capacity issues associated with excess power during low KAMO load periods being unavailable to AECI.

2.2.5 SPP Transmission Capacity

Currently, KAMO relies on SPP transmission capacity only on occasion. Often this capacity is unavailable to KAMO when most needed. As an alternative to line construction options, KAMO could purchase long term capacity on the SPP transmission system. Although this alternative would not require new line construction, it could require significant upgrades (approximately $100 million) throughout the SPP and KAMO systems. Additionally, KAMO would be required to purchase at least 300 MW of capacity at a cost of approximately $120 million. Much of this capacity would be unnecessary for a substantial portion of the year. Such an agreement with SPP would likely result in significant expense to KAMO, particularly due to the limited periods when it would be needed.

2.3 ALTERNATIVE SELECTED

KAMO has selected the construction of a new 345-kV line as the preferred alternative to address the current system transfer and reliability issues. Unlike the other alternatives evaluated, construction of a new line provides a robust solution that addresses all of KAMO's needs, including transfer capacity from Missouri to Oklahoma as well as Oklahoma to Missouri, excess power at the Chouteau Gas Plant, and separation of existing facilities to increase reliability during storm events.

Of the other alternatives evaluated, the No-Action alternative would result in continued system reliability and transfer issues. Conversion of existing 69-kV lines to 161-kV could solve some but not all of the capacity transfer issues. Additionally, the proximity of the 161-kV lines to other transfer facilities would create reliability concerns as a storm or icing event could result in the loss of these and other facilities, compounding the existing concerns. Also, neither

reconductoring existing 69-kV lines nor firm availability of SPP capacity would address all of the transfer capacity and reliability issues, with the SPP alternative resulting in significant, and likely unnecessary, costs.

3.0 TRANSMISSION LINE MACRO-CORRIDOR ANALYSIS

3.1 INTRODUCTION

As discussed earlier, a new 345-kV transmission facility between the new Blackberry Substation and the new GRDA Coal-Fired Complex (approximately 100 miles) is proposed. In order to identify the potential locations for these new transmission line facilities, Burns & McDonnell conducted an investigation of the existing human and environmental resources within the study area. This investigation centered on identifying those resources within the areas between the Blackberry Substation and the GRDA Coal-Fired Complex that would present issues or concerns for the routing of new transmission facilities. Additionally, this study sought to identify any opportunities within the study area that would provide a potential corridor or alignment for a new transmission line. The goal of the investigation was to identify and define one or more macro-corridors, an area up to several miles in width extending between the desired end-points, within which the proposed connecting transmission lines could be constructed.

3.2 TRANSMISSION FACILITIES STUDY AREA

The study area developed for the proposed transmission facilities encompassed the proposed site for the new Blackberry Substation in Missouri, the Maid Substation, the new Chouteau Substation in Oklahoma, the GRDA Coal-Fired Complex, AECI's Chouteau Gas Plant and substantial lands between these points (Figure 1-1). An area of sufficient size to provide potential macro-corridors with numerous alternatives for a new transmission line connecting the desired end-points was established. This study area consists of portions of nine counties, four in Oklahoma, three in Missouri, and two in Kansas. The following sections include a description of the study area and identify the macro-corridors developed within the study area for further investigation.

3.3 BLACKBERRY TO CHOUTEAU STUDY AREA

The Blackberry to Chouteau study area extends southwest from the new Blackberry Substation approximately 100 miles to the proposed Chouteau 345/161-kV Substation (Figure 1-1). A straight line between the two endpoints would cross through the Grand Lake of the Cherokees; therefore, the study area was established to provide opportunities to construct a line either north

or south of the lake. In addition, the study area was established to avoid the town of Joplin, Missouri and its surrounding communities. A transmission line routed around the east side of Joplin would not be feasible due to the additional length, associated environmental impacts, and cost associated with such a routing. Additionally, dense development precluded routing a line through the town. Therefore, the eastern boundary of the study area was established along the west side of the town of Joplin. The western boundary of the study area is located slightly west of the GRDA Coal-Fired Complex, which provides reasonable opportunities for a transmission line. Extending the study area further west would only increase the potential overall length, associated environmental impacts, and cost of the line.

The study area includes southern Crawford County, eastern Labette County, and all of Cherokee County in Kansas; the far western portions of Jasper, Newton, and McDonald counties in Missouri; and all of Ottawa and Delaware counties and the eastern portions of Craig and Mayes counties in Oklahoma. The new Blackberry Substation would be located approximately 3.5 miles north of the small town of Asbury, Missouri in Jasper County. The new Chouteau 345/161-kV Substation would be located approximately 2 miles east of the Chouteau Gas Plant. The terminus of the 345-kV line would be the Chouteau 345/161-kV Substation north of the GRDA Coal-Fired Complex in Mayes County, Oklahoma just east of US Highway 69. The most dominant features in the area between the Blackberry Substation and the GRDA Coal-Fired Complex include Interstate 44 and US Highway 69; the Grand Lake of the Cherokees, Lake Hudson, Lake Eucha, and Spavinaw Lake. Towns in the area include Miami, Vinita, and Big Cabin in Oklahoma, Baxter Springs and Galena in Kansas, and Loma Linda, Missouri.

3.3.1 Human Resources

The Blackberry to Chouteau study contains primarily undeveloped, rural lands with scattered residential development and small towns. General population and employment data for these counties is included in Tables 3-1 and 3-2. Land use throughout the area consists of a mixture of pasture land, woodlands, large lakes, small communities, and scattered rural residences and small farmsteads. Minor amounts of cropland are present; however, most agricultural lands are used for grazing or hay. The crops in the area primarily consist of soybeans, wheat, or sorghum.

Table 3-1 Population for Study Area

	Oklahoma				Kansas		Missouri		
	Ottawa	**Delaware**	**Craig**	**Mayes**	**Cherokee**	**Crawford**	**Jasper**	**Newton**	**McDonald**
Population 2006	33,026	40,061	15,046	39,774	21,451	38,059	112,505	56,047	22,949
Population 2000	33,195	37,077	14,950	38,369	22,605	38,242	104,686	52,636	21,681
Population % Change	-0.5	8.0	0.6	3.7	-5.1	-0.5	7.4	6.5	5.8

Source: US Census Bureau, 2006

Table 3-2 Percent Employment by County

	Oklahoma				Kansas		Missouri		
Industry	**Ottawa**	**Delaware**	**Craig**	**Mayes**	**Cherokee**	**Crawford**	**Jasper**	**Newton**	**McDonald**
Agriculture, forestry, fishing and hunting, and mining	4.9	5.0	6.2	3.9	3.8	2.2	1.8	3.1	10.1
Construction	6.3	9.8	5.9	8.5	8.5	6.1	6.0	7.0	9.0
Manufacturing	12.7	21.3	14.9	25.1	25.5	16.9	21.7	24.4	26.7
Wholesale trade	2.7	2.4	3.9	3.4	2.8	3.1	2.9	2.9	3.5
Retail trade	10.3	12.0	11.3	11.0	10.4	9.3	13.5	12.8	16.0
Transportation and warehousing, and utilities	5.0	5.2	9.2	7.2	5.5	8.8	6.7	6.9	4.6
Information	0.9	1.5	1.8	1.7	1.0	1.6	2.0	1.6	1.1

	Oklahoma				Kansas		Missouri		
Industry	**Ottawa**	**Delaware**	**Craig**	**Mayes**	**Cherokee**	**Crawford**	**Jasper**	**Newton**	**McDonald**
Finance, insurance, real estate, and rental and leasing	3.9	4.9	3.5	3.5	3.4	3.8	4.3	3.4	3.0
Professional, scientific, management, administrative, and waste management services	3.4	4.1	4.4	4.5	3.3	6.0	4.9	4.4	3.3
Educational, health and social services	23.9	17.2	23.5	17.4	22.0	30.2	19.7	19.0	10.9
Arts, entertainment, recreation, accommodation and food services	10.5	8.1	6.3	6.0	5.5	8.1	8.1	6.5	4.7
Other services (except public administration)	6.2	4.9	3.9	4.5	4.9	5.3	5.7	5.1	4.3
Public administration	4.3	3.4	5.1	3.4	3.5	3.7	2.6	2.8	2.8

Source: US Census Bureau, 2006

Several communities are located within the study area. The communities include Chouteau, Big Cabin, Vinita, Afton, and Miami in Oklahoma; Loma Linda in Missouri; and Baxter Springs and Galena in Kansas. Other than these communities, there is some development centered around the several lakes in the study area including Grand Lake of the Cherokees, Spavinaw Lake, Lake Eucha, and Lake Hudson. Populations for these communities are included in Table 3-3. These communities range in population from 293 to 13,704 persons.

Table 3-3

Populations of Communities in the Study Area

Community Name	Population in 2000
Chouteau, OK	1,931
Big Cabin, OK	293
Vinita, OK	6,472
Afton, OK	1,118
Miami, OK	13,704
Pryor Creek, OK	8,659
Loma Linda, MO	507
Baxter Springs, KS	4,602
Galena, KS	3,287

Source: US Census Bureau, 2000

There are several state parks and wildlife areas located in the study area (Figure 3-1). These include the Wah-Sha-She Prairie State Wildlife Area, the Mined Land Wildlife Area, the Spavinaw Wildlife Management Area, Twin Bridges State Park, Bernice State Park, Honey Creek State Park, Cherokee State Park, Disney/Little Blue State Park, Snowdale State Park, and Lake Eucha State Park. The Wah-Sha-She Prairie State Wildlife Area is located in Jasper County, Missouri just north of Asbury and south of the location for the Blackberry Substation. The Mined Land Wildlife Area consists of several different parcels of lands scattered throughout Crawford and Cherokee County, Kansas between the towns of Oswego, Columbus, and Pittsburg. The Spavinaw Wildlife Management Area is located southeast of the town of Spavinaw, Oklahoma and Spavinaw Lake.

There are five state parks located adjacent to the Grand Lake of the Cherokees. These parks include Twin Bridges State Park located near the town of Wyandotte, Oklahoma on the northern arm of the lake, Honey Creek State Park located just south of the town of Grove, Oklahoma, Bernice State Park located northeast of the town of Bernice, Oklahoma, Cherokee

LEGEND

- Study Area
- Substation
- Power Plant
- County Boundary
- State Boundary
- State Lands
- Oklahoma State Parks
- Federal Grassland Reserves

Crawford
Barton
Blackberry Substation
MON-SHON PRAIRIE CA
Pittsburg
McCune
Cherokee
Weir
WAH-SHA-SHE PRAIRIE
West Mineral
Roseland
Scammon
Asbury
Waco
Neck City
Purcell
Alba
Labette
Mound Valley
Altamont
Labette
KANSAS
Jasper
Oronogo
Carl Junction
STONES CORNER ACCESS
CARL JUNCTION ACCESS
Airport Drive
Webb City
Oswego
Cherokee
Columbus
Edna
Bartlett
Chetopa
Galena
Joplin
Duquesne
Shoal Creek Drive
Leawood
WILDCAT ACCESS
WILDCAT GLADE NA
Saginaw
Baxter Springs
Treece
Picher
Cardin
Loma Linda
WALTER WOODS CA
TIP TON FORD ACCESS
Quapaw
MISSOURI
JOPLIN TOWERSITE
Commerce
North Miami
Peoria
Newton
Miami
Welch
Neosho
Dotyville
Ottawa
Seneca
Twin Bridges State Park
Wyandotte
Bluejacket
Narcissa
Craig
GOODMAN TOWERSITE
Fairland
BUFFALO HILLS NA
Goodman
Federal Grassland Reserve
Afton
Anderson
TOWN HOLE ACCESS
Vinita
OKLAHOMA
Copeland
Grand Lake of the Cherokees
Bernice State Park
Bernice
McDonald
COWSKIN ACCESS
Cayuga
Lanagan
LANAGAN TOWERSITE
INDIAN CREEK
Honey Creek State Park
Grove
Dodge
Rogers
Cleora
MOUNT SHIRA ACCESS
Big Cabin
Dennis
Noel
Ketchum
Zena
South West City
Grand Lakee
Cherokee / Disney / Little Blue State Parks
Disney
Langley
Pensacola
ARKANSAS
Adair
Delaware
Strang
Jay Brush Creek
Spavinaw
Spavinaw Lake
Spavinaw State Park
New Eucha
Sycamore
Old Eucha
Spavinaw Game Management Area
Lake Eucha State Park
Hoot Owl
Spavinaw Public Hunting Area
Lake Eucha
Mayes
Tagg Flats
Snowdale State Park
Pryor Creek
Salina
Wickliffe
Bull Hollow
Lake Hudson
Pump Back
Cloud Creek
Colcord
AECI Power Plant
Chouteau 345/161 Substation
Maid Substation
GRDA Coal-Fired Complex
Chouteau
Leach
Kansas
Twin Oaks
Snake Creek
Rocky Ford
Oaks
Flint Creek
West Siloam Springs
Iron Post
Mazie
Murphy
Ballou
Adair

NORTH

0 5.5

Miles

Burns & McDonnell SINCE 1898

Figure 3-1
KAMO
Blackberry to Chouteau
Transmission Line Project
Public Lands

Revised May 7, 2007

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State Park located northeast of the town of Disney, Oklahoma, and Disney/Little Blue State Park located east of the town of Disney. Snowdale Park is located on Lake Hudson, located on the western shore of the lake across from the town of Salina, Oklahoma. Lastly, Lake Eucha State Park is located adjacent to Lake Eucha on the far eastern arm.

The primary roadways in the study area are Interstate Highway 44 and US Highway 69, as mentioned previously. Interstate Highway 44 runs southwest-northeast through the study area from Joplin, Missouri to Tulsa, Oklahoma, both located outside of the study area. US Highway 69 runs though the entire study area and runs predominately north-south from Pittsburg, Kansas located outside of the study area to Chouteau, Oklahoma. The Blackberry Substation would be accessed from Highway 126, which is just north of the substation property. Highway 126 can be accessed from US Highway 69. The Chouteau 345/161-kV Substation can be accessed from Highway 412B, which can be accessed from US Highway 69 via Highway 69A or US Highway 412. Interstate Highway 44 and US Highway 69 provide the main transportation routes in the area. In addition to Interstate Highway 44 and US Highway 69, an extensive network of county roads and highways are present in the area (Figure 3-2). Numerous other paved and unpaved roads provide access throughout the area.

Several rail lines provide service to customers in the local region. The Union Pacific Railroad (UP) runs predominantly north-south through Vinita and Chouteau, providing service to the GRDA Coal-Fired Complex. Two BNSF Railroad (BNSF) rail lines intersect in the study area in the town of Afton, Oklahoma. One of the BNSF rail lines runs north-south through Columbus, Kansas and Miami, Oklahoma. The other BNSF rail line runs east-west through Vinita. In addition, the South Kansas & Oklahoma Railroad runs through the northern portion of the study area.

Several transmission lines occur within the study corridor. The transmission lines are predominantly American Electric Power (AEP) or GRDA transmission lines. Numerous distribution lines are located along area roadways providing electrical service to local residents and commercial and industrial customers.

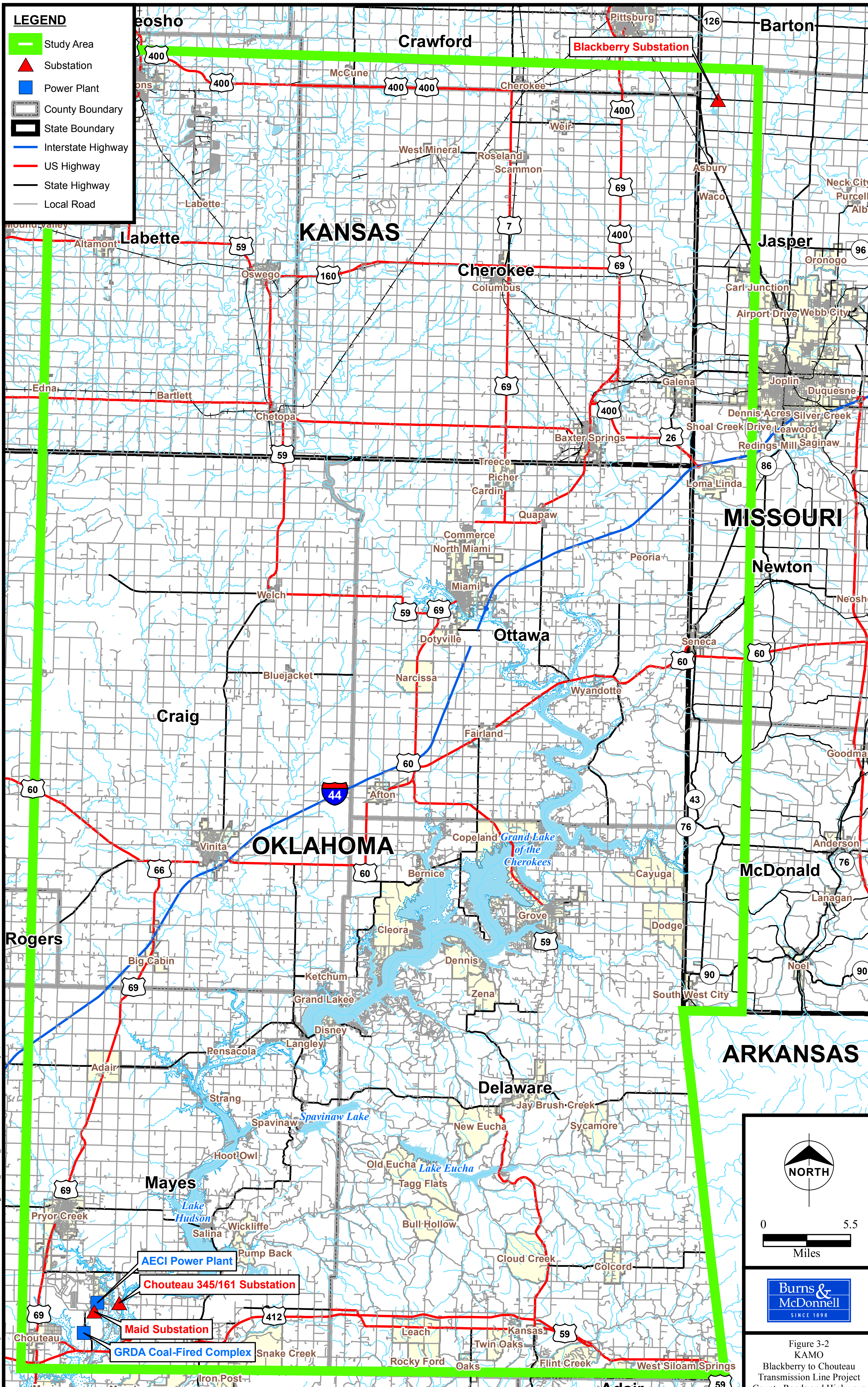
LEGEND
Study Area
Substation
Power Plant
County Boundary
State Boundary
Interstate Highway
US Highway
State Highway
Local Road
Blackberry Substation
AECI Power Plant
Chouteau 345/161 Substation
Maid Substation
GRDA Coal-Fired Complex
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
eosho
Crawford
Barton
Labette
Cherokee
Jasper
Newton
Ottawa
Craig
Rogers
Mayes
Delaware
McDonald
Adair
Pittsburg
McCune
Cherokee
Weir
West Mineral
Roseland
Scammon
Asbury
Waco
Neck City
Purcell
Alba
Labette
Mound Valley
Altamont
Oswego
Columbus
Oronogo
Carl Junction
Airport Drive
Webb City
Edna
Bartlett
Chetopa
Galena
Joplin
Duquesne
Dennis Acres
Silver Creek
Shoal Creek Drive
Leawood
Baxter Springs
Redings Mill
Saginaw
Treece
Picher
Cardin
Loma Linda
Quapaw
Commerce
North Miami
Peoria
Miami
Neosho
Welch
Dotyville
Seneca
Bluejacket
Narcissa
Wyandotte
Fairland
Goodman
Afton
Copeland
Grand Lake of the Cherokees
Vinita
Bernice
Cayuga
Anderson
Lanagan
Grove
Cleora
Dodge
Big Cabin
Dennis
Noel
Ketchum
Zena
Grand Lakee
South West City
Disney
Langley
Pensacola
Adair
Strang
Spavinaw
Spavinaw Lake
Jay Brush Creek
New Eucha
Sycamore
Hoot Owl
Old Eucha
Lake Eucha
Tagg Flats
Pryor Creek
Lake Hudson
Wickliffe
Salina
Bull Hollow
Pump Back
Cloud Creek
Colcord
Chouteau
Leach
Kansas
Snake Creek
Twin Oaks
Rocky Ford
Oaks
Flint Creek
West Siloam Springs
Iron Post
Mazie
Murphy
Ballou
400
126
69
7
59
160
96
26
86
60
44
66
43
76
90
412
NORTH
0
5.5
Miles
Burns & McDonnell
SINCE 1898

Figure 3-2
KAMO
Blackberry to Chouteau
Transmission Line Project
County Roads and Highways

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3.3.2 Natural Resources

The Blackberry to Chouteau study area is located in the Central Lowlands physiographic province. Topography of the area ranges from relatively flat, rolling hills to moderately steep areas around drainage valleys. Drainage flows southerly towards the large man-made lakes in the study area along the Neosho River. A large portion of the study area is drained by the Spring River and the Neosho River. Numerous creeks and rivers occur throughout the area. These drainage ways are predominantly contained within narrow, highly-incised stream channels.

Vegetation throughout the study area forms a mosaic of different community types. These types range from timbered hilly areas to mixed warm and cool season pastures to minor amounts of cultivated cropland. More level areas generally have been cleared for agricultural use, while areas along drainage ways and in more hilly areas are wooded. Wetland communities also occur within the study area but are primarily associated with lakes, drainage ways, and small ponds providing water for livestock.

The abundance and variety of vegetative communities provides habitat for numerous species of wildlife. Wildlife include both game species such as bobwhite quail, dove, cottontail rabbit, fox squirrel, white-tailed deer, eastern wild turkey, furbearers, and waterfowl as well as numerous non-game species including rodents, bats, songbirds, shorebirds, amphibians, and reptiles.

Preliminary investigation identified several federally listed species as potentially occurring in the counties included in the study area. Species such as the American burying beetle may occur in the study area. Others such as the American alligator, red-cockaded woodpecker, interior least tern, and piping plover are not expected due to the lack of suitable habitat in the area. Table 3-4 provides a complete list of the federally listed species potentially occurring in the area.

The study area has a long history of habitation, both by prehistoric Native American groups and Euro-American settlers. In addition to several National Register of Historic Places (NRHP) sites, there are likely many prehistoric archaeological sites occurring throughout the area. There are 32 historic places registered on the NRHP in the study area. Table 3-5 summarizes the types and locations of the historical places in the study area listed on the NRHP.

Table 3-4 Threatened and Endangered Species by County

			Oklahoma				Kansas		Missouri		
Common Name	**Scientific Name**	**Federal Status**	**Ottawa**	**Delaware**	**Craig**	**Mayes**	**Crawford**	**Cherokee**	**Jasper**	**Newton**	**McDonald**
American bittern	*Botaurus lentiginosus*								E		
American burying beetle	*nicrophorus amiercanus*	E						CH			
Arkansas darter	*Etheostoma cragini*	C	C	C	C	C		T	C	C	
Bald eagle	*Haliaeetus leucocephalus*	T		E			CH	T			E
Barn owl	*Tyto alba*								E		
Black-tailed jackrabbit	*Lepus californicus*								E	E	E
Broadhead skink	*Eumeces laticeps*						CH	T			
Butterfly	*Ellipsaria lineolata*							CH			
Cave salamander	*Eurycea lucifuga*							CH			
Common map turtle	*Graptemys geographica*						T	T			
Eastern narrowmouth toad	*Gastrophryne carolinensis*							CH			
Eastern newt	*Notophthalmus viridescens*						T	CH			
Eastern spotted skunk	*Spilogale putorius*						T	T			
Elktoe mussel	*Alasmidonta marginata*							CH			
Ellipse mussel	*Venustaconcha ellipsiformis*							CH			
Eskimo curlew	*Numenius borealis*	E					E	E			

			Oklahoma				Kansas		Missouri		
Common Name	**Scientific Name**	**Federal Status**	**Ottawa**	**Delaware**	**Craig**	**Mayes**	**Crawford**	**Cherokee**	**Jasper**	**Newton**	**McDonald**
Flat floater mussel	*Anodonta suborbiculata*							E			
Flutedshell mussel	*Lasmigona xostata*							CH			
Gray myotis	*Myotis griseascens*	E	E	E			CH	CH	E	E	E
Greater prairie chicken	*Tympanuchus cupido*								E	E	
Green frog	*Rana clamitans*						T	CH			
Grotto salamander	*Typhlotriton spelaeus*							CH			
Least tern	*Sterna antillarum*	E					E	E			
Longtail salamander	*Eurycea longicauda*							CH			
Many-ribbed salamander	*Eurycea multiplicata*							CH			
Neosho madtom	*Noturus placidus*	T	T					CH	E		
Neosho mucket	*Lampsilis rafinesqueana*	C	E	E				CH	C	C	C
Northern harrier	*Circus cyaneus*								E	E	
Oklahoma cave crayfish	*Cabarus tartarus*			E							
Ouachita kidneyshell	*Ptychobranchus occidentalis*	T						CH			
Ozark cavefish	*Amblyopsis rosae*	T	T	T					E	E	
Peregrine falcon	*Falco peregrinus*						E	E			
Piping plover	*Charadrius melodus*	T					T	T			
Rabbitsfoot	*Quadrula cylindrixa*							CH			

			Oklahoma				Kansas		Missouri		
Common Name	**Scientific Name**	**Federal Status**	**Ottawa**	**Delaware**	**Craig**	**Mayes**	**Crawford**	**Cherokee**	**Jasper**	**Newton**	**McDonald**
Redbelly snake	*Storeria occipitomaculata*						CH	CH			
Redfin darter	*Etheostoma whipplei*								E		
Redspot chub	*Nocomis asper*							CH			
Snowy plover	*Charadrius alexandriunus*						T	T			
Spring peeper	*Pseudacris crucifer*						CH	CH			
Western fanshell	*Cyprogenia aberti*							CH			
Western prairie fringed orchid	*Platanthera paraeclara*	T			T						

E – Endangered
T – Threatened
C – Candidate (Federal)
CH – State designated critical habitat (Kansas only)

Table 3-5 National Register of Historic Places by County

	Kansas		Missouri			Oklahoma			
	Crawford	**Cherokee**	**Barton**	**Jasper**	**Newton**	**Ottawa**	**Craig**	**Mayes**	**Delaware**
Building	0	3	0	0	0	8	3	3	2
Roadway	0	0	0	0	0	1	0	0	0
Cemetery	0	0	0	0	0	1	0	0	1
Church	0	0	0	0	0	1	1	0	1
Battlefield	0	0	0	0	0	0	0	1	0
Bridge	0	1	0	0	0	1	0	0	0
Courthouse	0	0	0	0	0	0	1	0	0
Site	0	0	0	0	0	0	0	1	1
Total	**0**	**4**	**0**	**0**	**0**	**12**	**5**	**5**	**5**

3.4 MACRO-CORRIDORS

Following establishment and investigation of the study area for the required transmission line, a more defined area, or macro-corridor, within which specific route alignment alternatives could be developed was identified. This macro-corridor considered the locations of natural and human resources within the study area and the potential opportunities available for the compatible location of a new transmission line. A macro-corridor was established so as to minimize potential environmental impacts to existing natural and human resources and make use of any potential opportunity areas. The macro-corridors identified for further evaluation of alternative routes are discussed below.

In developing the macro-corridors for alternative routes to connect the Blackberry Substation to the Chouteau 345/161-kV Substation and the GRDA Coal-Fired Complex, the primary constraints were:

- Communities located along Interstate Highway 44 and US Highway 69
- Residential development and growth patterns
- Grand Lake of the Cherokees, Spavinaw Lake, Lake Hudson and Lake Eucha
- Superfund areas in the Tri-State Mining District

The Grand Lake of the Cherokees, as well as the smaller lakes of Spavinaw, Hudson, and Eucha, encompass a large portion of the central part of the study area. Locating a line in the central, most direct portion of the study area would likely require a significant lake crossing or crossings; probably require acquisition of state lands; raise permitting concerns with the US Army Corps of Engineers; and pose engineering and construction complexities. Avoiding Grand Lake of the Cherokees, the next most direct route between the Blackberry Substation to the Chouteau 345/161-kV Substation would essentially be the US Highway 69 corridor. However, the communities of Baxter Springs, Kansas and Miami, Vinita, and Big Cabin in Oklahoma limit location of a new transmission line in close proximity to the highway. Therefore, the central portion of the study area, as well as the larger communities along Interstate Highway 44 and US Highway 69, were considered not suitable for inclusion in a macro-corridor.

Several superfund sites are located within the study area (Figure 3-3). These superfund sites are all associated with the Tri-State Mining District and previous lead mining activities in the area. Two of the larger areas, the Galena and Tar Creek sites, extend through the southeastern portion

LEGEND

- Study Area
- Substation
- Power Plant
- County Boundary
- State Boundary
- Super Fund Sites

Blackberry Substation

AECI Power Plant

Chouteau 345/161 Substation

Maid Substation

GRDA Coal-Fired Complex

KANSAS

OKLAHOMA

MISSOURI

ARKANSAS

Crawford

Barton

Jasper

Newton

McDonald

Labette

Cherokee

Craig

Ottawa

Delaware

Mayes

Rogers

Adair

Pittsburg

McCune

Cherokee

Weir

West Mineral

Roseland

Scammon

Asbury

Waco

Neck City

Purcell

Alba

Lawton

Oronogo

Crestline

Carl Junction

Webb City

Airport Drive

Belleville

Stone Creek

Joplin

Galena

Duquesne

Dennis Acres

Silver Creek

Shoal Creek Drive

Leawood

Redings Mill

Saginaw

Loma Linda

Iron Gates & Jasper Co &.Spring City Spurgeon

Peoria

Neosho

Seneca

Wyandotte

Goodman

Anderson

Lanagan

Dodge

Noel

South West City

Zena

Jay Brush Creek

Sycamore

New Eucha

Old Eucha

Lake Eucha

Tagg Flats

Bull Hollow

Cloud Creek

Colcord

Kansas

Twin Oaks

Flint Creek

West Siloam Springs

Leach

Rocky Ford

Oaks

Snake Creek

Iron Post

Mazie

Murphy

Ballou

Chouteau

Pryor Creek

Salina

Wickliffe

Pump Back

Hoot Owl

Spavinaw

Spavinaw Lake

Disney

Langley

Pensacola

Strang

Grand Lakee

Ketchum

Big Cabin

Vinita

Bernice

Copeland

Grand Lake of the Cherokees

Cayuga

Grove

Cleora

Dennis

Afton

Fairland

Bluejacket

Narcissa

Dotyville

Miami

Commerce

North Miami

Quapaw

Tar Creek Superfund Site

Cardin

Picher

Welch

Bartlett

Edna

Chetopa

Oswego

Columbus

Altamont

Mound Valley

Labette

Waco

Lake Hudson

NORTH

0 5.5

Miles

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Figure 3-3
KAMO
Blackberry to Chouteau
Transmission Line Project
Superfund Sites

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of Cherokee County, Kansas between the towns of Galena and Baxter Springs and through the northeastern portion of Ottawa County, Oklahoma around the towns of Picher and Cardin, respectively. These areas are generally undeveloped and not suitable for future development and would therefore lend themselves to construction of new transmission line facilities. Although not excluded from the study area, additional investigation of these areas is needed to determine if development of a transmission line across them would be acceptable or pose potential concerns for hazardous materials and contamination occurring in these areas. Transmission lines located on mine tailing piles or through contaminated lands could create engineering or environmental concerns. Therefore, pending further investigation, these areas may need to be avoided.

While the study area excludes the City of Joplin, Missouri, substantial growth of this community to the west and of the surrounding areas including Galena and Baxter Springs, Kansas, has created substantial residential density from Baxter Springs eastward. This development is a mix of large-lot residences, scattered rural residences, subdivisions, farmsteads, and mobile homes. This development, combined with the road network, terrain issues, streams and wetlands, creates a substantial amount of constraint to the potential location of a new transmission line. Open spaces and areas are available. However, the distribution of residences and other potential constraints make it difficult to develop a route through this area. Any such route would be required to weave its way through the area, resulting in numerous angles and substantial residential, wetland, and woodland impacts. As a result, this portion of the study area was excluded from consideration for the macro-corridor.

As noted above, Grand Lake lies roughly in the center of the study area between the Blackberry and Chouteau substations. As a result, routes extending between these two points could extend around either the north or south sides of the lake without one option resulting in a drastically longer route. However, due to the residential development east of Baxter Springs, any routes extending south from the Blackberry Substation would need to angle to the southeast, around the west side of Baxter Springs, to avoid the town and congestion to the east. Such a routing would take the proposed line several miles to the west, requiring it to then extend several miles back to the east to follow around the south side of Grand Lake. Once south of the lake, the line would again extend west. This back and forth would substantially increase the length of the line, leading to greater associated environmental impacts and project cost. Such a routing would also

be longer by its very nature as a result of generally following two sides of the triangle rather than the shorter, more direct hypotenuse between the substation sites. Additionally, a number of large lakes occur south of Grand Lake and these lakes, as well as associated lake development, create congestion and routing constraints which would likely require numerous angles for a route to weave its way through this area, further increasing project length, environmental impacts, and cost. As a result of these conditions, the area around the south of Grand Lake was eliminated from consideration for the macro-corridor.

One macro-corridor was established for the Blackberry to Chouteau transmission line connection (Figure 3-4). This corridor would extend along the north side of Grand Lake from the Blackberry Substation to the GRDA Coal-Fired Complex. A line east of Cherokee County, Kansas to just west of Vinita, Oklahoma, then south along US Highway 69 forms the western boundary of the macro-corridor. Although only a single macro-corridor was established, it includes a large area that would allow flexibility to avoid specific constraints that may be encountered during the routing process as well as area for the identification of numerous routing options.

Several existing transmission lines occur within the macro-corridor area. These lines are owned by GRDA, and AEP. Several opportunities exist where existing transmission lines could be paralleled for at least part of the distance between the Blackberry and Chouteau substations to minimize new route corridors within the study area. Existing north to south lines in the macro-corridor area include a line from Riverton, Kansas to just west of Ketchum, Oklahoma; a line from west of Pensacola, Oklahoma to Chouteau, Oklahoma; a line from Miami, Oklahoma to Cleora, Oklahoma; and a line from southwest of Grove, Oklahoma to Kansas, Oklahoma. Existing east to west lines in the macro-corridor area include a line from south of Cherokee, Kansas to Spring City, Missouri; a line from Vinita, Oklahoma to Copeland, Oklahoma; a line from northwest of Pensacola, Oklahoma to Sycamore, Oklahoma; and several lines north of Kansas, Oklahoma to Chouteau, Oklahoma.

The macro-corridor established for this project generally avoids the more developed portions of the study area, including Joplin, Missouri and Miami, Oklahoma. Additionally, it avoids Grand Lake of the Cherokees and other large lakes in the area that would be difficult to cross and

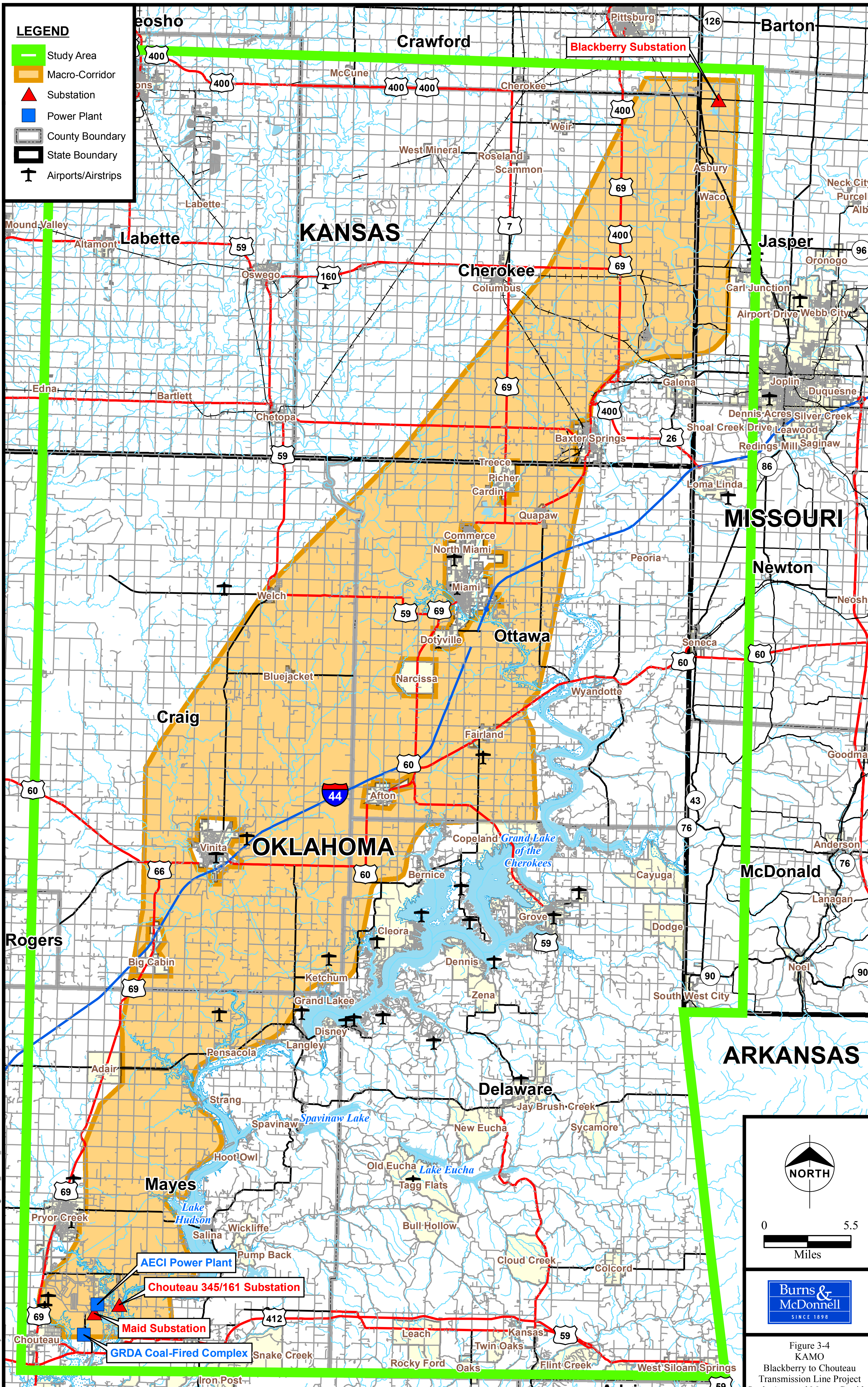

Figure 3-4
KAMO
Blackberry to Chouteau
Transmission Line Project
Study Area and Macro-Corridor

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conflict with lakeside land use and development. The macro-corridor developed provides substantial area within which to develop potential route alternatives, takes advantage of existing area transmission lines and other opportunities, avoids developed areas and communities, while still providing for a relatively direct route between the proposed substation locations. The macro-corridor established allows for potential environmental impacts to be minimized by providing options for avoiding sensitive areas and minimizing the overall length and presence of the project.

3.5 ROUTE CORRIDOR

The objective of the routing analysis was to identify a route corridor from the new Blackberry Substation to the new Chouteau 161/345-kV Substation and the existing GRDA Coal-Fired Complex. Route corridors were developed as narrow corridors, generally approximately 0.5 mile wide, although wider in some areas, within which one or more route alignments for the proposed project could be developed. The preferred route corridor would be one providing reliable electric power while minimizing overall adverse impacts on the human and natural environment in a cost-effective manner. The process to develop initial corridors included several main activities:

- Map review, including United States Geological Service (USGS) topographic maps, United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps, aerial photographs, Soil Conservations Service (SCS) Soil Survey maps, U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) data and Soil Data Mart data, and the Oklahoma Center for Geospatial Information (OCGI) Gap Analysis Program (GAP)

- Contacts with local, state, and federal resource agencies (carried out as part of the RUS scoping process for the overall project environmental impact statement)

- Cursory field reconnaissance of the study area

The purpose of these activities was to identify potential constraints (natural or human resources that conflict with the location of new transmission line facilities) and opportunities (locations or areas well-suited for the location of new transmission line facilities) within the macro-corridor to

consider when developing route corridors. Generally, constraint areas would be avoided, or at least minimized during the route corridor development process, and opportunities would be used, to the extent practicable, to develop route corridors between the two substations and the power plant. Within the backdrop of constraints and opportunities, practical considerations such as total project length and potential cost issues were also considered.

Burns & McDonnell identified a number of preliminary route corridors (Figure 3-5) within the macro-corridor between the new Blackberry Substation, the new Chouteau Substation and the existing GRDA Coal-Fired Complex. In order to provide flexibility within the route corridor for the eventual location of the actual route alignment while keeping the route corridors manageable in size, route corridors approximately 0.5 mile wide were developed. The entire area within the macro-corridor was reviewed to determine if areas suitable for route corridors were present. That is, investigation for the route corridors was not limited only to the central area of the macro-corridor, but the northern, southern, and all areas in between were considered.

Route corridors were developed to avoid constraints, take advantage of opportunities, and use areas of the macro-corridor as appropriate. The preliminary route corridors were developed in similar fashion to the macro-corridor itself. Preliminary route corridors took advantage of existing infrastructure (electrical transmission lines and roadways) to the extent practicable, while avoiding constraints such as the communities of Baxter Springs, Picher, Commerce, Miami, Narcissa, Vinita, Afton, Big Cabin, airfields, and large lakes.

The preliminary route corridors shown in this report are subject to further review and refinement based on field review and agency comments, as well as agency and public scoping meetings. A set of final route corridors will be retained for detailed comparison and evaluation leading to identification of a preferred and recommended route as part of the EA for the project.

LEGEND

- Study Area
- Macro-Corridor
- Route Corridors
- Substation
- Power Plant
- County Boundary
- State Boundary
- Airports/Airstrips

Blackberry Substation

AECI Power Plant

Chouteau 345/161 Substation

Maid Substation

GRDA Coal-Fired Complex

KANSAS

OKLAHOMA

MISSOURI

ARKANSAS

Crawford

Barton

Labette

Cherokee

Jasper

Craig

Ottawa

Newton

McDonald

Rogers

Mayes

Delaware

Adair

Pittsburg

McCune

Weir

West Mineral

Roseland

Scammon

Asbury

Waco

Neck City

Purcell

Alba

Mound Valley

Altamont

Oswego

Columbus

Carl Junction

Oronogo

Airport Drive

Webb City

Edna

Bartlett

Chetopa

Galena

Joplin

Duquesne

Dennis Acres

Silver Creek

Shoal Creek Drive

Leawood

Redings Mill

Saginaw

Baxter Springs

Treece

Picher

Cardin

Loma Linda

Quapaw

Commerce

North Miami

Peoria

Miami

Welch

Dotyville

Seneca

Neosho

Bluejacket

Narcissa

Wyandotte

Fairland

Goodman

Afton

Vinita

Copeland

Grand Lake of the Cherokees

Anderson

Bernice

Cayuga

Lanagan

Cleora

Grove

Dodge

Big Cabin

Dennis

Noel

Ketchum

Zena

South West City

Grand Lakee

Disney

Langley

Pensacola

Strang

Spavinaw

Spavinaw Lake

Jay Brush Creek

New Eucha

Sycamore

Hoot Owl

Old Eucha

Lake Eucha

Tagg Flats

Pryor Creek

Lake Hudson

Salina

Wickliffe

Bull Hollow

Pump Back

Cloud Creek

Colcord

Chouteau

Leach

Kansas

Twin Oaks

Snake Creek

Rocky Ford

Oaks

Flint Creek

West Siloam Springs

Mazie

Murphy

Ballou

Iron Post

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NORTH

0 5.5

Miles

Burns & McDonnell SINCE 1898

Figure 3-5
KAMO
Blackberry to Chouteau
Transmission Line Project
Route Corridors

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