GRAIN BELT EXPRESS CLEAN LINE

MISSOURI

ROUTE SELECTION STUDY

Prepared For Clean Line Energy Partners, LLC

CLEAN LINE ENERGY PARTNERS

Prepared By The Louis Berger Group, Inc.

THE Louis Berger Group, INC.

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Acronyms and Abbreviations

AC	alternating current
A.D.	Anno Domini
B.C.	Before Christ
CRP	Conservation Reserve Program
DC	direct current
FAA	Federal Aviation Administration
GIS	Geographic Information System
Grain Belt Express	Grain Belt Express Clean Line LLC
Grain Belt Project	Grain Belt Express Clean Line Project
HVDC	high voltage direct current
IDNR	Illinois Department of Natural Resources
KCC	Kansas Corporation Commission
KDWPT	Kansas Department of Wildlife, Parks, and Tourism
kV	kilovolt
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MISO	Midcontinent Independent System Operator, Inc.
MONHP	Missouri Natural Heritage Program
MW	megawatt
NASS	National Agricultural Statistics Service
National Register	National Register of Historic Places
NRCS	Natural Resources Conservation Service
Project	Grain Belt Express Clean Line Project
ROW	right-of-way
SHPO	State Historic Preservation Office (Officer)
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WRP	Wetland Reserve Program

Glossary

Alternative Routes—routes assembled from links that were refined after the Open Houses. One Alternative Route is ultimately selected as the Proposed Route.

Conceptual Routes—initial routes developed to consider a range of reasonable alignments in the Study Area. They are the first step in identifying routes based on large-scale opportunities and constraints and are aligned more generally than Potential Routes or Alternative Routes.

constraint—areas that should be avoided to the extent feasible and reasonable during the route selection study process. The constraints were divided into two groups based on the size of the geographic area encompassed by the constraint. The first group includes constraints covering large areas of land in the Study Area. The second group of constraints encompasses other features covering smaller geographic areas or point-specific locations.

general routing guidelines—a set of principles that guide the development of alignments with respect to area land uses, sensitive features, and considerations of economic reasonableness.

link—the section of a Potential Route located between two nodes.

node—a common point of intersection between two or more Potential Routes.

Open House—a public open house meeting in the Missouri study area.

opportunities—areas where the transmission line would have less disruption to area land uses and the natural and cultural environment. Opportunities typically include other linear infrastructure and utility corridors, such as the existing electric and gas transmission network, rail lines, and roads but may also include reclaimed lands or unused portions of industrial or commercial areas.

Potential Routes—Conceptual Routes are refined into Potential Routes as additional information from agency coordination, public outreach, and ongoing route revisions are considered. Potential Routes ultimately become Alternative Routes after further refinement following Open Houses.

Potential Route Network—all Potential Routes and their interconnection points (nodes).

Proposed Route—route identified by the Route Selection Study that is ultimately filed with the Missouri Public Service Commission for construction.

Refined Potential Route Network—as the Potential Route Network is refined, links are modified, removed, or added creating the refined Potential Route Network. The Refined Potential Route Network is then presented to regulators and the public for comment and input.

Roundtables—community leader roundtables.

Routing Team—the multi-disciplinary team that developed the conceptual route network, refined the Potential Routes, analyzed and compared Alternative Routes, and selected the Proposed Route. The Routing Team's experience includes transmission line route

planning and selection, impact assessment for natural resources, land use assessment and planning, cultural resource identification and assessment, impact mitigation, transmission engineering and design, and construction. A list of the Routing Team members, along with a description of their individual role, is in Appendix A.

Study Area—portions of Kansas, Missouri, Illinois, and Indiana. The Study Area includes the converter station locations in Ford County, Kansas; a converter station in eastern Missouri; and a converter station near Sullivan County, Indiana.

technical guidelines—technical limitations for the Routing Team to follow related to the physical limitations, design, right-of-way requirements, or reliability concerns of the Project infrastructure.

Executive Summary

Introduction

Grain Belt Express Clean Line LLC proposes to construct a new high voltage direct current transmission line from Ford County, Kansas, to Sullivan County, Indiana. The high voltage direct current transmission line would be approximately 750 miles long and deliver approximately 3,500 megawatts of low-cost, renewable power to markets in Missouri, Illinois, Indiana, and states farther east.

The HVDC transmission line would connect to the grid at three converter stations to be constructed near 1) Sunflower Electric Cooperative's Spearville Substation in Ford County, Kansas; 2) at a point along the Maywood-Montgomery 345 kilovolt line; and 3) near American Electric Power's Sullivan Substation in Sullivan County, Indiana. Together, the HVDC transmission line, converter stations, and a series of alternating current transmission lines that will collect electricity from generators in Kansas (AC Collector System) comprise the Grain Belt Express Clean Line Project.

Grain Belt Express retained The Louis Berger Group, Inc., in late 2010 to support the siting, public outreach, and regulatory process for the Project. Together, staff from The Louis Berger Group, Inc., and Grain Belt Express conducted a Route Selection Study to identify a Proposed Route for the Grain Belt Express HVDC transmission line in Missouri. The Proposed Route was considered by the Routing Team to be the route that minimizes the overall effect of the transmission line on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements.

Routing Process

The Routing Team employed a route selection process that involved iterative phases of information gathering, outreach, route development, and route review and revision. The assemblage of routes under consideration was referred to with terminology representing each major phase of route development from the earliest Conceptual Routes, to Potential Routes, to Alternative Routes, and ultimately to the selection of the Proposed Route.

Initial route development efforts started with identifying large area constraints and opportunity features across the entire Project Study Area. Using this information, the Routing Team developed a range of Conceptual Routes, which were approximate alignments that focused the early data gathering, field reconnaissance, and public outreach efforts of the Routing Team. During this step, Roundtables were held in portions of the Study Area in each county with Conceptual Routes. The Roundtable meetings were held to gather input from local officials, economic development representatives, and community leaders on area constraints,

opportunities, and Conceptual Route alignments in those areas that provided the most suitable routing options for the Project. Fifty-seven Roundtable meetings were held across the Study Area. Upon completion of these Roundtables, the Routing Team had collected information from more than 740 community leaders in the Study Area. In Missouri, 24 Roundtables were held, with more than 250 participants attending from more than 40 counties.

As the Routing Team continued to collect information, coordinate with regulatory agencies, and gather additional information, the assemblage of Conceptual Routes was narrowed and refined. These refinements ultimately eliminated the Conceptual Routes in the southern and central portions of the Study Area from further consideration due to challenges associated with a range of routing constraints, including: large areas of federal land ownership, large complexes of reservoirs and recreational lakes, dense and interspersed development, and a lack of suitable crossings of the Mississippi River.

The remaining routes in the northern portion of the Study Area were considered Potential Routes and extended northeast from Ford County, Kansas; crossed the Missouri River between Kansas City and the Nebraska state line; crossed the Mississippi River north of St. Louis; and continued to the Sullivan Substation remaining south of Springfield, Illinois. The Potential Routes were further refined and presented to state and local agency officials and the general public at a series of Open House meetings. At the Open Houses, the Routing Team provided information about the Project and collected feedback to help further refine the Potential Routes. More than 1,200 people attended the 13 Open House meetings in Missouri.

Following the Open Houses, the Routing Team assembled and reviewed the input gathered during and after the meetings, revised the Potential Route Network where necessary, and reviewed the potential Mississippi River crossing locations. Several potential river crossing locations were presented at the Open House meetings and reviewed with state and federal regulatory agencies. Once the preferred Mississippi River crossing location was determined, Alternative Routes were developed for analysis and comparison across Missouri. The Routing Team divided the Alternative Routes into two distinct segments that had common beginning and end points: Segment 1 (A through C) and Segment 2 (D through I). Alternative Routes in each segment were compared against one another, and the most suitable route from each segment was selected for compilation of the Proposed Route.

Alternatives Analysis and Selection of the Proposed Route

The Alternative Routes (Alternative Routes A through I) were assessed and compared with respect to their potential impacts on natural resources (water resources, wildlife and habitats, special status species, and geology and soils), human uses (agricultural use, populated areas and community facilities, recreational and aesthetic resources, and cultural resources), and any

noted engineering or construction challenges (transportation, existing utility corridors, and other existing infrastructure).

From that analysis, the Routing Team recommended a combination of Alternative Routes B and D as the Proposed Route for the Project. This combination of Alternative Routes met the overall goal of minimizing impacts on the natural and human environment along the route, while best utilizing existing linear rights-of-way and avoiding non-standard design requirements.

Alternative Route B was selected as the Proposed Route in Segment 1. The route follows the existing Rockies Express/Keystone gas pipelines, an existing transmission line, and section/parcel boundaries for 36 percent of its total length. In addition, no residences are located within 250 feet of the Alternative Route B, and it avoids the residential congestion located along the gas pipeline further east and north of the town of Agency. Alternative Route B had the least amount of potential impact to forested areas, which also results in the least potential impact to Indiana bat and northern long-eared bat summer roosting habitat. Alternative Route B also reduces the fragmentation of area land use, by locating the line adjacent to the existing utility infrastructure.

Alternative Route D was selected in Segment 2. It follows the Rockies Express/Keystone pipelines, existing transmission lines, and section parcel boundaries for approximately 57 percent of its total length. Alternative Route D has the least number of residences within 250 and 500 feet. Alternative Route D is also located approximately 5 miles south of the Swan Lake National Wildlife Refuge, which is an important area for migratory birds. In addition, the area around Swan Lake National Wildlife Refuge has large complexes of wetlands, some of which are protected under the Natural Resource Conservation Service's Wetland Reserve Program. Considering Alternative Route D parallels existing linear infrastructure for a significant portion of the total length, new fragmentation in forested areas would be minimized. Furthermore, Alternative Route D also has the fewest acres of forested habitat within the right-of-way, which results in the least potential impact to the Indiana bat and northern long-eared bat habitat.

The combination of Alternative Routes B and D comprise a Proposed Route for the Project that is reasonable and sound because: 1) the selection of the Proposed Route integrated input from government agencies, local officials, and the general public into the route development, analysis, and selection process; and 2) the Proposed Route best minimizes the overall effect of the Grain Belt Express transmission line on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements.

1. Introduction

1.1 Project Overview

Grain Belt Express Clean Line LLC (Grain Belt Express) proposes to construct a new high voltage direct current (HVDC) transmission line from Ford County, Kansas, to Sullivan County, Indiana. The HVDC line would be approximately 750 miles long and deliver approximately 3,500 megawatts (MW) of low-cost, renewable power to markets in Missouri, Illinois, Indiana, and states farther east. HVDC is the ideal technology for transferring a large amount of power over long distances for several reasons, including electrical reliability and land use efficiency.

The HVDC transmission line would connect to the grid at three distinct locations. The proposed converter stations would be constructed near 1) Sunflower Electric Cooperative's Spearville Substation in Ford County, Kansas; 2) near Ameren Missouri's Maywood-Montgomery 345 kilovolt (kV) line in Ralls County, Missouri; and 3) near American Electric Power's Sullivan Substation in Sullivan County, Indiana. The converter station in Ford County, Kansas, would convert the alternating current (AC) electricity from new wind generators in the local area to direct current (DC) electricity for delivery by the HVDC line. The proposed converter stations near the Missouri/Illinois border and near the Sullivan Substation in Indiana would convert DC electricity to AC electricity for delivery to the local AC electric grid.

Together, the HVDC transmission line, converter stations, and a series of AC transmission lines that would collect electricity from generators in Kansas (AC Collector System) comprise the Grain Belt Express Clean Line Project (Grain Belt Project or Project) (**Figure 1-1**). The primary focus of this study will be on the siting effort associated with the HVDC transmission line.

Figure 1-1. Project Overview Diagram

1.2 Overview of the Regulatory Process

Grain Belt Express is seeking approval to own, construct, and operate the HVDC transmission line in each state crossed by the Project, including Kansas, Missouri, Illinois, and Indiana. Regulatory approval has been secured in Kansas and Indiana. Regulatory proceedings associated with the approval of the Project are being hosted independently by each state utility commission per specific regulatory requirements in that state. Approval from the Illinois Commerce Commission will be requested following the filing with the Missouri Public Service Commission. Once approvals for the Project are received from each state, site-specific permitting and consultation efforts concerning wetlands, cultural resources, highway crossings, and others will be initiated with the appropriate state and federal agencies.

In Missouri, the regulatory process for approval to construct the Project will require submitting an application for a transmission line Certificate of Convenience and Necessity. The application will include a description of the Proposed Route in Missouri; the location of the intermediate converter station in Ralls County, Missouri. The buffer area will allow for micro-siting efforts during engineering and landowner negotiations. The buffer around the Proposed Route is narrower in some locations due to land use constraints, such as an incorporated town, state park, or federal land, which makes that area less suitable for a transmission line. This study will be presented as part of the Certificate of Convenience and Necessity application process for the HVDC portion of the Grain Belt Express Project in Missouri.

1.3 Project Timeline and Routing Process Overview

Grain Belt Express began formal development of the Project in July 2010. Soon after, Grain Belt Express contracted with The Louis Berger Group, Inc., to support the siting, public outreach, and regulatory process for the Project. Staff from The Louis Berger Group, Inc., and Grain Belt Express (the Routing Team) began compiling information about the Study Area by coordinating with various regulatory agencies and identifying Conceptual Routes (see Section 2.2 for a description of route development) for the Project.

In spring 2011, the Routing Team began hosting a series of community leader roundtables (Roundtables) (see Section 3.3.1) in southern Missouri and Kansas to gather information regarding local area constraints, regulatory concerns, and development plans from county officials, mayors, economic development coordinators, regional planners, environmental organization leaders, and federal and state agency officials. Throughout the summer of 2011, the Routing Team continued to consider routing concepts, coordinate with agencies, and review possible routing options in the field between the western converter station proposed near Spearville, Kansas, and an eastern delivery point to be located near the St. Francois Substation in Missouri.

In July 2011, the Midcontinent Independent System Operator, Inc. (MISO)[1] provided Grain Belt Express with preliminary Systems Planning Analysis results from the interconnection studies of the Project. The results showed that the upgrades necessary to deliver 3,500 MW to the St. Francois Substation in Missouri would make the Project economically infeasible. The results of this analysis required Grain Belt Express to identify an additional connection point on the electric grid that could accept a large portion of power delivered by the Project, in addition to maintaining a delivery point in Missouri and MISO. After identifying the Sullivan Substation near the Illinois/Indiana border as a logical and suitable location for the Project's final delivery point, Grain Belt Express initiated a feasibility study in August 2011 with PJM Interconnection, Inc.

In fall 2011, the Routing Team expanded the Study Area to account for the change in the Project's eastern delivery point and began to develop Conceptual Routes for the newly reconfigured Project. Under the new configuration, the eastern endpoint was shifted 85 miles north, allowing for possible routes north of Kansas City and St. Louis, in addition to potential routing options in southern Kansas and Missouri. The expanded Study Area also included a new range of reasonable interconnection points for the intermediate converter station in Missouri (see Section 5.3).

During winter 2011, the Routing Team developed a range of Conceptual Routes in the Study Area for the reconfigured Project. By spring 2012, the Routing Team began a series of Roundtable meetings in locations along the northern portion of the Study Area in Kansas, Missouri, and Illinois, and in southern Illinois, gathering information to add to the information previously gathered across southern Kansas and Missouri to reach St. Francois. Fifty-seven Roundtable meetings were held across the Study Area. By the time these Roundtables were completed, the Routing Team had collected information from more than 740 community leaders in the Study Area. In Missouri alone, representatives from more than 40 counties, totaling more than 250 participants, attended 24 Roundtables.

During summer and fall 2012, the Routing Team continued to coordinate with state and federal regulatory agencies concerning key constraint areas, routing opportunity features, and potential suitable crossing locations of the Missouri, Mississippi, and Illinois rivers. The Routing Team continued to review and refine the network of Conceptual Route alignments, and by fall 2012, it had eliminated the southern and central Conceptual Routes to focus analysis and Potential Route development efforts on the northern portion of the Study Area. The refined Study Area encompasses the area around Spearville, Kansas; north of the Flint Hills and Kansas City and south of the Nebraska state line; east toward the Mississippi River between St. Louis, Missouri, and Quincy, Illinois; and then east across Illinois (on a general trajectory south of Springfield) toward the Sullivan Substation in Indiana, south of Terre Haute. Numerous conceptual routes

[1] Formerly the Midwest Independent Transmission System Operator, Inc.

were formed across the Study Area and multiple Missouri and Mississippi river crossing locations were evaluated to determine reasonable alignments across the rivers into Missouri and Illinois.

In summer 2013, the proposed route in Kansas was selected. The Proposed Route crossed the Missouri river and entered Missouri south of St. Joseph along the Rockies Express/Keystone Pipeline corridor. This location became the official starting point of the otential Routes under evaluation in Missouri.

The Routing Team planned and hosted 12 Open House meetings (see Section 3.3.2) throughout the northern portion of the Study Area in Missouri to present Potential Routes to local landowners and the general public in late summer 2013. An additional Open House was also held in December, southeast of Moberly, to inform the public and receive feedback on a Potential Route that was added to the network. More than 1,200 members of the public attended the Open Houses in Missouri; the attendees were asked to provide comments on the Project and the Potential Routes.

During summer and fall 2013, the Routing Team reviewed and replied to hundreds of public comments from the Open Houses in Missouri and comments submitted online, by mail, or by telephone. The Routing Team reviewed input from the public and considered specific sensitive features and areas of concern, resulting in further refinement of the Potential Routes for the Project. Grain Belt Express continued coordination with state and federal regulatory agencies and non-governmental groups associated with historic and natural resources during this period.

By late fall 2013, the Routing Team had refined the assemblage of Potential Route alignments and identified Alternative Routes from the Missouri River to the Mississippi River. The Routing Team continued to coordinate with and update state and federal regulatory agencies to determine a preferred Mississippi River crossing location. Next, a preferred river crossing was identified, and Alternative Routes were assembled from the Potential Route Network. After analyzing and comparing the Alternative Routes, a Proposed Route through Missouri was selected. This report presents the process, activities, analysis, and decision rationale for selection of the Proposed Route.

1.4 Project Description

1.4.1 Line Characteristics

The Grain Belt Express Project would be constructed as ±600 kV HVDC transmission line that would be capable of delivering 500 MW of power to the intermediate converter station in Missouri and 3,500 MW of power to the Sullivan Substation. The HVDC transmission line facility consists of the primary conductors that carry the electricity, metallic return conductors,

shield wires that protect the line from lightning strikes, structures that support the conductors and wires, and foundations that support the structures.

Up to eight primary conductors would be arranged in two bundles of three or four conductors, representing the positive and negative poles of the HVDC line. Each conductor would be roughly 1.5 inches in diameter and composed of aluminum wire strands surrounding inner strands of steel. Each conductor bundle would be suspended at the structures by insulators arranged in either a "V-string" or "I-string" configuration. The metallic return conductors would be located above the pole conductors and would be supported at the structures by insulators rated to approximately 90 kV. At the top of the structures would be two shield wires. One or both of these shield wires may be optical ground wires that provide both lightning protection and fiber optics for communications involved in the control and protection of the line and converter stations.

Grain Belt Express is proposing the use of steel lattice, lattice mast, and/or steel monopole transmission structures for the majority of the Project. In some instances guyed lattice structures may be used. Grain Belt Express may use all three structure types for the Project, based on conditions at specific locations or in particular segments of the line.

Figure1-2 presents schematics of the three typical structure types showing standard dimension ranges. These ranges are approximate and subject to final engineering.

1.4.2 Right-of-Way Characteristics

The HVDC portion of the Grain Belt Express Project would be constructed within a 150- to 200-foot-wide right-of-way (ROW), which would be primarily composed of easements across private land. The ROW would be cleared to its full width of tall growing vegetation (taller than 10 feet) or as necessary for the safe and reliable operation of the transmission line. Farming and grazing land uses are typically compatible and can continue under the transmission line. Only the area at the base of each structure would be removed from existing land use (roughly 0.018 acre for a typical lattice structure or 0.0009 acre for a typical monopole or steel lattice mast structure).

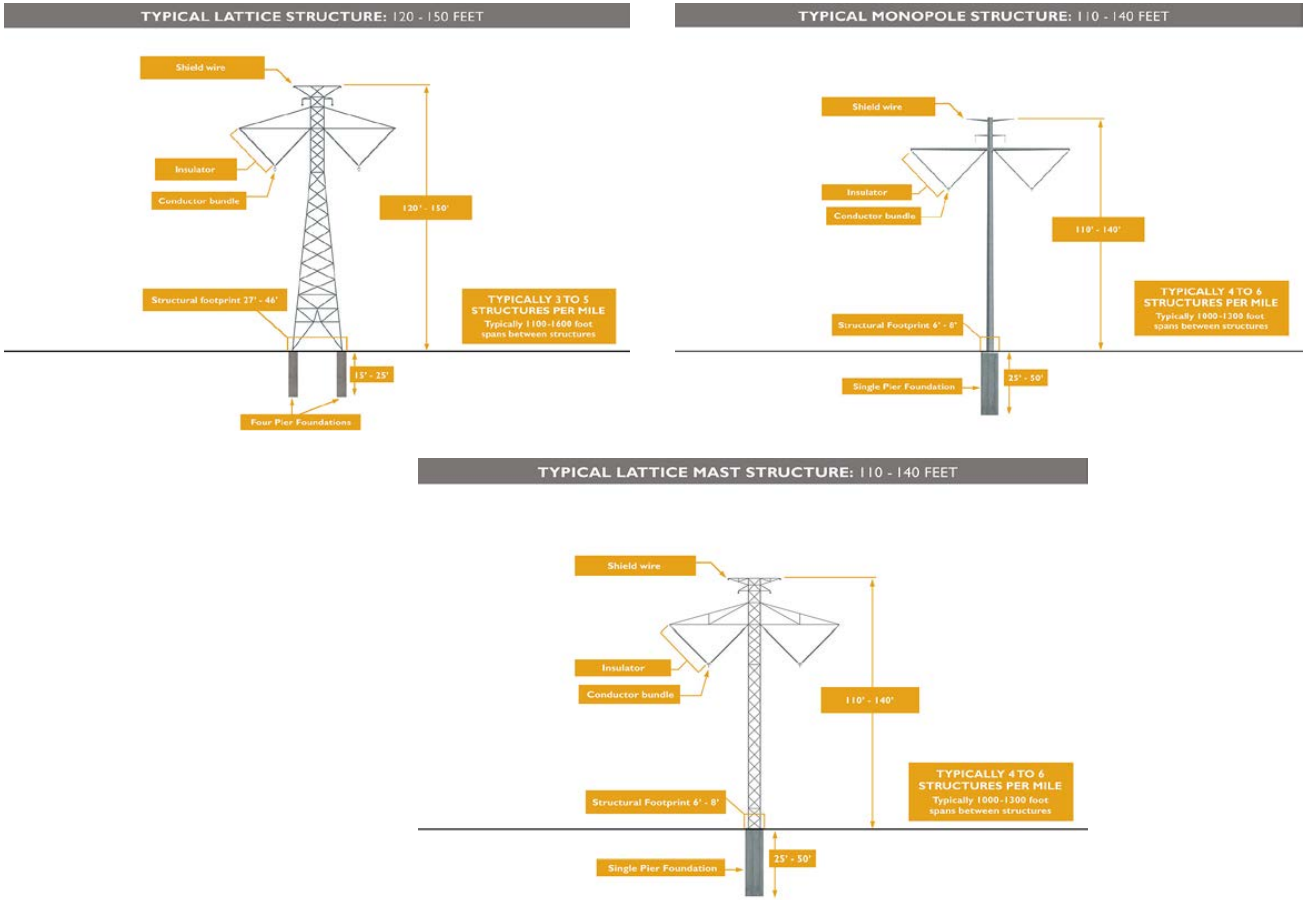


Figure 1-2. Typical Structure Types

1.4.3 Converter Stations

As mentioned previously, three HVDC converter stations are components of the Grain Belt Express Project. A converter station at the western end, where the wind energy is generated in Kansas, would convert power from AC to DC. The other two converter stations would invert power from DC into AC for delivery to customers through the existing AC electric grid. The Grain Belt Express Project would deliver power to the AC grid in two locations, one in Missouri and one near the Illinois/Indiana border, to serve consumers in the MISO and PJM Interconnection, Inc., markets, respectively.

The intermediate converter station would be located near the intersection of the existing Ameren Missouri's Maywood-Montgomery 345 kV transmission line and the Proposed Route in Ralls County, Missouri. A converter station for an HVDC transmission line looks similar to a typical large electric substation; however, there is also a building that contains the converter power electronics in an enclosed environment. Each converter station would require roughly 40 to 60 fenced-in acres and be located near its point of interconnection to the AC grid. Section 5.3 discusses the potential sites for the intermediate converter station in Missouri.

1.4.4 Project Vicinity

The Project would be constructed between Ford County, Kansas, and Sullivan County, Indiana (**Figure 1-3**). Land use in the area is dominated by a combination of rural agricultural land uses (active farm and ranch lands) in the west and along the north with a progressive transition to more heavily forested landscapes farther east and south in Missouri and Illinois. Four major rivers, the Arkansas, Missouri, Mississippi, and Illinois, cross the area and provide water for agricultural lands.

Major cities from west to east include Dodge City, Wichita, and Topeka, Kansas; St. Joseph, Kansas City, Springfield, Columbia, Jefferson City, and St. Louis, Missouri; and Quincy, Springfield, and Belleville, Illinois. Kansas City and St. Louis are by far the largest cities in the Study Area; together, they are home to nearly a million residents in the cities proper with estimates up to five million when combining the populations of both metro areas.

Major large land area attractions and recreational resources include the Flint Hills (Tall Grass Heartland); the Mark Twain and Shawnee National Forests; Mark Twain Lake; the general region of the Ozarks within which the forests lie; and a widely distributed array of federally and state-managed reservoirs that provide outdoor recreation, flood protection, and water sources.

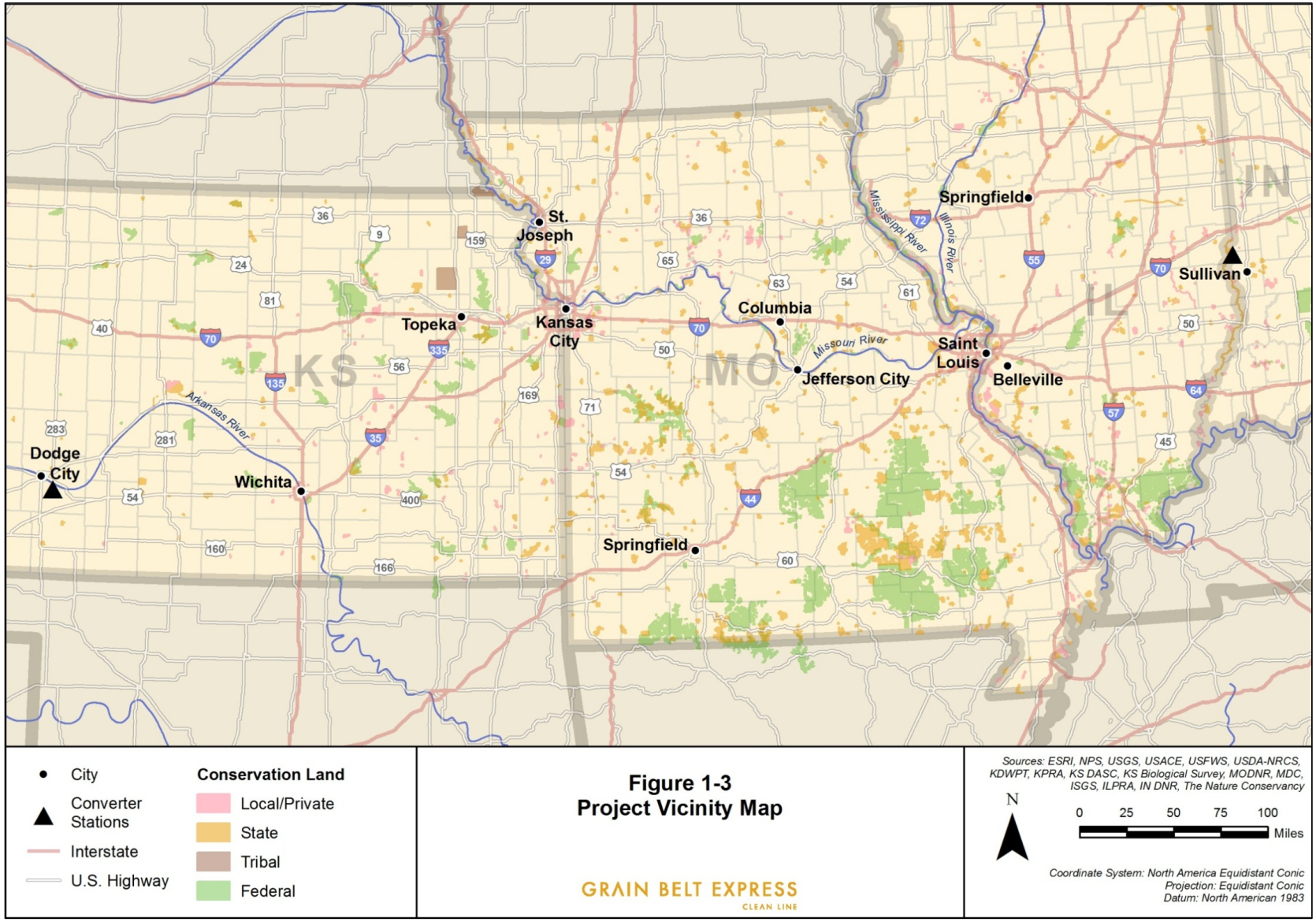


Figure 1-3
Project Vicinity Map

GRAIN BELT EXPRESS
CLEAN LINE

2. Routing Process

2.1 Goal of the Route Selection Study

The route selection study was conducted to identify the route for the Grain Belt Express Project transmission line. The overall goal of this Route Selection Study is to gain an understanding of the opportunities and constraints in the Study Area, develop feasible Alternative Routes, evaluate potential impacts, and identify a Proposed Route for the Project. The Proposed Route is defined as the route that minimizes the overall effect of the transmission line on the natural and human environment, avoids unreasonable and circuitous routes and unreasonable costs, and minimizes special design requirements.

This document describes the route selection methodology, public and agency outreach processes, and the Proposed Route identification process for the Missouri portion of the Grain Belt Express Project that extends from the Missouri River to the Mississippi River.

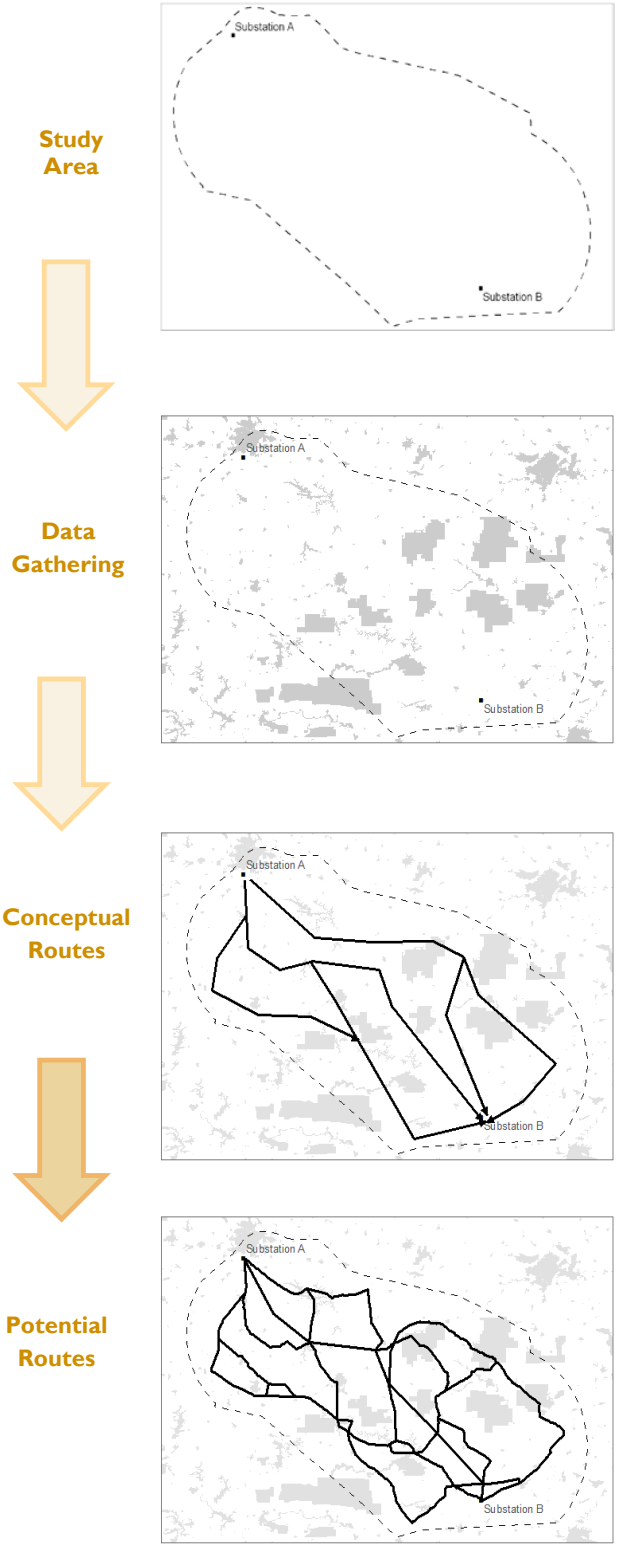
2.2 Process Steps and Terminology

The route development process is inherently iterative with frequent additions or deletions of line segments and revisions to existing alignments as new constraints, opportunities, and inputs are received. Because of the evolutionary nature of the route development process, the Routing Team uses specific vocabulary to describe the routes at different stages of development.

Initial route development efforts start with identifying large area constraints and opportunity features within the **Study Area**, which encompasses the endpoints of the project and areas in between. These areas are typically identified using a combination of readily available public data sources.

The Routing Team uses this information to develop **Conceptual Routes** adhering to a series of general routing and technical guidelines (see Section 2.4). Efforts are made to develop Conceptual Routes throughout the Study Area to ensure that all reasonable alignments are considered. Alignments are approximate at this stage, but are revised after ongoing review and analysis and with input from the public, regulators, and stakeholders. During this step, Roundtables are held in each county with a Conceptual Route to gain more information about the Study Area.

As the Routing Team continues to collect information, coordinate with regulatory agencies, and gather additional site-specific information, Conceptual Routes are refined. The revised Conceptual Routes are considered **Potential Routes**.



Where two or more Potential Routes intersect, a **node** is created, and between two nodes, a **link** is formed. Together, the Potential Routes and their interconnected links are referred to as the **Potential Route Network**. The links are numbered for identification, and evaluated independently and collectively for refinements.

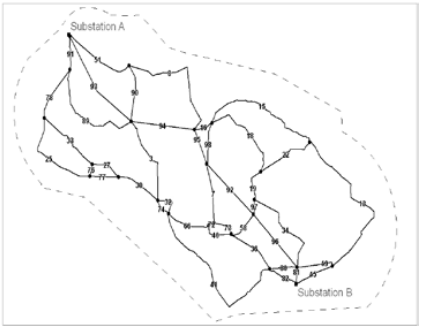
As the Routing Team continues to gather information and review the links of the Potential Route Network, links are modified, removed, or added. After an iterative process, a **Refined Potential Route Network** is presented to regulators and the public at Open Houses. Attendees provide input on Potential Route links and additional site-specific information for the Routing Team to consider.

After public input is incorporated, the links of the Potential Route Network are further refined and compared and a selection of the most suitable links is assembled into **Alternative Routes**.

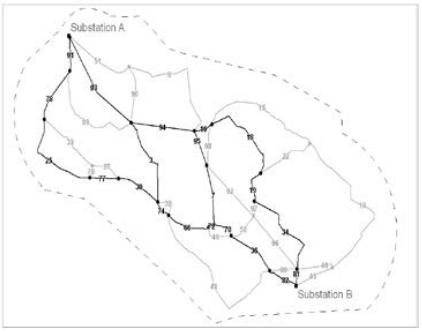
Alternative Routes are routes that begin and end at similar locations for direct comparison. Potential impacts are assessed and compared with land uses, natural and cultural resources, and engineering and construction concerns.

Ultimately, through analysis and comparison of the Alternative Routes, a **Proposed Route** is identified. The Proposed Route minimizes the effect of the Project on the natural and human environment, while avoiding circuitous routes, extreme costs, and non-standard design requirements.

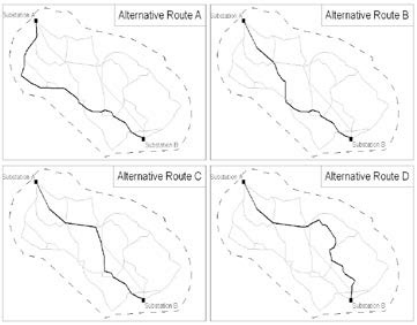
Potential Route Network



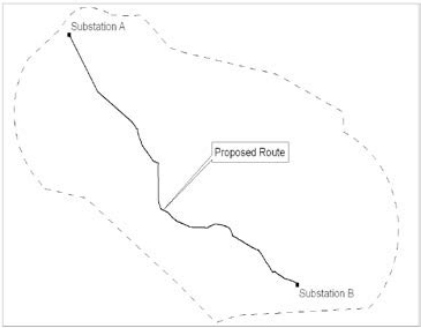
Refined Potential Route Network



Alternative Routes



Proposed Route



*Please note the above graphics are for illustration purposes only and do not reflect actual routes.

2.3 Routing Team Members

A multidisciplinary Routing Team performed the Route Selection Study. Members of the Routing Team have experience in transmission line route planning and selection, impact assessment for natural resources, land use assessment and planning, cultural resource identification and assessment, impact mitigation, transmission engineering and design, and construction. The team's objective is to identify a route that would provide a reasonable balance between impacts on local communities and the natural environment, while applying appropriate routing and technical guidelines, as addressed in detail below. **Appendix A** lists the Routing Team members and their respective areas of responsibility.

The team worked together during the route selection study to:

- Define the Study Area
- Develop routing guidelines
- Collect and analyze environmental and design data
- Identify routing constraints and opportunities
- Consult with resource and permitting agencies
- Develop and revise the route alternatives
- Analyze and report on the selection of a Proposed Route

2.4 Routing Guidelines

As described above, the overall goal of the Route Selection Study is to identify a Proposed Route that minimizes the overall effect of the transmission line on the natural and human environment, avoids unreasonable and circuitous routes and unreasonable costs, and minimizes special design requirements. Routing guidelines help the Routing Team reach that goal by setting forth general principles that guide the development of alignments considered in the study.

The Routing Team considered two types of Routing Guidelines: General Guidelines and Technical Guidelines. General Guidelines establish a set of principles that guide the development of alignments with respect to area land uses, sensitive features, and considerations of economic reasonableness. Technical Guidelines provide the Routing Team with technical limitations related to the physical limitations, design, ROW requirements, or reliability concerns of the Project infrastructure.

2.4.1 General Guidelines

The following are General Guidelines used for the Grain Belt Express Project:

a. Minimize route length, circuity, cost, and special design requirements

b. Maximize the separation distance from and/or minimize impacts on residences

c. Maximize the separation distance from and/or minimize impacts on schools, hospitals, and other community facilities

d. Minimize the removal of existing barns, garages, commercial buildings, and other nonresidential structures

e. Minimize impacts on agricultural use, including the operation of irrigation infrastructure, where possible

f. Avoid crossing cemeteries or known burial places

g. Minimize crossing designated public resource lands, such as national and state forests and parks, large camps and other recreational lands, designated battlefields or other designated historic resources and sites, and state designated wildlife management areas

h. Minimize crossing large lakes, major rivers, and large wetland complexes

i. Minimize impacts on critical habitat, protected species, and other identified sensitive natural resources

j. Minimize substantial visual impacts on residential areas and public resources

2.4.2 Technical Guidelines

The following are Technical Guidelines used for the Grain Belt Express Project:

a. Minimize the crossing of 345 kV and 500 kV transmission lines

b. Minimize paralleling corridors with more than one existing 345 kV or above circuit

c. Maintain 200 feet of centerline-to-centerline separation when paralleling existing transmission lines of 345 kV or above

d. Maintain 150 feet of centerline-to-centerline separation when paralleling 138 kV or lower voltage transmission lines

e. Minimize turning angles in the transmission line greater than 45 degrees

f. Minimize placing structures on sloping soils more than 30 degrees (20 degrees at angle points)

g. Avoid underbuild arrangements with existing AC infrastructure

h. Maintain a safe operational distance from existing wind turbines

2.5 Data Collection

The following sources of information were used to support the analysis in the Route Selection Study.

2.5.1 Digital Aerial Photography

Aerial photography is an important tool for route selection. The primary sources of aerial imagery used in the route identification, analysis, and selection effort for the Project include the National Agricultural Imagery Program's:

- 2010 color aerial photography and
- 2012 color aerial photography

Aerial photography from these sources was viewed using Geographic Information System (GIS) software (ArcMap v10.1). Updated information, such as the location of residences and other constraints, was annotated to the photography by using either paper maps (at the public meetings) and transferred into the GIS, or digitizing the data directly into the GIS during field inspections.

2.5.2 GIS Data Sources

The study made extensive use of information from existing GIS data sets from many sources, including federal, state, and local governments (**Appendix B**). Much of this information was obtained from official agency GIS data access websites and government agencies. The Routing Team digitized information from paper-based maps, completed aerial photo interpretation, conducted interviews with stakeholders, and completed field reconnaissance.

2.5.3 Route Reconnaissance

Routing Team members examined Potential Routes by automobile from points of public access and correlated observed features to information identified on aerial photography, U.S. Geological Survey 7.5 minute topographic maps in digital format, road maps, and the range of GIS sources. Prior to field reconnaissance, some key features, such as residences, outbuildings, recognized places of worship, cemeteries, and commercial and industrial areas, were identified and mapped in GIS using aerial photography. Residences were categorized as either occupied or unoccupied. In instances where it was unclear whether or not a residence was occupied, it was assumed to be occupied. These features were then verified and added to the GIS database using laptops running GIS software supported by real-time Global Positioning System during field reconnaissance efforts.

In addition to automobile reconnaissance, the Routing Team also conducted a helicopter review to examine the Proposed Route from the air to determine the presence or absence of features not visible from the ground-based reconnaissance efforts.

2.6 Routing Constraints

The Routing Team identified and mapped routing constraints in the Study Area. These constraints were defined as areas that should be avoided to the extent feasible during the route selection study process. The constraints were divided into two groups based on the size of the geographic area encompassed by the constraint. The first group included constraints covering large areas of land in the Study Area. The Routing Team considered large-area constraints as unfavorable or incompatible for developing routes and avoided those areas to the extent possible.

The constraint list was revised as the Routing Team developed greater familiarity with the Study Area and gathered additional data through agency and public meetings. The list of large-area constraints consists of:

a. Urban areas, including cities, towns, villages, and other built-up areas
b. Federal lands, including national forests, national parks, national wildlife areas, lands administered by the U.S. Army Corps of Engineers (USACE) for flood control, and military facilities
c. State forest and park lands and wildlife management areas
d. Conservation lands and lands designated for their natural importance or scenic value
e. Native American reservation lands
f. Areas near airports and airstrips
g. National Register of Historic Places (National Register) Historic Districts and adjacent areas
h. Large recreational sites
i. Large lakes and reservoirs that could not be spanned with the structures set well back from the shores
j. Large wetlands or wetland complexes

The second group of constraints encompasses other features covering smaller geographic areas or point-specific locations. As noted previously, Conceptual Routes were developed to avoid large-area constraints. The alignments were then refined to create Potential Routes that avoided, to the extent possible and practical, point-specific constraints, including but not limited to:

a. Individual occupied[2] residences (including houses, permanently established mobile homes, and multi-family buildings)
b. Commercial and industrial buildings
c. Oil and gas wells and their associated storage tanks and pumping facilities
d. Irrigation facilities
e. Recorded and designated historic buildings and sites, including any specified buffer zone around each site
f. Recorded sites of designated threatened, endangered, and other rare species or unique natural areas and the specified buffer zone around each site
g. Small wetlands or playas
h. Developed recreational sites or facilities
i. Communication towers
j. Wind turbines
k. Designated scenic vista points

2.7 Routing Opportunities

Routing opportunities were identified by the Routing Team as locations where the proposed transmission line might be located with less disruption to surrounding land uses and the natural and cultural environment. Opportunity features typically included other linear infrastructure and utility corridors, such as the existing electric and gas transmission networks, rail lines, and roads, but may also include reclaimed lands or unused portions of industrial or commercial areas.

Existing transmission lines were considered an opportunity if they were aligned in a suitable direction. Paralleling existing transmission lines is a common practice used when routing new transmission lines and is supported by many state utility commissions, state and federal regulatory agencies, and the Federal Energy Regulatory Commission (FERC 1970). Paralleling existing linear utilities consolidates utility corridors, logically placing a new land use feature in close alignment with an existing similar land use feature, thereby avoiding the fragmentation of existing land uses and habitats through an area. In addition, paralleling existing transmission lines can reduce the overall impact of the new transmission line on visually sensitive areas (e.g., historic sites and outdoor recreational areas), avian resources, and airfield flight zones, since any impacts of the new line are considered with respect to the impacts of the existing line. In

[2] See Section 2.5.3, *Route Reconnaissance*.

these areas, the impacts of the new line are considered incremental to the existing impacts, rather than completely new impacts in otherwise unimpacted areas.

Major pipelines were also considered an opportunity feature, especially in areas where existing transmission lines were not available and in forested areas where the pipeline has an established and cleared ROW. Like transmission lines, pipeline ROWs are cleared linear corridors of existing disturbance, where construction of buildings and other non-pipeline facilities are prohibited. Paralleling these features consolidates linear ROWs with similar construction and use limitations, thereby avoiding the fragmentation of land uses through an area.

Roads are typically considered as a logical linear opportunity for planning transmission lines and are commonly paralleled by lower voltage transmission and distribution lines. However, for higher voltage lines with larger structures and longer spans, alignments along roads often conflict with the residential and commercial development.

Rail lines present a similar type of opportunity feature; one that can be limited by adjacent development. Communities and industrial facilities (including grain elevators) are often located along rail lines, making it difficult to parallel them for any significant distance. However, when feasible, both roads and rail lines were considered.

In addition to existing linear infrastructure, the grid-based section lines of the public land survey system and the parcel boundaries that further dissect each section (referred to as section/parcel boundaries) also served to guide the development of alignments along logical divisions of ownership. The Routing Team aligned routes along section/parcel boundaries in the absence of, or as an alternative to, parallel alignments along existing linear infrastructure if existing land use would be more impacted by the Project otherwise. This was most relevant in farmed areas, where farming operations extend to the edge of the property boundary.

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3. Agency and Public Outreach

3.1 Regulatory Agency Coordination

The Routing Team contacted numerous federal, state, and local agencies to gather information for the route planning process. Coordination efforts focused on introductions to the Project, data gathering, and discussions concerning likely permitting and consultation requirements. Discussions were also held with Missouri Department of Conservation (MDC), Missouri Department of Natural Resources (MDNR), Missouri State Historic Preservation Office (SHPO), U.S. Fish and Wildlife Service (USFWS), Illinois Department of Natural Resources (IDNR), and USACE regarding the crossing location of the Mississippi River. The agencies were asked to review the potential river crossing locations and identify any information that would be helpful in selecting a preferred crossing. The outcome of these discussions helped to select the final crossing location and is discussed in Section 4.3.

The agencies consulted are provided in the list below. Copies of correspondence with federal and state agencies are provided in **Appendix C**.

Federal Agency and Regulatory Authorities:

- U.S. Environmental Protection Agency, Region 7
- U.S. Fish and Wildlife Service
  - Midwest Region, Columbia Ecological Services Office
  - Mountain-Prairie Region, Kansas Ecological Services Field Office
  - Midwest Region, Rock Island Ecological Services Field Office
  - Midwest Region, Marion Ecological Services Sub-Office
- U.S. Army Corps of Engineers
  - Kansas City District (Kanopolis Office)
  - Rock Island District
  - Louisville District
  - St. Louis District
  - Tulsa District

- National Park Service
  - Fort Larned National Historic Site
  - National Historic Trails
    - California National Historic Trail
    - Santa Fe National Historic Trail
    - Oregon National Historic Trail
- Natural Resources Conservation Service

State Agency and Regulatory Authorities:

- Missouri
  - Missouri Public Service Commission
  - Missouri Department of Conservation
  - Missouri Department of Transportation
  - Missouri Department of Natural Resources
    - State Historic Preservation Office
    - Division of Environmental Quality
- Kansas
  - Kansas Corporation Commission
  - Kansas Department of Transportation
  - Kansas Department of Wildlife, Parks and Tourism
  - Kansas Historical Society
  - Kansas Forest Service
  - Kansas Department of Agriculture
  - Kansas Department of Health and Environment
- Illinois
  - Illinois Commerce Commission
  - Illinois Department of Agriculture
  - Illinois Department of Natural Resources, Historic Preservation Office
  - Illinois Department of Natural Resources
  - Illinois Department of Transportation

- Indiana
  - Indiana Utility Regulatory Commission
  - Indiana Department of Environmental Management
  - Indiana Department of Natural Resources
    - Division of Fish and Wildlife
    - Division of Historic Preservation and Archeology

3.2 Non-Government Organizations

In addition to state and federal agencies, the Routing Team coordinated with members of several natural and historic conservation groups during the process. These contacts provided valuable additional information sources for identifying sensitive natural resource habitats and historic resources in the Study Area. These groups included:

- The Nature Conservancy, Missouri, Kansas, and Illinois Chapters
- National Pony Express Association
- Oregon-California Trails Association
- Sierra Club, Kansas and Missouri Chapters
- Audubon Missouri
- Missouri Coalition for the Environment
- Missouri Prairie Foundation
- Environment Missouri

3.3 Community Outreach Activities

The Routing Team led a community outreach program designed to educate the public about the purpose and benefits of the Project, inform community leaders and the public about the regulatory process and Project timeline, and gather general comments on the Project and specific information that would refine the siting effort.

An important part of initiating the outreach program was to identify key community leaders in each county that might experience Project construction. To this end, Grain Belt Express staff met with local county officials throughout the Study Area early in the development process to introduce the Project and identify key planning, economic development, and community leaders in each county. These contacts provided insight into local planning issues and development efforts.

Two rounds of public outreach meetings were conducted for the Grain Belt Express Project: Roundtables and Open Houses. The Routing Team planned meeting locations within the Study Area so that potential attendees would be within a 30-mile radius of at least one meeting location. In addition, Grain Belt Express staff held five local business opportunity meetings in Missouri to explore opportunities to work with local businesses during the development, construction, and maintenance phases of the Project.

3.3.1 Roundtables

The main goal of the Roundtables was to coordinate with and gain valuable information from community leaders in each county in the Study Area, including local, county, and municipal elected officials, local government planners, community and business leaders, economic development experts, local utilities and cooperatives, as well as federal and state agency officials. At each meeting, members of the Routing Team presented an overview of the Project and described the routing process. After the presentation, attendees and members of the Routing Team broke into small working groups to review aerial maps of the Study Area counties. Attendees were encouraged to write on the maps and to provide and verify specific information about sensitive features, planned development, and existing infrastructure in their community. Attendees were also encouraged to draw route suggestions on the aerial maps that the Routing Team should consider in the study, based on current and future opportunities and constraints. After the meetings, the constraints identified and routes suggested were digitized, reviewed, and/or incorporated into the routing process. Copies of the invitations for the meetings can be found in **Appendix D**.

In Missouri, 24 Roundtables were held with collectively more than 250 participants attending from more than 40 counties. **Table 3-1** shows the locations and attendance for each Roundtable.

Table 3-1. Roundtable Locations and Attendance		
Location	**Date**	**Attendance**
Nevada	June 15, 2011 (AM)	9
Carthage	June 15, 2011 (PM)	6
Greenfield	June 16, 2011 (AM)	15
Hermitage	June 16, 2011 (PM)	6
Buffalo	June 17, 2011 (AM)	14
Waynesville	June 28, 2011 (AM)	9
Rolla	June 28, 2011 (PM)	13
Houston	June 29, 2011 (AM)	9
Centerville	June 29, 2011 (PM)	6
Farmington	June 30, 2011 (AM)	23
Potosi	June 30, 2011 (PM)	11
St. Joseph	March 5, 2012 (PM)	16
Hamilton	March 6, 2012 (AM)	10
Carrollton	March 6, 2012 (PM)	18
Moberly	March 7, 2012 (AM)	18
Mexico	March 7, 2012 (PM)	21
Bowling Green	March 8, 2012 (AM)	11
Hannibal	March 8, 2012 (PM)	12
Macon	May 7, 2012	5
Livingston	June 29, 2012	4
Camden County	July 12, 2012	5
Holt County	October 12, 2012	4
Andrew County	October 29, 2012	4
Monroe	December 12, 2012	6
Total		**255**

The Roundtables provided the Routing Team an avenue to gain community perspectives on new or planned infrastructure in relationship to their county or jurisdiction through face-to-face communication. Generally, the community leaders at the Roundtables helped to identify large area constraints or opportunities in their county or jurisdiction. Community leader input also helped identify potential future land use plans, such as the construction of new water storage facilities; communication towers; or new industrial, commercial, or residential development, and they helped identify and verify the approximate location of existing features, such as historic sites, mining activities, communication towers, airstrips, schools, and churches.

The Routing Team considered data provided by community leaders at the Roundtables in its route development and selection efforts.

3.3.2 Open Houses

In July, August, and December of 2013, Grain Belt Express hosted 13 Open Houses in Missouri along the Potential Route Network; 12 of those meetings occurred in July and August. At the Open Houses, Grain Belt Express representatives provided information about the Project and collected feedback to help refine the Potential Routes and ultimately select a single Proposed Route to file for approval with the Missouri Public Service Commission. After the gathered information was reviewed, the routing options near Moberly were reconsidered and a new Potential Route was added to the network to provide additional options for Alternative Route development. Since the new Potential Route was outside of the previously notified area for the Open Houses in July and August, the Routing Team decided that an additional Open House would be helpful to get public feedback. This additional Open House was held in December and followed the same invitation process and format as the original Open Houses in July and August.

Meeting notification for the Open Houses included individual mailings sent to landowners, newspaper advertisements, coordination with local community leaders, and posts on the Project website. Mailings were sent to property owners (as identified in the local county tax and parcel information received from each county) within an approximately 2.5-mile-wide 'planning corridor' surrounding each Potential Route. Portions of the planning corridors that included major developed and/or incorporated areas were typically removed from mailing lists because these areas were not suitable for route development and the intent of the notification effort was to invite landowners with property that may be directly affected by the Project. Invitations were sent to more than 11,500 people within the planning corridors. Copies of the invitations can be found in **Appendix D**.

More than 1,200 people attended the 13 Open Houses in Missouri. **Table 3-2** contains the locations and attendance for each Open House.

At each Open House, members of the Routing Team greeted and signed in meeting attendees. At sign in, attendees were provided a comment card and asked to fill in their address and contact information at the top of their comment card. The comment card was perforated, and after signing in, the top of the card was removed to document an individual's attendance. The lower portion of the comment card included several questions for attendees to answer and a space to write in general comments about the Project. Attendees were encouraged to turn in this portion prior to leaving the meeting, but were also provided the opportunity to mail comments back to the Routing Team. The upper and lower portions of the comment card were labeled with the same unique number to identify the attendee. In this way, landowner

attendance was tracked, and once filled out and submitted, the lower body of the comment card could be linked back to the individual landowner's contact information.

Table 3-2. Open House Locations and Attendance		
Location	**Date**	**Attendance**
Salisbury	July 15, 2013 (PM)	159
Chillicothe	July 16, 2013 (AM)	78
Carrollton	July 16, 2013 (PM)	106
Hamilton	July 17, 2013 (AM)	91
Cameron	July 17, 2013 (PM)	172
St. Joseph	July 18, 2013 (AM)	75
Macon	July 29, 2013 (PM)	106
Moberly	July 30, 2013 (AM)	66
Mexico	July 30, 2013 (PM)	158
Hannibal	July 31, 2013 (AM)	65
Monroe City	July 31, 2013 (PM)	113
Bowling Green	August 1, 2013 (AM)	77
Moberly	December 4, 2013 (PM)	22
Total		**1,288**

After attendees signed in, they were given a guided tour of the Project on poster boards set up on easels. The tour presented information regarding the purpose of the Project, Project benefits, the routing process and criteria, physical characteristics of the line, easement and compensation information, and the Grain Belt Express Code of Conduct. These guided tours typically lasted 15 minutes and were conducted in small groups to allow attendees the opportunity to ask questions and receive immediate answers from members of the Routing Team.

At the end of the tour, Routing Team members assisted attendees in locating their property or other features of concern on aerial photography maps displaying the array of Potential Route links under consideration. Each map presented a specific portion of the line with information on identified constraints, land areas, and existing infrastructure presented at a scale of 1 inch = 1,500 feet. Participants were provided the opportunity and encouraged to document the location of their houses, places of business, properties of concern, or other sensitive resources on the printed maps. Routing Team members worked with landowners and ensured that each comment or group of comments provided by an attendee was also referenced to the number

on the attendee's individual comment card (by recording it on or next to the attendee's comments on the map).

One or two digital mapping stations were also provided at each Open House to allow attendees the opportunity to find their lands and document their concerns directly in the GIS database. Each digital mapping station was run by a GIS technician and contained all of the data presented on the printed maps and a full parcel database to help search for parcels that owners could not find on the printed maps. The GIS station was most often used and most efficient for those attendees who were not familiar with their properties from an aerial map perspective, owned a multitude of properties in the area, or had brought a list of properties by either parcel identification number or section/township/range for consideration.

After the Open Houses, all of the maps used to collect comments were scanned, geo-referenced, and integrated into the GIS database. The locations of specific comments provided by attendees, denoted by the commenter's unique comment card identification number, and were digitized and linked to the information provided on the individual's complete comment card. All comments received via the comment cards were recorded and categorized in a database for review and correlation with mapped comment locations.

The comment card included a question related to opportunity features. In developing Potential Routes, the Routing Team looked at paralleling several linear features including transmission lines, gas pipelines, parcel boundaries, roads, and rail lines. To gain greater perspective on these opportunity features, the comment card contained a question asking the public which types of features would be preferred for parallel alignments. **Figure 3-1** below shows the summary of responses to this question. In general, the public preferred paralleling transmission lines, pipelines, parcel boundaries, and roads/highways.

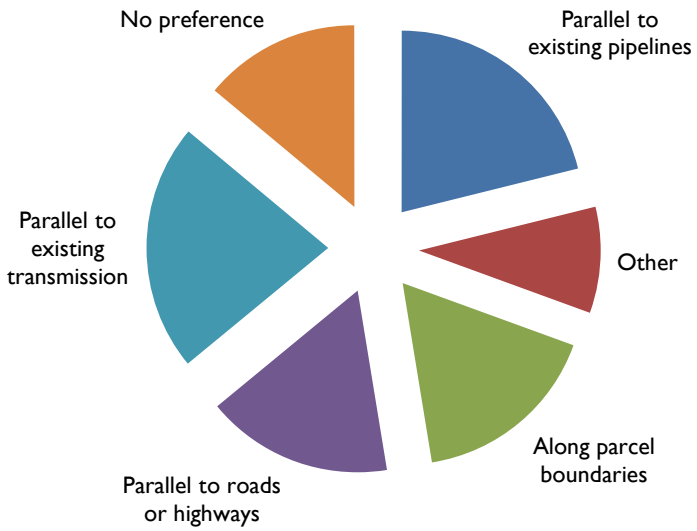


Figure 3-1. Summary of Public Response to Parallel Options

Summary of Public Comments

Generally, the members of the public who attended the Open House meetings helped to identify small area constraints or opportunities on their properties or in their communities. Meeting attendees provided specific information regarding the location, or planned location of elements such as residences, barns or outbuildings, irrigation facilities, historic markers, cemeteries, schools, and airfields. They also provided information regarding current land use such as agriculture uses, rangeland, and recreational areas. Similar comments were also collected from the public through the Project website, mailed letters, emails, and a toll-free phone number. The maps with the Potential Routes presented at the Open Houses were also posted online, so stakeholders could review the Potential Routes and provide comments even if they were unable to attend the Open Houses. More than 300 comments were received following the Open Houses, and members of the Routing Team responded to individuals posing a question or specific concern.

Categories were created in order to capture the main concerns or issues raised through public comments and included: aesthetics, the need to keep the public informed, ROW, electric and magnetic fields, roject need, safety, farm/rangeland, noise, sensitive species and habitats, health, other, state commission, historic/cultural, property values, vegetation management, irrigation, recreation, and water resources. The categories that were recorded most often included ROW, property values, aesthetics, and farm/rangeland concerns.

A summary of all comments received (via email, website, comment card, phone call, and letter) is shown below in **Figure 3-2.** The Routing Team reviewed and considered the comments as it refined Potential Routes.

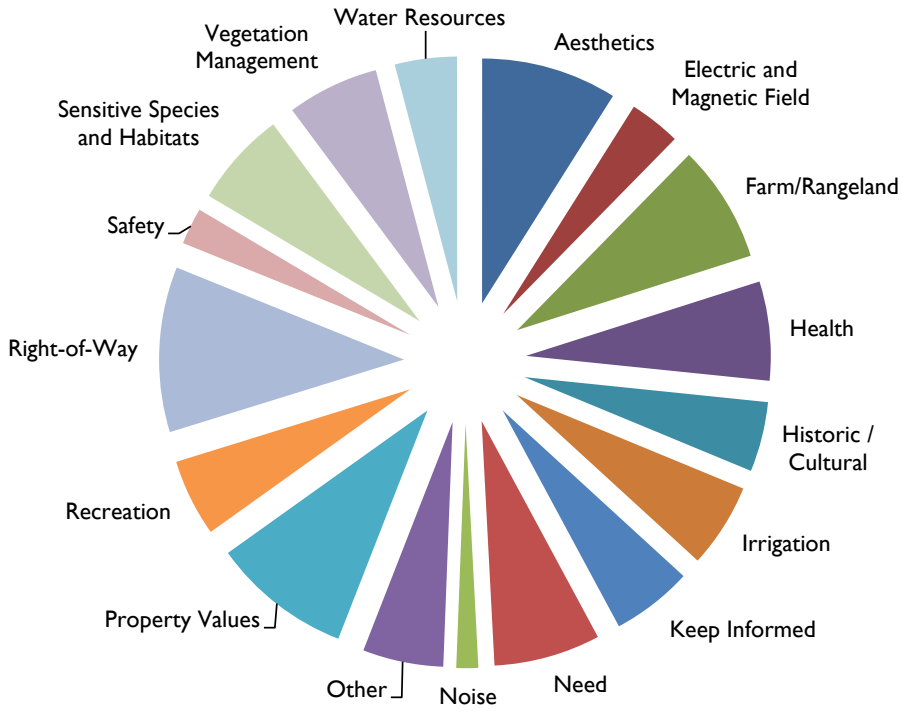


Figure 3-2. Summary of Public Comments

4. Route Development

As described in Section 2.2, the route development effort is an iterative process with a set of Conceptual Routes that are further refined to become a network of Potential Routes. The network of Potential Routes are then analyzed, compared, and refined to be assembled into Alternative Routes. Finally, comparative potential impacts are evaluated for each Alternative Route to identify a Proposed Route.

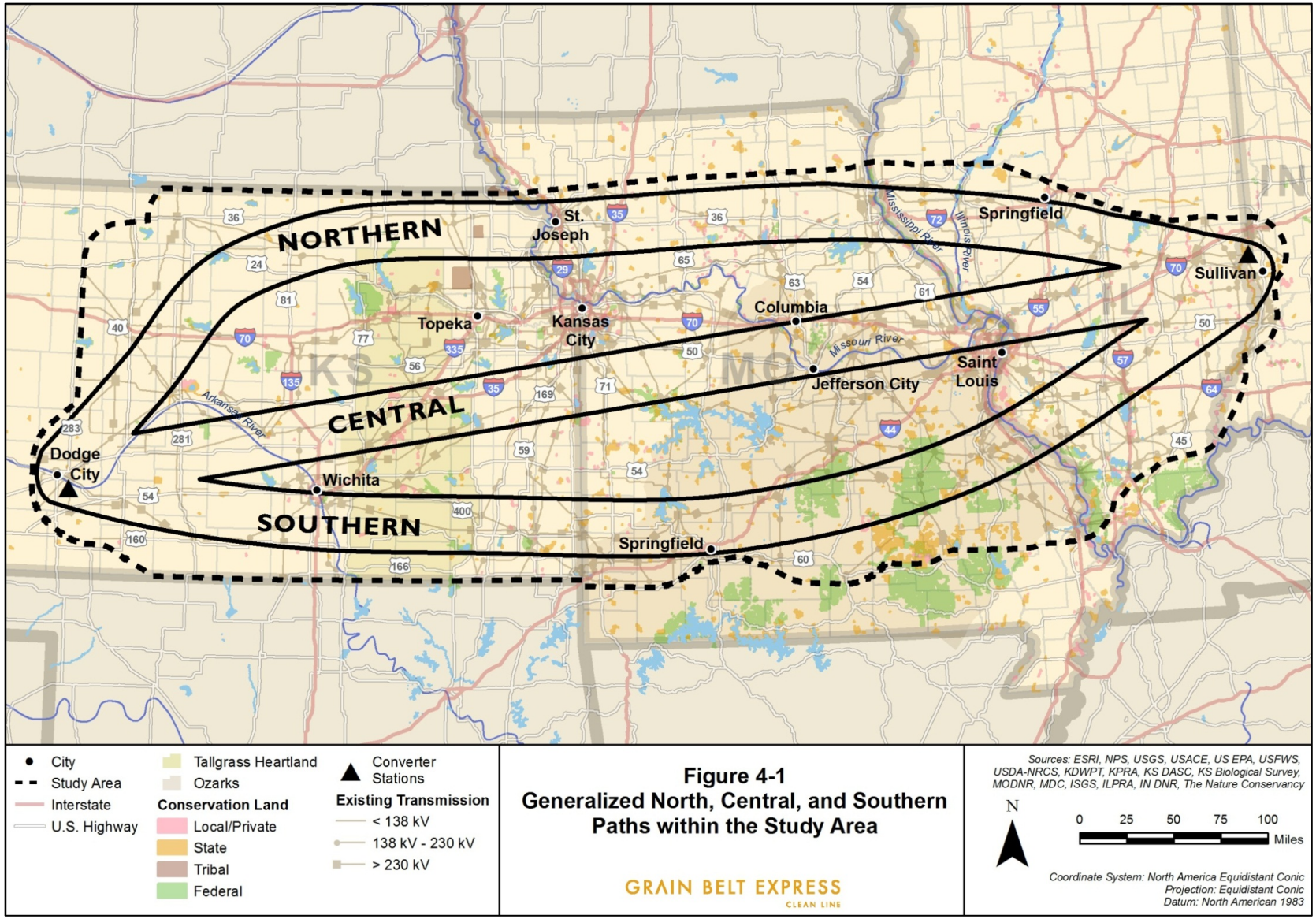
Conceptual Routes were initially developed and compared across all four states to identify the most suitable location for the Project from a high level. The Conceptual Routes were then further refined to become Potential Routes, Alternative Routes, and a Proposed Route in each state. While this report was being prepared, the KCC approved the Kansas proposed route (KCC 2013, Docket # 13-GBEE-803-MIS). Conceptual Routes in Illinois have not been refined to Potential Routes at this time, but will undergo the process in 2014-2015.

At each stage of development, the route alignments became more specific and the data analysis more resolute. The following sections provide discussions of each phase of route development and present a summary of routing decisions and analysis that led to the subsequent refinement stage.

4.1 Study Area

The Study Area for the Grain Belt Express Project is generally defined as the geographic area encompassing the two end-point converter stations in Ford County, Kansas, and Sullivan County, Indiana, and logical interconnection locations for the third, intermediate converter station near the Missouri/Illinois border (**Figure 4-1**). The presence and extent of certain relevant resources within the Study Area were also considered while delineating the Study Area boundary. One of the major factors that guided the definition of the Study Area boundary is the presence of opportunity features, particularly existing linear ROWs, including electric transmission line and pipeline ROWs. Siting new transmission lines parallel to existing linear features is a common practice in transmission line siting and supported by many state and federal regulatory authorities (see Section 2.7). Incorporating the location and trajectory of existing linear utility corridors in the delineation of the Study Area ensures that Potential Routes parallel to existing lines are considered.

Although the term Study Area boundary suggests that the Study Area is maintained throughout the study process as a fixed boundary, in practice this is not usually the case. As the routing study progresses, the Routing Team identifies additional opportunities and constraints, and the Study Area boundary is modified, as necessary.


NORTHERN
CENTRAL
SOUTHERN
St. Joseph
Springfield
Sullivan
Topeka
Kansas City
Columbia
Jefferson City
Saint Louis
Dodge City
Wichita
Springfield
Mississippi River
Illinois River
Missouri River
Arkansas River
KS
MO
IL
IN
City
Study Area
Interstate
U.S. Highway
Tallgrass Heartland
Ozarks
Conservation Land
Local/Private
State
Tribal
Federal
Converter Stations
Existing Transmission
< 138 kV
138 kV - 230 kV
> 230 kV
Figure 4-1
Generalized North, Central, and Southern Paths within the Study Area
GRAIN BELT EXPRESS
CLEAN LINE
Sources: ESRI, NPS, USGS, USACE, US EPA, USFWS, USDA-NRCS, KDWPT, KPRA, KS DASC, KS Biological Survey, MODNR, MDC, ISGS, ILPRA, IN DNR, The Nature Conservancy
N
0 25 50 75 100
Miles
Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983

4.2 Conceptual Route Development in the Study Area

Conceptual Routes are the first step in the route development effort. As the name suggests, Conceptual Routes are developed as broad routing 'concepts' that typically avoid large area constraints or incorporate notable opportunity features in the Study Area. In practice, the transition from Conceptual Routes to Potential Routes falls along a continuum. However, for the purpose of this study and to provide for clarity in referencing different decision phases of the effort, routing decisions that impacted route planning across all four states are presented under the Conceptual Route development process.

The Routing Team developed an array of initial Conceptual Routes for the Grain Belt Express Project in Kansas, Missouri, Illinois, and Indiana. The following sections provide a summary of the Conceptual Routes that the team considered, including the basis for the routing concept, key constraints and opportunities encountered, and the decision whether to eliminate or continue refinement of each Conceptual Route. For simplicity and clarity, the Conceptual Routes are grouped based on their relative geography in the Study Area (see **Figure 4-1**). Conceptual Routes in the northern portions of the Study Area followed paths that led north of Kansas City and St. Louis to reach the eastern converter station location. Conceptual Routes in the central portion of the Study Area generally followed paths north of Wichita, south of Kansas City, and north of St. Louis, and Conceptual Routes in the southern portion of the Study Area generally followed a trajectory either north or south of Wichita and the reservoir system in Missouri but crossed into Illinois south of St. Louis.

4.2.1 Conceptual Routes — Northern Portion of the Study Area

Conceptual Routes along the northern portion of the Study Area were developed to consider alignments that crossed the Missouri River between Kansas City and the Nebraska state line, crossed the Mississippi River north of St. Louis, and continued to the Sullivan Substation remaining south of Springfield, Illinois (**Figure 4-2**). Residential density along the northern Conceptual Routes is relatively minimal, and most large area constraints were readily avoidable. However, three major river crossings, sensitive grassland habitats, and numerous historic sites and trails represented notable challenges to the route development effort through this portion of the Study Area.

Large area constraints in the northern portion of the Study Area in Kansas include: multiple federally owned reservoirs and state conservation lands; two national wildlife refuges; several army bases; and the towns of Topeka, Lawrence, Salina, Hays, and Great Bend. In addition, the Flint Hills Ecoregion, one of the largest intact areas of tallgrass prairie in North America, occupies a significant portion of the Study Area in Kansas. In Missouri, large area constraints include: developed areas along U.S. Highway 36 and numerous conservation easements associated with the Grand River and Swan Lake National Wildlife Refuge, Mark Twain National

Wildlife Refuge, Thomas Hill Reservoir, Mark Twain Reservoir, the Missouri National Guard Macon Training Site, two state parks, and several state conservation areas. In Illinois, dense development around Quincy, Springfield, and Effingham presented challenges for routing the Project, as well as conservation easements along the Illinois River, the Meredosia National Wildlife Refuge, and Lake Shelbyville.

Opportunity features in the northern portion of the Study Area include the existing network of transmission lines and an array of interstate pipelines passing from southwest to the northeast in Kansas and from west to southeast in Missouri. Section lines and parcel boundaries also served to guide the development of route alignments by allowing alignments to follow along ownership boundaries when possible. Several rail lines and state or federal highways were also considered in the initial development of Conceptual Routes; however, restrictions on overhanging state ROW combined with the close relationship between roads, rail, and commercial or residential development limited the development of reasonable alignments along many of these features.

The Routing Team considered a variety of different route options to exit the western converter station in Kansas toward the northern portion of the Study Area. Route development in this area of Kansas is encumbered by extensive farmlands and irrigation facilities; the physical congestion of existing wind generation facilities, transmission lines, substations, and residences; and sensitive lesser prairie-chicken habitat that surrounds the Spearville area along its eastern and northern periphery. However, several suitable route options were developed along section/parcel boundaries to the north and east and along existing transmission lines to the northeast toward Great Bend.

Conceptual Routes north of Great Bend continued either along section/parcel boundaries west of U.S. Highway 183, north along an existing 115 kV transmission line near U.S. Highway 281, or northeast along the Natural Gas Pipeline of America pipeline corridor to Concordia. Conceptual Routes were initially developed between Cheyenne Bottoms Wildlife Area and Quivira National Wildlife Refuge but were eliminated from further consideration following agency coordination with the Kansas Department of Wildlife, Parks, and Tourism (KDWPT) and USFWS because of concerns relating to migratory birds and the federally listed endangered whooping crane. In addition, Conceptual Routes initially formed along Interstate 70 were also eliminated from further consideration due to the frequent diversions required for development along the interstate and proximity to Fort Riley Army Installation. These routes would also cross the Tallgrass Heartland of the Flint Hills, a highly scenic area viewed by 12,000 to 20,000 travelers a day.

From Concordia to the Missouri River, three main west-to-east Conceptual Routes were developed with periodic north-to-south interconnections between each route. The Routing Team considered three primary Missouri River crossing locations near St. Joseph, Missouri:

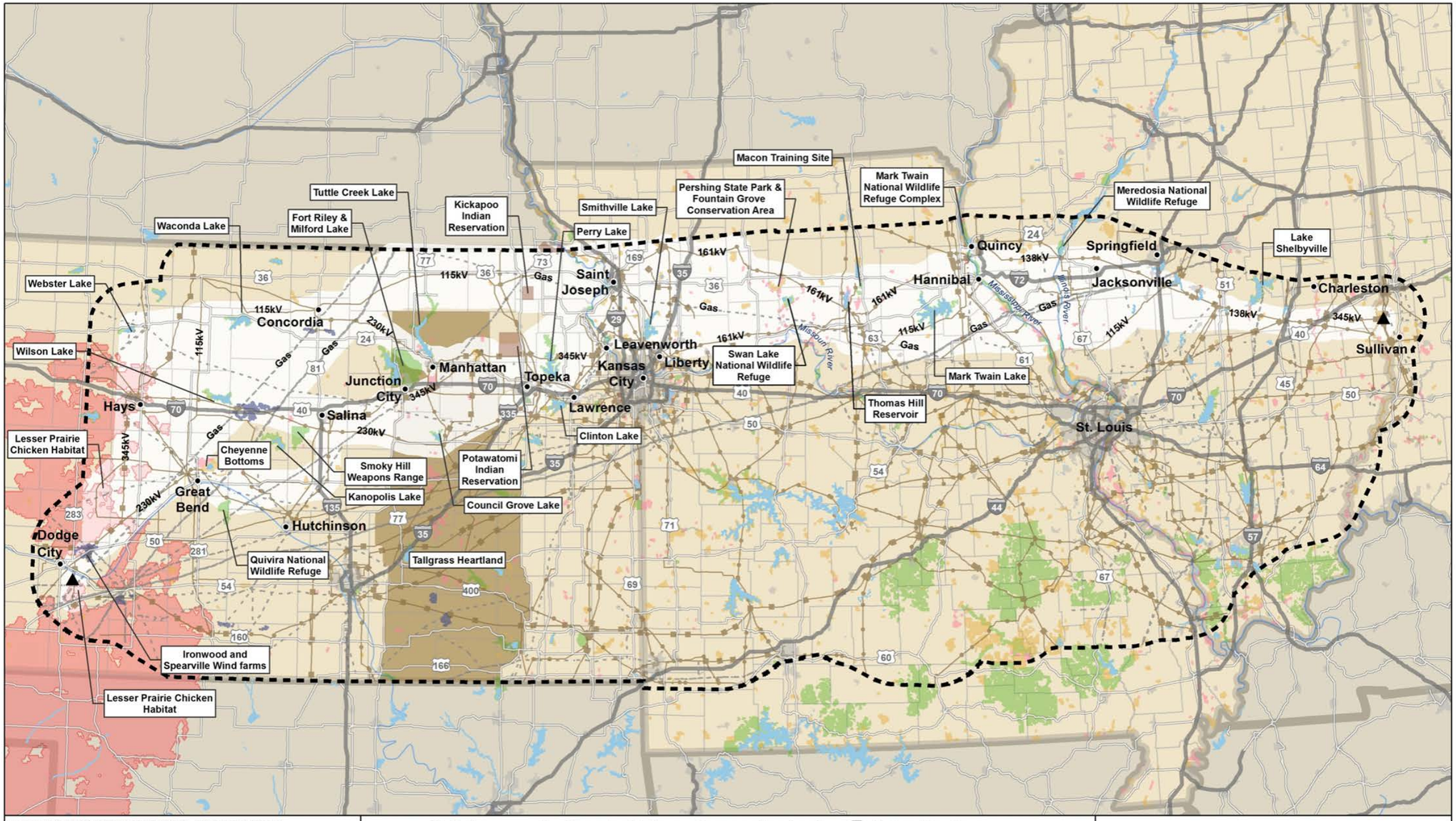


Figure 4-2
Conceptual Route Development in the Northern Portion of the Study Area

GRAIN BELT EXPRESS
CLEAN LINE

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two on a trajectory north of the city and one to the south. The two northern river crossings were developed at locations that avoided a series of MDC lands in the floodplain on the eastern bluffs of the river and crossed at locations that readily provided access to parallel a 345 kV line toward St. Joseph. The southernmost crossing was developed to parallel the Rockies Express/Keystone Pipeline corridor from near Fairview, Kansas, up to and across the Missouri River.

St. Joseph's residential and commercial development served as the primary constraint on the eastern bluffs of the Missouri River. The steep topography beyond the floodplain quickly shifts land use from floodplain farmland to a combination of forest-covered hillsides and moderate to high-density residential development. The Routing Team initially developed alignments from the two northern river crossings along the Cooper – St. Joseph 345 kV line north of the city. However, fingers of residential and commercial development extending northward from the city along Interstates 229 and 29 prevented suitable parallel alignments along the line through this area. Ultimately, the Routing Team developed routing alignments that diverged from a parallel alignment near Amazonia and continued farther east before angling south to continue along the east side of St. Joseph, paralleling the existing Hawthorne – St. Joseph 345 kV transmission line toward the southeastern corner of Buchanan County.

The Routing Team developed a network of Conceptual Routes starting at the Rockies Express/Keystone Pipeline crossing of the Missouri River. Similar to the northern crossing, steep topography beyond the floodplain quickly shifts land use from floodplain farmland to a combination of forested hills and moderate density residential development. A network of routes was developed from this southern crossing location eastward, through the farmlands in the Missouri floodplain and into the sporadic residential development along the bluffs and in the subsequent valleys eastward. Conceptual Routes were developed through this area along pipeline or existing transmission lines to the southeast to pass through the residential development along the bluffs and around the community of Agency, Missouri, located farther east.

Conceptual Routes beyond St. Joseph and east across Missouri were developed around three primary concepts: an alignment based on the section/parcel boundary just south of U.S. Highway 36; a route that continued parallel along the Rockies Express/Keystone Pipeline corridor; and an alignment that paralleled existing transmission lines to the north that looped between St. Joseph, Fairport, Jamesport, Brookfield, and Marceline, Missouri. The Routing Team ultimately removed this latter route alignment from further consideration because the benefits of paralleling the existing transmission lines through this area did not outweigh the likelihood of impacts associated with frequent diversions to avoid residences near Gallatin and Jamesport, multiple transmission line crossings, and crossings of several private and federal conservation easements and Pershing State Park.

Extensive federal, state, and private conservation areas line the banks of the Grand River just east of Highway 65. Two key breaks in these conservation lands along the river were considered for crossing the Grand River and its floodplain forests. The first crossing was identified just north of the Swan Lake National Wildlife Refuge and south of the town of Sumner. The second crossing was identified approximately ten miles south along the Rockies Express/Keystone Pipeline corridor.

East of the Grand River, conceptual routes were developed to avoid the Thomas Hill Reservoir and the conservation lands surrounding it by passing north or south around the reservoir. Conceptual Routes south of Thomas Hill Reservoir paralleled an existing 161 kV transmission line that angles southeast of the reservoir before turning east, just south of Cairo. Conceptual Routes north of Thomas Hill Reservoir avoided conservation lands and the Army National Guard's Macon Training Site, located just east of the reservoir.

In Monroe and Ralls counties, Mark Twain Lake encompasses a large area of land that includes a state park, federal land managed by the USACE, and a patchwork of private conservation easements. Conceptual Routes were developed north and south of the lake. Routes developed along the north side connected to potential Mississippi River crossings near Quincy, Illinois and Hannibal, Missouri. Routes that continued south of the lake—both through Monroe County and along the Rockies Express/Keystone Pipeline farther south in Audrain County—connected to potential river crossings near Hannibal, Louisiana, and Clarksville, Missouri.

The Routing Team considered numerous Mississippi River crossing locations during the Conceptual Route development phase both north and south of St. Louis, from roughly Quincy, Illinois to Grand Tower, Illinois. Conceptual Routes in the northern portion of the Study Area fell between a 75-mile stretch of the Mississippi River from Quincy, Illinois, to Winfield, Missouri. Initial siting efforts focused on locations along the river with existing infrastructure crossings but soon expanded to considered all areas where residential development, sensitive habitats, public lands, and cultural resources were limited. Of the many crossings of the Mississippi River considered, the Routing Team identified six potential crossings from which the preferred crossing location was ultimately selected (see Section 4.3.2 for a discussion of Mississippi River crossings).

Once across the Mississippi and Illinois rivers, the Routing Team developed a network of Conceptual Routes that continued east along existing transmission and pipeline corridors, and along section/parcel boundaries toward the Sullivan Substation. In general, land use in the area is agricultural with an increasing prevalence of forested lands further south near St. Louis. Major communities in the northern portion of the Study Area in Illinois included Quincy, Jacksonville, Springfield, Chatham, Pana, and Effingham.

Minimal or easily avoidable large public land areas exist through this portion of the Study Area, and a range of opportunity features are available to develop Conceptual Routes across the state. However, in general, residential development tended to be higher in the northern portion of the Study Area in Illinois when compared to Missouri or Kansas.

4.2.2 Conceptual Route Development — Central Portion of the Study Area

The central portion of the Study Area essentially consists of those routes that generally followed the most direct path from the western converter station to Sullivan Substation while still considering various opportunity features and avoiding constraints. As **Figures 4-1** and **4-3** readily show, Conceptual Route development efforts through this portion of the Study Area were greatly affected by almost every major metropolitan area, and its associated suburban development sprawl, in the Study Area.

The primary path for exiting the western converter station in the central portion of the study area was along a 115 kV transmission line to Stafford. One other conceptual route was initially considered immediately south of Cheyenne Bottoms but was later eliminated due to concerns from KDWPT and USFWS (see Northern Conceptual Route Discussion).

From Stafford, Conceptual Routes either continued northeast to Hutchinson along existing transmission lines or due east along section/parcel boundaries for more than 75 miles to approximately 7 miles south of Newton. The routes to Hutchinson continued north along an existing 345 kV line between Hutchinson and the Summit Substation and then east through the Tallgrass Heartland along existing transmission lines. Maintaining parallel alignments along this route became increasingly difficult as residential development adjacent to the existing line increased in the satellite communities south of Topeka and Kansas City.

Conceptual Routes from Newton continued either northeast across the Tallgrass Heartland parallel to an existing 345 kV line eventually connecting with the routes described above through Carbondale or east to parallel a 115 kV line across the Tallgrass Heartland. Continuing east of the Tallgrass Heartland, Conceptual Route development became encumbered by development protruding south of Kansas City and the Harry S. Truman Reservoir to the east and south. Attempts were made to develop Conceptual Routes through this area along existing transmission lines that connect the outer suburbs of Gardner, Spring Hill, Raymore, and Pleasant Hill and along a pipeline that passed between Waverly, Kansas, and Holden, Missouri; however, these routes were later eliminated due to the spread and density of residential development and the numerous diversions from parallel alignments along transmission lines, pipelines, and section/parcel boundaries required to avoid individual residences.

East of the Kansas-Missouri state boundary and dense residential development south of Kansas City, the Conceptual Routes split with the northernmost routes following an existing gas

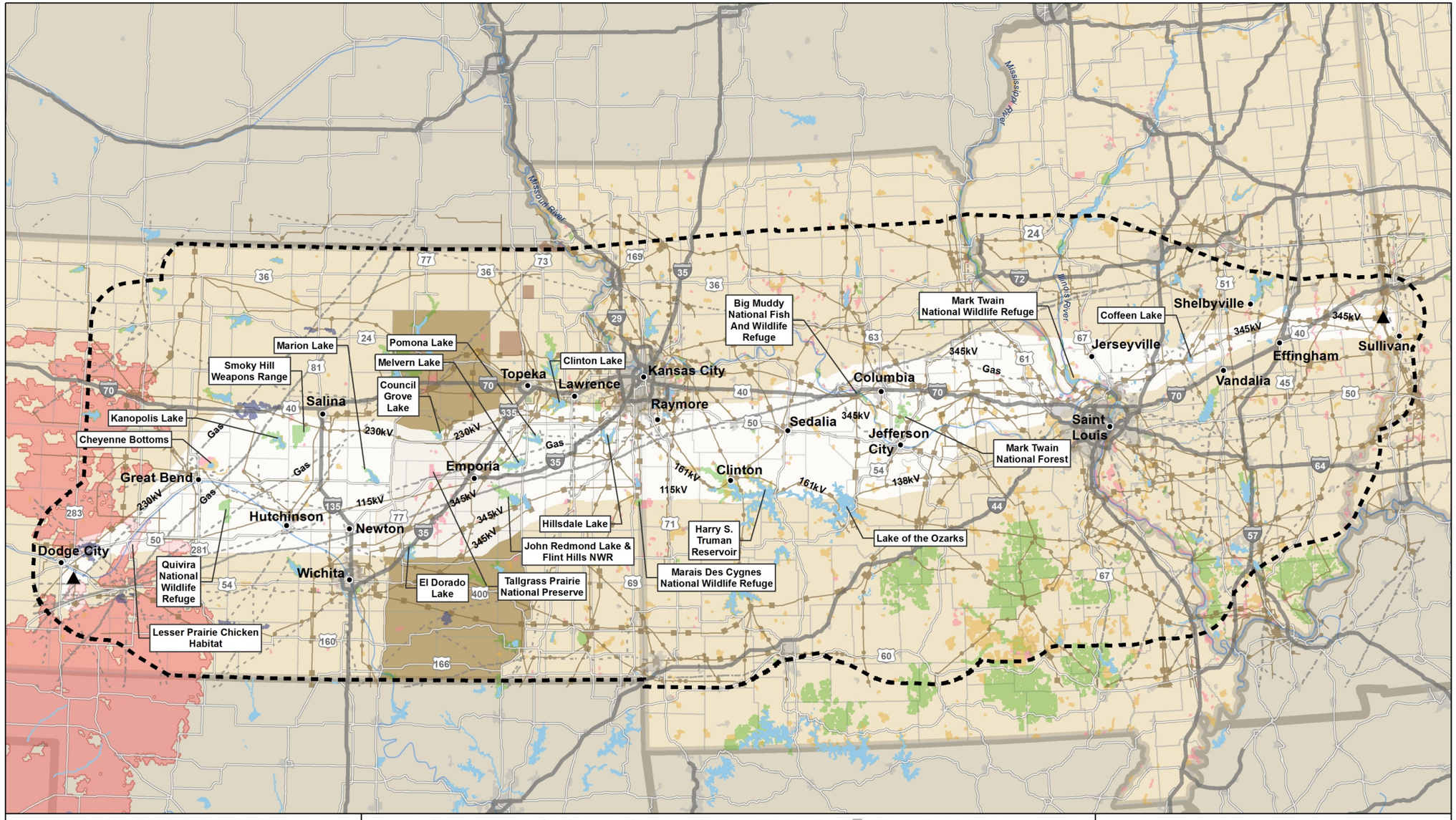
pipeline corridor northeast toward Warrensburg, diverting to find a suitable crossing of the Missouri River and picking up the gas line corridor again north of the Missouri River and south of Franklin. The southernmost Conceptual Routes in this area attempted to follow 161 kV transmission lines around the north shores of the Truman Reservoir and Lake of the Ozarks, although frequent diversions from a parallel alignment were necessary due to residential development and recreational areas adjacent to the reservoirs. Additional Conceptual Routes were developed north of the lakes and south of Warrensburg and Sedalia.

Conceptual Routes following the gas line corridor past Franklin continued north of Columbia and into the northern Conceptual Route area. Increased residential development linking Columbia, Jefferson City, and communities on the north shore of the Lake of the Ozarks, and increased conservation land along the section of the Missouri River from Arrow Rock to Jefferson City decreased routing opportunities and suitable crossings of the Missouri River in this area. The Conceptual Routes that were developed followed primarily parcel boundaries or connected sections of existing transmission lines heading east or northeast for relatively short distances. The terrain between the reservoir complex in the south and the Missouri River in the north became increasingly more variable, and land use became more heavily forested as the Conceptual Routes proceeded east into the Ozark Mountains.

The Conceptual Routes just north of the Lake of the Ozarks turned northeast along 69 kV and 138 kV transmission lines toward Jefferson City and Chamois or toward Owensville. Due east from there, the larger metro area of St. Louis dominates the landscape with development extending far to the west and south of the city preventing the development of Conceptual Routes in these areas. The Conceptual Routes crossed the Missouri River by Chamois and angled northeast across an increasingly agricultural landscape when compared to the Ozark region to the south.

As the Conceptual Routes approached the Mississippi River, the Routing Team identified existing transmission line crossings near Bolter Island and Iowa Island, due north of St. Charles. Conceptual Routes using existing transmission line crossings closer to St. Louis were not feasible due to the density of residential and commercial development outside of St. Louis and significant federal, state, and private conservation lands around the confluence of the Missouri, Mississippi, and Illinois rivers.

Conceptual Routes in the central portion of the Study Area in eastern Missouri continued north to blend into the northern portion of the Study Area or crossed the Mississippi River at locations not occupied by public lands or historic communities. East of the Mississippi and Illinois rivers, the Conceptual Routes converged south of Litchfield to parallel existing 345 kV transmission lines northeast toward Pana, Illinois, in the northern portion of the Study Area or east toward the eastern converter station, staying north of Effingham and south of Charleston, Illinois.



Sources: ESRI, NPS, USGS, USACE, USFWS, USDA-NRCS, US EPA, KDWPT, KPRA, KS DASC, KARS, KS Biological Survey, MODNR, MDC, ISGS, ILPRA, IN DNR, The Nature Conservancy

0 20 40 60 80 100 Miles

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983

N

- City
- Study Area
- Interstate
- U.S. Highway
- Gas Pipeline
- Converter Stations

Existing Transmission

- < 138 kV
- 138 kV - 230 kV
- > 230 kV

Conservation Land

- Local/Private
- State
- Tribal
- Federal

- Metropolitan Area
- Water Body
- Tallgrass Heartland
- Lesser Prairie Chicken Habitat CHAT Categories 1-3
- Wind Farm

Figure 4-3
Conceptual Route Development in the Central Portion of the Study Area

GRAIN BELT EXPRESS
CLEAN LINE

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4.2.3 Conceptual Routes — Southern Portion of the Study Area

The southern portion of the study area include routes north and south of Wichita, north of Springfield, and south of St. Louis. Constraints in the southern portion of the Study Area include: Wichita and its associated suburban sprawl, the extensive airfields in and around Wichita, the ecologically unique and scenic Tallgrass Heartland, the expansive Harry S. Truman reservoir, Lake of the Ozarks, Pomme De Terre, Stockton Lake, Mark Twain National Forest, and land administered by the Department of Defense and the National Park Service.

Conceptual Routes exiting the western converter station primarily followed either section lines through farm lands east of Wichita, and/or paralleled existing transmission lines north and south of the Wichita metro area. Routing opportunities near Wichita were highly encumbered by the expansive suburbs both north and south of the city, as well as an abundance of airfields associated with Wichita's extensive aviation industry. These two factors led to routes that were developed either north along existing 345 kV lines that crossed midway between Wichita and Newton or south of the city along section/parcel boundaries 10 and 20 miles south of the city. As a result, Conceptual Routes were developed along each of the four 345 kV transmission lines east of Wichita that transect the Tallgrass Heartlands in this area (see **Figure 4-4**). Beyond the Tallgrass Heartlands, Conceptual Route alignments continued along existing transmission lines or section/parcel boundaries. Although route development through this area was comparatively simple given the low number of residences and public lands, significant oil and gas development and numerous wind farms hindered route development in some areas.

The Conceptual Routes in southeastern Missouri were primarily developed along roads, section/parcel lines, and paralleling existing transmission. Land use in southwestern Missouri is similar to that in eastern Kansas with farms and grasslands primarily used for grazing. The prevalence of grassland areas was specifically noted by MDC as a focus for preservation of grassland/prairie habitat and reintroduction of greater prairie chickens in the area. The Routing Team attempted to avoid these areas and/or parallel existing transmission lines where possible through this area.

Continuing east, terrain becomes more variable with less land suitable for agricultural use and a greater proportion of land under forest cover. An increase in large parcels of publicly owned lands, recreational areas, and reservoirs coincides with this physiographic change and greatly affected Conceptual Route development. Most notably, the irregular sprawl of the extensive Harry S. Truman, Lake of the Ozarks, Pomme De Terre, and Stockton Lake reservoirs significantly limited the potential for reasonable alignments south of Jefferson City and north of Springfield. Through this area, the most suitable alignments were either along the northern edge of the Harry S. Truman and Lake of the Ozarks reservoirs; weaving south of the Harry S. Truman and Lake of the Ozarks reservoirs and north of Stockton Lake and Pomme De Terre;

or following a southern path along an existing 345 kV transmission line between Springfield, Missouri, and Lake Stockton.

Farther east, the large land holdings of the Mark Twain National Forest and interspersed holdings of the Department of Defense, National Park Service, and state of Missouri affected Conceptual Route development. Routes developed through this area primarily followed alignments that diverted either north of the main body of the Mark Twain National Forest (Houston/Rolla and Salem/Potosi Ranger Districts) or south along a trajectory between the National Forest System lands and the Ozark National Scenic Riverway. An alignment was also considered that loosely paralleled the north side of Interstate 40 (along a lower voltage transmission line) for more than 150 miles. Direct parallel along Interstate 40 was avoided because of the significant residential and commercial development along its path and in recognition of its role as part of the historic Route 66 corridor. Remnants of this historic travelway through the Ozarks are found just off Interstate 40 and have been designated as scenic roads by the state of Missouri.

As described in Section 3, the intermediate converter station for the southern portion of the Study Area routes was proposed to be at or near the St. Francois Substation in the northeast corner of St. Francois County, Missouri. The extensive network of public lands west of this area guided and limited route development. Approaches to the converter station were forced to either: 1) follow along a northern trajectory, ultimately turning south into the converter station area once west of the Potosi Ranger District of the Mark Twain National Forest; or 2) follow a path from the southwest after weaving through the patchwork of state parks and National Forest System lands (between the Salem and Fredericktown Ranger Districts) forming the Heart of the Ozarks recreational attractions.

While the extensive network of public lands in the area limited route development opportunities in many places, it also had a compounding effect of concentrating development to the areas in between. This effect was found throughout the Ozarks region, most notably in the area immediately adjacent to the St. Francois Substation. In this area, several large state parks (the St. Joe and St. Francois State Parks) and a dense stretch of intervening development (Farmington, Leadington, Park Hills, Deslodge, and Bonne Terre) served as major constraints to identifying suitable routes into the St. Francois Substation area.

Conceptual Routes east of the midpoint converter station location were largely guided by the identification of suitable Mississippi River crossing locations. The Routing Team focused on the area south of St. Louis and north of the Shawnee National Forest that occupies the east shore of the river from Grand Tower, Illinois, to roughly the Kentucky border. Few existing utility crossings of the river were found in this area, and extensive development extending south of St. Louis combined with large federal and state conservation areas—largely associated with the Mark Twain National Wildlife Complex—made many crossing locations unsuitable. The