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2. Project Description and Alternatives

2.1 Project Overview

The Applicant Proposed Project would include an overhead ± 600 kilovolt (kV) HVDC electric transmission system and associated facilities with the capacity to deliver approximately 3,500MW primarily from renewable energy generation facilities in the Oklahoma and Texas Panhandle regions to load-serving entities in the Mid-South and southeastern United States via an interconnection with TVA in Tennessee. DOE Alternatives (as described in Section 2.4.3) would increase the capacity of the proposed transmission system and facilities by 500MW (to 4,000MW) to facilitate delivery of electricity to Arkansas. A description of the Applicant Proposed Project's major facilities and improvements is included in Section 2.1.2. Further details and information for each of the Applicant Proposed Project's major facilities, construction procedures, and environmental protection measures are included in Appendix F.

Commonly Used Terms

Throughout the Plains & Eastern EIS, the following terms are used to describe different elements of the proposal being evaluated.

Applicant Proposed Project—Based on Clean Line's modified proposal to DOE,[1] the basic elements include converter stations in Oklahoma and Tennessee, AC interconnections at each converter station, an AC collection system, and an HVDC transmission line from the Oklahoma Panhandle to western Tennessee. The Applicant Proposed Project is described in detail in Sections 2.1.2 through 2.1.7.

Proposed Action—For DOE to participate, acting through the Administrator of Southwestern, in the Applicant Proposed Project in one or more of the following ways: designing, developing, constructing, operating, maintaining, or owning a new electric power transmission facility and related facilities located within certain states in which Southwestern operates, namely Oklahoma, Arkansas, and possibly Texas,[2] but not Tennessee.

Applicant Proposed Route—The single 1,000-foot-wide route alternative defined by Clean Line to connect the converter station in the Oklahoma Panhandle to the converter station in western Tennessee. The analyses of impacts are typically based on a representative 200-foot-wide right-of-way (ROW) within the 1,000-foot corridor. The Applicant Proposed Route is defined in detail in Section 2.4.2.

DOE Alternatives—Pursuant to NEPA, DOE has identified and analyzed potential environmental impacts for several reasonable alternatives in addition to the Applicant Proposed Project. These alternatives include an Arkansas converter station and alternative routes for the HVDC transmission line. In each instance, these alternatives have been discussed and evaluated with Clean Line for feasibility. The DOE Alternatives are described in detail in Section 2.4.3.

The Project—A broad term that generically refers to elements of the Applicant Proposed Project and/or DOE Alternatives when differentiation between the two is not necessary. The term also refers to whatever combination of project elements would be built if a decision is made by DOE to participate with Clean Line.

2.1.1 DOE Proposed Action

DOE's Proposed Action is to participate, acting through the Administrator of Southwestern, in the Applicant Proposed Project in one or more of the following ways: designing, developing, constructing, operating, maintaining, or owning a

[1] In response to DOE's *Request for Proposals for New or Upgraded Transmission Line Projects under Section 1222 of the Energy Policy Act of 2005.*

[2] Depending on AC collection system routes implemented (some of which are in Texas).

new electric power transmission facility and related facilities located within certain states in which Southwestern operates, namely Oklahoma, Arkansas, and possibly Texas.

2.1.2 Applicant Proposed Project Description

The Applicant Proposed Project would include an overhead ± 600kV HVDC electric transmission system and associated facilities with the capacity to deliver approximately 3,500MW primarily from renewable energy generation facilities in the Oklahoma and Texas Panhandle regions to load-serving entities in the Mid-South and Southeast United States via an interconnection with TVA in Tennessee.

Major facilities associated with the Applicant Proposed Project consist of converter stations in Oklahoma and Tennessee, an approximate 720-mile, ± 600kV HVDC transmission line, an AC collection system, and access roads. The following sections summarize the Applicant Proposed Project's major facilities and improvements.

2.1.2.1 Converter Stations and Other Terminal Facilities

The Applicant Proposed Project includes two AC/ DC converter stations, one at each end of the transmission line. The Applicant proposes to locate a converter station in Texas County, Oklahoma, and a converter station in either Shelby County or Tipton County, Tennessee.[3] At each converter station, AC transmission lines would be required to connect to the existing grid. These lines would include:

- One double-circuit 345kV AC transmission line connecting to the future Xcel Energy/Southwestern Public Service Co. Optima Substation in Oklahoma
- 500kV AC transmission lines connecting to the TVA Shelby Substation in Tennessee

An additional converter station in Arkansas is also being evaluated as part of the DOE Alternatives. Information on this alternative is provided in Section 2.4.3.

2.1.2.1.1 Elements Common to the Converter Stations

Some elements are common to all of the converter stations, regardless of location. These elements are described in this section. Elements that are unique to a specific converter station are discussed in Sections 2.1.2.1.2 and 2.1.2.1.3. A converter station would be similar to a typical AC substation, but with additional equipment to convert between AC and DC. Ancillary facilities such as communications equipment and cooling equipment would be required at each converter station. In addition, AC transmission lines would connect each converter station to the existing grid. Each converter station would include:

- DC switchyard
- DC smoothing reactors
- DC filters
- Valve halls (which contain the power electronics for converting AC to DC and vice versa)
- AC switchyard
- AC filter banks

[3] The eastern converter station would be located either in Shelby County or Tipton County, and the AC interconnection would be located at the existing Shelby substation in Shelby County.

- AC circuit breakers and disconnect switches
- Transformers

A typical converter station may require 45 to 60 acres. The AC switchyard would occupy the largest area of the electrical facility within the converter station footprint. There could be up to two buildings (valve halls) to house the power electronic equipment used in AC/DC conversion, each approximately 200 feet long by 75 feet wide. The valve halls could be 60 to 85 feet tall. Additionally, smaller buildings would house the control room, control and protection equipment, auxiliaries, and cooling equipment. Other electrical equipment may be required within the AC portion of the switchyard. The Applicant would utilize a 10- to 20-acre laydown area during construction and post construction as parking and for locating warehousing facilities within the fenced converter station if needed. Figure 2.1-1 (located in Appendix A) shows a typical converter station layout. Tables 2.1-1 and 2.1-2 provide the typical facility dimensions and anticipated land requirements for converter stations during construction and operations and maintenance.

Figure 2.1-2 (located in Appendix A) depicts the potential siting areas under consideration for the converter stations and interconnection facilities for the Project. Figures 2.1-3 and 2.1-4 (located in Appendix A) depict the converter station siting area locations in Oklahoma and Tennessee, respectively.

Typical structures for AC Interconnection include 345kV lattice structures and tubular pole structures and their respective dimensions are summarized in Tables 2.1-1 and 2.1-2. The typical pole structures for AC interconnection are depicted on Figures 2.1-5 through 2.1-10 (located in Appendix A).

2.1.2.1.2 Oklahoma Converter Station and Associated Facilities

In addition to the common features described in Section 2.1.2.1.1, the Oklahoma Converter Station would also include the features/facilities as described below. Table 2.1-1 summarizes the facilities, dimensions, and land requirements for the Oklahoma converter station.

The western terminus of the Project would interconnect to the existing transmission system operated by the Southwest Power Pool (SPP) in Texas County, Oklahoma. To facilitate this interconnection, Xcel Energy/Southwestern Public Service Company would construct a new 345kV substation called Optima. A double-circuit 345kV transmission line up to 3 miles in length would be needed to interconnect the proposed converter station with the Optima Substation. The Applicant would use a mix of lattice and tubular pole structures to support the transmission line.

The 345kV AC lines would consist of an arrangement of three electrical phases, each with a two-conductor bundle (two subconductors) in a vertical configuration with approximately 18 to 24 inches of separation between the subconductors. Each conductor would be an approximate 1- to 1.5-inch-diameter aluminum conductor with a steel reinforced core, or a very similar configuration. The exact height of each structure and required vertical clearances would be governed by topography and safety requirements. The Applicant would design minimum conductor height above the terrain, assuming no clearance buffers, per Rule 232D of the 2012 edition of the National Electrical Safety Code (NESC), which requires 25 feet for general areas and vehicular traffic (for a 345kV AC line). The NESC provides for minimum distances between the conductors and the ground, crossing points of other lines and the transmission support structure, and other conductors, and minimum working clearances for personnel during energized operations and maintenance activities (IEEE 2011).

Table 2.1-1:
Oklahoma Converter Station and Associated Facilities Dimensions and Land Requirements

Facility	Construction Dimensions[1]	Operation Dimensions[1]
Converter Station	45 to 60 acres of land would be required for the station, plus an additional 5 to 10 acres for construction.	45 to 60 acres of land would be required for the station; approximately 45 acres would be fenced.
Converter Station Access Roads	All weather access roads 20 feet wide x less than 1 mile long would be required. Construction of the access roads may disturb an area up to 35 feet wide.	20-foot-wide paved roadways.
ROW	One 345kV ROW; 150–200 feet wide x 3 miles long.	One 345kV ROW: 150–200 feet wide x 3 miles long.
345kV—Lattice Structures	Structure assembly area: 150 feet wide (ROW width) x 150 feet long (within ROW) 5 to 7 structures per mile. 3 miles x 6 structures per mile = 18 structures for 345kV AC.	Structural footprint 28 feet x 28 feet (typical for lattice structures) 75 to 180 feet tall; 5 to 7 structures per mile.
345kV—Tubular Pole Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW); 5 to 7 structures per mile.	Structural footprint 7 feet x 7 feet (typical for tubular pole structures) 75 to 180 feet tall; 5 to 7 structures per mile.
AC Interconnection Point	Inside the Xcel Energy/Southwestern Public Service Co., substation that is planned to be built in the future (identified by transmission planning studies as Optima).	Inside the Xcel Energy/Southwestern Public Service Co. substation that is planned to be built in the future (identified by transmission planning studies as Optima).

1 Final design and/or dimensions may differ from typical dimensions expressed here.

2.1.2.1.3 Tennessee Converter Station and Associated Facilities

In addition to the common features described in Section 2.1.2.1.1, the Tennessee converter station would also include the following features/facilities. Table 2.1-2 summarizes the facilities, dimensions, and land requirements for the Tennessee converter station. Based on preliminary designs and studies, this converter station would have a nominal capacity of 3,500MW.

The proposed eastern converter station would interconnect to the existing transmission system operated by TVA at the existing Shelby Substation, located in Shelby County, Tennessee, which sits adjacent to the county line of Tipton County. Based on TVA's final Interconnection System Impact Study (SIS), TVA would need to make substation and transmission upgrades to accommodate interconnection of the Project to the transmission system in Tennessee. The upgrades to the TVA transmission system are described in more detail in Section 2.5.2 and are addressed as connected actions in this EIS.

The interconnection would consist of 500kV AC transmission lines up to a mile long and/or associated new electrical hardware. The Applicant would use a mix of lattice and tubular pole structures to support the transmission line. It is anticipated that the AC interconnection facilities would be contained wholly within the Tennessee converter station siting area, which is shown on Figure 2.1-4 (located in Appendix A).

The 500kV AC lines would consist of an arrangement of three electrical phases each with a three-conductor bundle (i.e., three subconductors) in a triangle configuration about 18 to 24 inches on each side. Each conductor would be an approximate 1- to 2-inch-diameter aluminum conductor with a steel reinforced core, or a very similar configuration. The Applicant would design minimum conductor height above the terrain, assuming no clearance buffers, per Rule 232D of the 2012 edition of the NESC, which requires 29 feet for general areas and vehicular traffic (for a 500kV AC line). The 500kV lattice and tubular pole structures are shown in Figures 2.1-11 and 2.1-12 through 2.1-16, respectively, in Appendix A.

Table 2.1-2:
Tennessee Converter Station and Associated Facilities Dimensions and Land Requirements

Facility	Construction Dimensions[1]	Operation Dimensions[1]
Converter Station	45 to 60 acres of land would be required, plus an additional 5 to 10 acres for construction.	45 to 60 acres of land would be required for the station; approximately 45 acres would be fenced.
Converter Station Access Roads	All weather access roads 20 feet wide x less than 1 mile long would be required. Construction of the access roads may disturb an area up to 35 feet wide.	20-foot-wide paved roadways.
ROW	One 500kV ROW: 150–200 feet wide x up to 1 mile long.	One 500kV ROW: 150–200 feet wide x up to 1 mile long.
500kV—Lattice Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile (1 mile x 6 structures per mile = 6 structures for 500kV AC.	Structural footprint 28 feet x 28 feet (typical for lattice structures), 75 to 180 feet tall, 5 to 7 structures per mile.
500kV—Tubular Pole Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile.	Structural footprint 7 feet x 7 feet (typical for tubular pole structures) 75 to 180 feet tall, 5 to 7 structures per mile.
AC Interconnection Point	Inside the existing Shelby Substation	Inside the existing Shelby Substation

1 Final design and/or dimensions may differ from the typical dimensions expressed here.

2.1.2.2 HVDC Transmission Line

The Applicant Proposed Project would transmit energy from the Oklahoma converter station to the Tennessee converter station via an approximate 720 mile ± 600kV HVDC overhead electric transmission line. HVDC transmission technology includes the ability for bi-directional power flow, or the flow of power in either direction through the converters. Under normal operating conditions for the Project, power would flow from the wind farms (directly connected to the Oklahoma converter station via the AC collection system) in an eastward direction with power injection in Arkansas (under a DOE alternative) and Tennessee. Because of its unique characteristics as a direct current interconnection, system operators in each of the three states could utilize the Project to help stabilize the regional electric grids by changing the direction of power flow in sub-second intervals, if necessary. In these rare conditions, power could be injected from the Project to the western SPP in Oklahoma. The power for injection into the Oklahoma grid could come from either of two sources: (1) power generated from the wind farms connected through the AC collection system, or (2) power from the Arkansas or Tennessee electrical grids temporarily flowing westward into Oklahoma.

As part of its Applicant Proposed Project, Clean Line proposed one route for the HVDC transmission line. As required by NEPA, DOE has identified and analyzed other reasonable alternative routes. To simplify and organize the analysis of impacts from the HVDC transmission line, DOE has divided the 720-mile-long transmission line into seven sequential regions, numbered Region 1 to Region 7, and describes impacts from the Applicant Proposed Project by region. All HVDC alternatives, including the Applicant Proposed Route, considered for development and analyzed as part of this EIS are described in Section 2.4 and in the Alternatives Development Report (DOE 2013). The regions potentially affected by the HVDC Applicant Proposed Route (and the counties included in each region) are listed in Table 2.1-3. Figures 2.1-17a though 2.1-17f in Appendix A present an illustration of the Project (Applicant Proposed Route and DOE alternative routes). HVDC transmission facilities, which are described in detail in Appendix F, include:

- ROW easements for the transmission line, with a typical width of approximately 150 to 200 feet
- Tubular and lattice steel structures used to support the transmission line
- Electrical conductor (transmission line) and metallic return
- Communications/control and protection facilities (optical ground wire [OPGW] and fiber optic regeneration sites).

Table 2.1-3:
Counties Potentially Affected by the Applicant Proposed Route

Feature	Length (Miles)	State	Counties
Region 1 (Oklahoma Panhandle)	115.9	Oklahoma	Texas, Beaver, Harper, and Woodward
Region 2 (Oklahoma Central Great Plains)	106.2	Oklahoma	Woodward, Major, and Garfield
Region 3 (Oklahoma Cross Timbers)	162.1	Oklahoma	Garfield, Kingfisher, Logan, Payne, Lincoln, Creek, Okmulgee, and Muskogee
Region 4 (Arkansas River Valley)	126.7	Oklahoma and Arkansas	Muskogee and Sequoyah counties, Oklahoma, and Crawford, Franklin, Johnson, and Pope counties, Arkansas
Region 5 (Central Arkansas)	113.2	Arkansas	Pope, Conway, Van Buren, Cleburne, White, and Jackson
Region 6 (Cache River, Crowley's Ridge Area, and St. Francis Channel)	54.5	Arkansas	Jackson, Cross, and Poinsett
Region 7 (Arkansas Mississippi River Delta and Tennessee)	42.9	Arkansas and Tennessee	Poinsett and Mississippi counties, Arkansas, and Tipton and Shelby counties, Tennessee
Total Length of the Applicant Proposed Route	721.5		

2.1.2.2.1 Right-of-Way

Construction and operations of the HVDC transmission line would require ROW easements, which would typically be 150 to 200 feet wide. The analyses of impacts in Chapter 3 are based on a representative 200-foot wide ROW within a 1,000-foot corridor. The ROW easements for the HVDC transmission line would be identified within the selected corridor. The final location of the ROW within the corridors for the HVDC transmission line would be determined following the completion of the NEPA process, engineering design, and ROW acquisition activities. Figure 2.1-18 (located in Appendix A) depicts the ROW requirements for the HVDC transmission line.

The width of easements is related to the required clearance distances for the conductors, which are dictated by the NESC. They are directly related to the structure height, span width, and terrain. The width of an easement would be wider than typical where tall structures, wider spans, or terrain demands greater horizontal clearance to maintain safe clearances. To date, the Applicant has identified two locations where the easement would be significantly wider than the typical 150 to 200 feet. These include the Arkansas River and the Mississippi River crossings, where the easement could be as wide as 200 to 550 feet. Preliminary engineering indicates that the easement widths in these two locations are likely to be near the middle of this range.

Section 2.1.3 provides information relating to the acquisition of ROW easements and Section 2.1.5.1 describes restrictions on other uses within the ROW during operations and maintenance.

2.1.2.2.2 Structures

The structures used to support the HVDC transmission line would be constructed using a mix of either tubular (monopole) or lattice steel and would typically range in height from 120 to 200 feet. Structure heights, span lengths, and vertical clearance would be determined in accordance with the NESC, the Applicant's design criteria, and applicable standards and laws. The Applicant may use taller structures in circumstances where additional clearances and/or longer spans are required. The dimensions and land requirements of typical lattice and monopole structures are summarized in Table 2.1-4 and depicted in Figures 2.1-19 through 2.1-21 (located in Appendix A). In addition to typical structures, there would be limited use of lattice crossing structures (presently planned for the crossing of the Mississippi River and the Arkansas River). These crossing structures would be constructed of lattice steel and could approach 350 to 380 feet in height at the Mississippi River crossing and 200 to 250 feet in height at the Arkansas River crossing (up to 200 feet on the western bank and up to 250 feet on the eastern bank) in order to maintain necessary clearance over the navigable channels. There could also be limited use of guyed structures, either tubular or lattice steel.

The span length for a transmission line is measured along the centerline between structures. For perspective, a structure spacing of six structures per mile would result in an average span length of 880 feet. At the Arkansas River, preliminary engineering indicates that the span length would be approximately 2,000 feet. At the Mississippi River, preliminary engineering indicates that the span length would be approximately 3,300 feet. These preliminary estimates are subject to change based on final engineering and site conditions (e.g., soil, structural, or geotechnical constraints).

Table 2.1-4:
HVDC Transmission Line Facility Dimensions and Land Requirements

Facility	Construction Dimensions[1]	Operation Dimensions[1]
ROW	200 feet wide x approximately 720 miles long.	200 feet wide x approximately 720 miles long.
Lattice Structures	Structure assembly area 200 feet wide (ROW width) x 200 feet long (within ROW), 4 to 6 areas per mile (one for each structure).	Structural footprint 28 feet x 28 feet (typical); 120 to 200 feet tall, 4 to 6 structures per mile.
Monopole Structures	Structure assembly area 200 feet wide (ROW width) x 200 feet long (within ROW), 5 to 7 areas per mile (one for each structure).	Structural footprint 7 feet x 7 feet (typical); 120 to 160 feet tall, 5 to 7 structures per mile.
Guyed Structures	Structure assembly area 200 feet wide x 300 feet long with the ROW as necessary in limited situations.	Structural footprint 7 feet x 7 feet typical (does not include guy wire[s]), 120 to 200 feet tall, as necessary in limited situations.
Lattice Crossing Structures	Structure assembly area 200 to 550 feet wide x 300 feet long as necessary in limited situations (e.g., Mississippi River and Arkansas River crossings), assumed within the 1,000-foot-wide corridor.	Structural footprint 70 feet x 70 feet (380-foot-tall version) 200 to 380 feet tall as necessary in limited situations.
Fiber Optic Regeneration Sites	100 feet wide x 100 feet long with one site every 50 to 55 miles (720 miles/1 site every 50 miles = approximately 14 sites), typically outside the ROW (but within 750 feet) and within the 1,000-foot-wide corridor.	100 feet wide x 100 feet long, 75 feet wide x 75-foot-long fenced area, control building 12 x 32 feet and 9 feet tall and within the fenced area, permanent access road to the fenced area, power supply to control building, backup power generator and fuel supply.

1 Final design and/or dimensions may differ from typical dimensions expressed here.

The Applicant would select structure types at locations along the Project ROW based on these and other factors: land use, engineering efficiency, and existing facilities. Generally, the Applicant expects to use lattice structures for longer spans in open and wooded terrain and tubular (monopole) steel structures for spans that are shorter in length. The Applicant anticipates using guyed structures only in open grass or shrub terrain.

The Applicant would use either galvanized or weathering steel structures. Pier foundations, screw piles, caissons, concrete footings, guying, or other appropriate foundations would support the structures based on engineering considerations, cost, and land use. Structures would be directly embedded if loading and soil conditions at a specific site allow for direct burial. The structure footprint would vary by structure type as provided in Table 2.1-4.

The Applicant would complete final design for the HVDC transmission line after a final route has been chosen and subsequent detailed engineering studies and ROW acquisition activities have been completed. The final design and location of the transmission line would be consistent with the project description and analysis contained in the Plains and Eastern EIS. Drawings of the guyed structures are included as Figures 2.1-22 through 2.1-24 (located in Appendix A). A lattice crossing structure is shown in Figure 2.1-25 (located in Appendix A).

Further information and details regarding the HVDC transmission line including conductor types, metallic return, optical ground wire, communication facilities, and fiber optic regeneration sites are included in Appendix F.

2.1.2.3 AC Collection System

In addition to the HVDC transmission line, the Applicant Proposed Project would also include construction and operations and maintenance of AC collection system transmission lines to collect energy from generation resources in the Oklahoma and Texas Panhandle regions. The collection system would consist of four to six AC transmission lines up to 345kV from the Oklahoma converter station to points in the Oklahoma and Texas Panhandle regions to facilitate efficient interconnection of wind energy generation. Components of the AC collection system include:

- ROW easements for the transmission line, with a typical width of 150 to 200 feet
- Tubular or lattice steel structures used to support the transmission line
- Electrical conductor
- Communications/control and protection facilities (optical ground wire (OPGW) and fiber optic regeneration sites)

The Applicant expects that the points of interconnection from generation facilities would be located in the Oklahoma Panhandle and the Texas Panhandle, within approximately 40 miles of the Oklahoma converter station. The Applicant based the 40-mile radius on preliminary studies of engineering constraints and wind resource data, industry knowledge, and economic feasibility. Wind energy generation facilities (wind farms) would connect to the AC collection system by way of a number of possible configurations. These configurations could range in size from a direct tap, a bus ring, or even a small substation (about 2 to 5 acres in size) with transformer and switching equipment. The type and size of these AC connections is unknown at this time; the final design of these facilities would depend on a number of factors including their location, the number of connections, and the nameplate capacity and voltage of generation facilities.

Figures 2.1-17a and 2.1-26 (in Appendix A) depict the siting area for the AC collection system in the Oklahoma and Texas Panhandle regions. This EIS refers to possible locations of the AC collector lines as the AC collection system routes. These routes do not represent alternatives for DOE selection. Rather, future development of AC transmission lines within these possible routes would be driven by the locations of wind farms that may be constructed in the future to connect to the Project. Of the 13 possible routes identified, the Applicant anticipates that only 4 to 6 of these routes would be developed (Clean Line 2014b). The counties crossed by the AC collection system routes are provided in Table 2.1-5. Table 2.1-6 provides the typical facility dimensions and land requirements for construction and operations and maintenance of the AC collection facilities.

Table 2.1-5:
Counties Potentially Crossed by the AC Collection System Routes

Route	Length (Miles)	State	Counties
E-1	29.0	Oklahoma	Texas and Beaver
E-2	40.0	Oklahoma	Texas and Beaver
E-3	40.1	Oklahoma	Texas and Beaver
NE-1	29.9	Oklahoma	Texas
NE-2	26.2	Oklahoma	Texas
NW-1	51.9	Oklahoma	Texas and Cimarron
NW-2	56.0	Oklahoma	Texas and Cimarron
SE-1	40.2	Oklahoma	Texas
		Texas	Hansford and Ochiltree
SE-2	13.3	Oklahoma	Texas
		Texas	Hansford
SE-3	49.0	Oklahoma	Texas and Beaver
		Texas	Ochiltree
SW-1	13.3	Oklahoma	Texas
		Texas	Hansford
SW-2	37.0	Oklahoma	Texas
		Texas	Hansford and Sherman
W-1	20.8	Oklahoma	Texas

Table 2.1-6:
AC Collection System Facility Dimensions and Land Requirements

Facility	Construction Dimensions[1, 2]	Operation Dimensions[1, 2]
ROW	Four to six 345kV ROWs each: 150–200 feet wide x extending up to 40 miles from the converter station, (assumes 300 miles of 345kV for the AC collection system on the western end of the Project).	Four to six 345kV ROWs each: 150–200 feet wide x extending up to 40 miles from the converter station
345kV—Lattice Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile.	Structural footprint 28 feet x 28 feet (typical for lattice structures) 75 to 180 feet tall, 5 to 7 structures per mile.
345kV—Tubular Pole Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile, (300 x 6 structures per mile = 1,800 total structures for 345kV AC, it is assumed that half [900] would be monopole).	Structural footprint 7 feet x 7 feet (typical for tubular pole structures), 75 to 180 feet tall, 5 to 7 structures per mile.

Table 2.1-6:
AC Collection System Facility Dimensions and Land Requirements

Facility	Construction Dimensions[1, 2]	Operation Dimensions[1, 2]
345kV H-Frame Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile.	Structural footprint two poles spaced 25 feet apart each with a 7 feet x 7 feet footprint (typical for H-frame structures) 75 to 180 feet tall, 5 to 7 structures per mile.
Fiber Optic Regeneration Site	100 feet wide x 100 feet long (outside the ROW), 345kV: approximately 6 sites required, outside the ROW and near the ROW (within 750 feet) but not necessarily abutting the ROW.	100 feet wide x 100 feet wide, 75 feet wide x 75-foot-long fenced area, control building 12 x 32 feet and 9 feet tall, within the fenced area, permanent access road to the fenced area, power supply to control building, backup power generator and fuel supply

1 Final design and/or dimensions may differ from typical dimensions expressed here.

2 The AC collection system transmission lines may not consist of a straight line from the converter station to the wind farms and therefore could be longer than 40 miles.

2.1.2.3.1 Right-of-Way

ROW easements for the AC transmission lines, with a typical width of approximately 150 to 200 feet, would be required. The ROW requirements for the AC transmission line are depicted on Figure 2.1-27 (located in Appendix A). Restrictions on other uses within the ROW during operations and maintenance are described in Section 2.1.5.1. Section 2.1.3 provides information relating to the acquisition of ROW easements.

2.1.2.3.2 Structures

The structures used to support the AC transmission lines would be constructed of either tubular (monopole) or lattice steel and would generally range in height from 75 to 180 feet. The Applicant would determine structure heights, span lengths, and vertical clearance in accordance with the NESC, the Applicant's design criteria, and all applicable standards and laws. The Applicant may use taller structures in circumstances where additional clearances and/or longer spans are required based on engineering review.

The Applicant would construct the structures of either galvanized or weathering steel. Pier foundations, screw piles, caissons, concrete footings, guying, or other appropriate foundations would support the structures based on engineering considerations, cost, and land use. Structures could be directly embedded if loadings and soil conditions at a specific site allow for direct burial. The structural footprint would vary by structure type as described in Table 2.1-6 and depicted in Figures 2.1-5 through 2.1-10 (located in Appendix A).

Further information and details regarding the analytical assumptions for the AC collection system including conductor types, metallic return, optical ground wire, communication facilities, and fiber optic regeneration sites are included in Appendix F.

2.1.2.4 Access Roads

Access roads would be necessary for the Project. The Applicant would use existing access roads, improve existing roads where necessary, and build new roads where required to access facilities, transmission ROWs, structures, fiber optic regeneration sites and work areas during construction, operations and maintenance. The Applicant does not anticipate the need for a permanent access road along the entire length of transmission line ROWs. The Applicant would use existing roads to the extent practicable and would locate access roads between structures in active agricultural areas along fence lines or field lines where practicable to minimize impacts. Where existing roads are not available, the Applicant would construct new roads. Paving of roads would be limited to approach aprons at intersections with existing paved roads and all-weather access roads to converter stations, unless otherwise required by jurisdictional authorities.

Site conditions, engineering design, construction requirements, adopted environmental protection measures and relevant permits would govern the specific locations of proposed new access roads. The Applicant's road construction standards would comply with the applicable jurisdictions' requirements.

The road types, definitions and the typical access road dimensions during construction and operations and maintenance are included in Table 2.1-7. Typical access roads are depicted on Figure 2.1-28 (located in Appendix A).

Table 2.1-7:
Access Roads Dimensions and Land Requirements

Road Type	Definition	Construction Dimensions[1]	Operation Dimensions[1]
Existing Roads			
Existing Roads with No Improvements (Public and Private Roads)	Existing roads with no improvements include public roads maintained by local or state jurisdictions. Private roads that can support construction traffic with no improvements are also included in this category.	Existing roads that require no improvements would support construction of the Project as is. No road construction or ground disturbance expected.	Roads would be retained as is where practical for maintenance and operations.
Existing Roads that May Need Repairs (Private Roads)	Existing roads that may need repairs include most dirt and unimproved two-track roads on private land (not publically maintained roads), which are generally in a condition that supports construction traffic with repairs in some spots. No improvements to public roads are planned for construction. Examples of repairs would include grading to remove potholes or surface ruts over short distances. In many cases, grading would include reshaping the surface to promote drainage from the travel surface. In some cases, it may be necessary to replenish and re-grade gravel-surfacing material.	Typically, 14-foot-wide travel surface at straight sections and 16 to 20 feet wide at corners. Construction disturbance would typically include a total corridor up to 35 feet wide for these roads in limited areas where repairs are needed. It is assumed that the new disturbance width would be reduced by the width of the existing road (e.g., 35-foot-wide construction corridor – 16-foot-wide existing road = 19-foot-wide new disturbance). In areas with steep side slopes (greater than 15%), the construction disturbance corridor may be up to 50 feet wide.	Roads would be retained as is where practical for maintenance and operations.

Table 2.1-7:
Access Roads Dimensions and Land Requirements

Road Type	Definition	Construction Dimensions[1]	Operation Dimensions[1]
Existing Roads that Need Improvements (Private Roads)	Existing roads that need improvements include private roads along which modifications to alignment, structural improvements, or drainage improvements would be required before they could be used for construction and/or operations and maintenance of the Project. These roads could not support construction traffic without significant upgrades. Examples include private roads that traverse numerous drainages, exhibit severe rutting, or have sharp switchbacks. Structural improvements typically involve excavation and replacement of unstable roadbed with structural embankment fill over geotextile and gravel surfacing.	Typically, 14-foot-wide travel surface at straight sections and 16 to 20 feet wide at corners. Construction disturbance would typically include a total corridor up to 35 feet wide for these roads. It is assumed that the new disturbance width would be reduced by the width of the existing road (e.g., 35-foot-wide construction corridor – 16-foot-wide existing road = 19-foot-wide new disturbance). In areas with steep side slopes (greater than 15%), the construction disturbance corridor may be up to 50 feet wide.	Roads would be retained as constructed where practical for maintenance and operations.
New Roads			
New Overland Travel Roads (no improvements needed) (Private Roads)	Overland-travel roads include routes that are created by direct vehicle travel over low-growth vegetation and do not require clearing or grading. Existing low-growth vegetation would be maintained where practicable.	Typically, 14-foot-wide travel surface at straight sections and 16 to 20 feet wide at corners. There would be no clearing or grading for these roads. Construction traffic would occur over an area 14-20 feet wide.	Roads would be retained where practical for maintenance and operations. The Applicant estimates that 75% of these roads would be retained for operations and maintenance access. The remaining 25% would be abandoned and terrain would be restored to the extent practicable.
New Overland Travel Roads with Clearing (Private Roads)	New overland travel roads with clearing include overland travel routes that require clearing and minor grading using heavy machinery to remove larger vegetation or other obstructions in some locations to ensure safe vehicle operation and access.	Typically, 14-foot-wide travel surface at straight sections and 16 to 20 feet wide at corners. Construction disturbance would typically include a total corridor up to 35 feet wide for these roads. In areas with steep side slopes (greater than 15%), the construction disturbance corridor may be up to 50 feet wide.	Roads would be retained as constructed where practical for maintenance and operations. The Applicant estimates that 90% of these roads would be retained for operations and maintenance access. The remaining 10% would be abandoned and terrain would be restored to the extent practicable.

Table 2.1-7:
Access Roads Dimensions and Land Requirements

Road Type	Definition	Construction Dimensions[1]	Operation Dimensions[1]
New Bladed Roads (Private Roads)	New bladed roads may be constructed to access structures in steep or uneven terrain. Bladed roads are generally used on side slopes greater than 8% and are shaped to provide drainage. New bladed roads are typically un-surfaced unless required by the applicable jurisdiction, although gravel surfacing may be required where soil and moisture conditions would otherwise contribute to surface erosion or rutting.	Construction disturbance for these roads would typically be 35 feet wide (for 90% of the new bladed roads used for the Project). In areas with steep side slopes (greater than 15%), construction disturbance may be up to 50 feet wide. (It is assumed that less than 10% of new bladed roads for the Project would be up to 50 feet wide.)	Roads would be retained as constructed where practical for maintenance and operations. The Applicant estimates that 90% of these roads would be retained for operations and maintenance access. The remaining 10% would be abandoned and terrain would be restored to the extent practicable.

1 Final design and/or dimensions may differ from typical dimensions expressed here.

As described in Section 2.4 of Appendix F, the Applicant used a desktop analysis of 10 existing high-voltage transmission lines (10-mile reference lines) across the Project area in the proximity of the Applicant Proposed Route and DOE alternative routes. The Applicant used engineering judgment to estimate the typically required length and type of access roads necessary for construction of these reference lines and to estimate the percent of access roads typically inside and outside of the Project ROW. The typical values derived from this desktop analysis were applied for the length of the HVDC and AC transmission lines to develop the estimated access road miles for the Project. The estimated length (by road type within each state) for access roads associated with HVDC and AC transmission lines (which includes those associated with the fiber optic regeneration sites)is provided in Table 2.1-8 and 2.1-9, respectively. The Applicant would use existing public roads during construction and operations and maintenance of the Project to the extent practicable, and has no plans for improvements to public roads.

Table 2.1-8:
Estimated Access Road Miles by Road Type for HVDC Transmission Lines

Road Type	OK	AR	TN	Totals
Existing Roads that Need Improvements (miles)	45	64	4	113
Existing Roads that May Need Repairs (miles)	145	44	3	192
New Overland Travel Roads (miles)	269	180	11	460
New Overland Travel Roads with Clearing (miles)	91	75	4	170
New Bladed Roads (miles)	25	23	4	52
Totals (miles)	575	386	26	987
Total Disturbance (acres)	1,400	1182	78	2,660
Road Miles In ROW (percentage)	55	77	58	
Road Miles Outside ROW (percentage)	45	23	42	
Inside ROW (acres)	770	910	45	
Outside ROW (acres)	630	272	33	

Table 2.1-9:
Estimated Access Road Miles by Road Type for AC Transmission Lines

Road Type[1]	OK/TX[2]	AR	TN	Totals
Existing Roads that Need Improvements (miles)	5	2	1	8
Existing Roads that May Need Repairs (miles)	27	1	1	29
New Overland Travel Roads (miles)	253	3	1	257
New Overland Travel Roads with Clearing (miles)	0	2	1	3
New Bladed Roads (miles)	2	1	1	4
Totals (miles)	287	9	5	301
Total Disturbance (acres)	643	22	4	669
Road Miles In ROW (percentage)	85	78	85	
Road Miles Outside ROW (percentage)	15	22	15	
Inside ROW (acres)	547	17	3	
Outside ROW (acres)	96	5	1	

1 AC transmission lines include those proposed for AC interconnection at the converter stations and those proposed for the AC collection system.

2 The column for access road miles represents both Oklahoma and Texas and is not further segregated since the locations of the actual AC transmission lines for the AC collector system are not yet known and would be determined based on the locations of future wind farms.

2.1.3 Easements and Property Rights

Prior to construction, the Applicant or DOE, if it elects to participate in the Project, would acquire property interests from owners of land along the path of the Project. These interests could take the form of a temporary easement to allow for access roads and storage yards that will be needed during construction. They could also take the form of longer term easements or fee estates (i.e., full ownership), for siting transmission line structures, converter stations, and other facilities.

Any property interests in land needed for the Project would be acquired through a negotiated sale or eminent domain proceedings, where the land owners would be compensated for their property interests. According to the Applicant's expressed intent, the first step would be for the Applicant to offer compensation to landowners in exchange for easements or other property interests needed for the Project. If the Applicant is unable to acquire the necessary property interests from a landowner through a negotiated agreement, DOE may choose to acquire those property interests through a negotiated agreement for compensation. Where a negotiated agreement is not possible, DOE may in appropriate circumstances exercise the federal government's eminent domain authority to acquire the interests. Consistent with the Constitution of the United States and other applicable law, the landowner would be paid just compensation for the real estate interest. Real estate acquisition by federal entities, such as DOE, is governed by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646) (42 USC 4601 et seq.). DOE must also comply with 49 CFR Part 24, Subpart B, "Real Property Acquisition," the government-wide regulation that implements Public Law 91-646.

2.1.4 Proposed Project Construction

This section provides an overview for typical construction activities associated with different elements of the Project. A detailed description of construction of the converter stations, HVDC and AC transmission lines, AC collection system, and access roads is provided in Appendix F. Appendix F also provides estimates of the construction workforce, crew types (based on construction activities), crew numbers, average daily production rates per crew, construction equipment, local traffic from construction, and local vs. non-local workers.

The Applicant would implement the EPMs listed in Appendix F to avoid or minimize potential impacts from construction of the Project. Construction activities described in Appendix F would incorporate and be subject to the Environmental Protection Measures as well as measures/requirements imposed as part of federal or state permits and authorizations. The implementation and monitoring of these EPMs are discussed in Section 3.1 of the Plains & Eastern EIS.

The construction of a typical converter station would include:

- Land surveying and staking
- Pre-construction surveys for biological and cultural resources
- Clearing and grubbing, grading, and construction of all-weather access roads
- Fencing
- Compaction and foundation installation
- Installation of underground electrical raceways and grounds
- Steel-structure erection and area lighting
- Installation of insulators, bus bar, and high-voltage equipment
- Installation of control and protection equipment
- Placement of final crushed-rock surface
- Installation of security systems, including cameras
- Testing and electrical energization

The construction of a typical converter station would begin with survey work, geotechnical sample drillings, and soil resistivity measurements. The site-development work would include grubbing and reshaping the general grade to form a relatively flat (1 percent slope maximum) working surface. This effort also would include the construction of all-weather access roads. The Applicant would erect a chain-link fence (8 to 10 feet tall) around the perimeter of the station to prevent unauthorized personnel from accessing the construction and staging areas. The perimeter fence would be a permanent safety feature to prevent the public from accessing the station. The Applicant would compact the excavated and fill areas to the required densities to allow structural foundation installations. Following the foundation installation, underground electrical raceways and copper ground-grid installation would take place, followed by steel-structure erection and area lighting. The steel-structure erection would overlap the installation of the insulators and bus bar as well as the installation of the various high voltage apparatus (typical of an electrical substation). The installation of the high voltage transformers would require special high-capacity cranes and crews (as recommended by the manufacturer) to be mobilized for the unloading, setting-into-place, and final assembly of the transformers.

Construction activities for the HVDC and AC transmission lines would typically include the following activities:

- Preparation of multi-use construction yards
- Pre-construction surveys for biological and cultural resources
- Preparation of the ROW
- Clearing and grading
- Foundation excavation and installation
- Structure assembly and erection
- Conductor stringing
- Grounding
- Cleanup and site restoration

Figure 2.1-29 located in Appendix A illustrates these activities and the typical transmission construction sequence.

The duration of construction is expected to be approximately 36 to 42 months for the entire Project, including the time from initiation of clearing and grading through cleanup and restoration. The actual construction duration would depend on a number of factors such as weather and availability of labor. The Applicant would most likely divide the construction of the HVDC transmission line into several segments with multiple contractors working concurrently on different portions of the route to accomplish this schedule and to maintain effective management of construction activities and allocation of resources. For the purposes of estimating resource needs for construction, the Applicant has assumed that the HVDC transmission line would be divided into five construction segments of approximately 140 miles in length. The Applicant would construct the four to six AC collection lines that would range in length from 13 to 56 miles, depending on the routes required (based on the location of future wind farms) (see Table 2.1-5). The construction crews would complete each of the individual activities required for construction along each segment in assembly line fashion (see Figure 2.1-29 in Appendix A and Appendix F). Construction may be active on any or all segments at any given time and activities may occur in parallel with other segments or staggered.

The Applicant expects that the duration of construction for either a HVDC segment or a shorter AC collection system route would be approximately 24 months from mobilization of equipment to site restoration. The construction personnel peak in any HVDC segment (or AC collection system route) would be approximately 290 workers. This peak would occur when the structure setting operations begin, while several other operations are occurring at the same time. The size, number, and average daily production of each crew type are included in Appendix F, along with an estimate of construction workforce over time. The Applicant would stage construction on each segment from multi-use construction yards located at regular intervals (approximately every 25 miles) along the route.

Project-wide, the workforce would reach a peak of approximately 1,700 workers. The average workforce across the Applicant Proposed Project would be approximately 965 people.

2.1.4.1 Temporary Construction Areas

Temporary construction areas would be required to support construction. Temporary multi-use construction yards and fly yards (landing areas for helicopters used during construction) would be used for staging construction personnel and equipment, and for storage of materials to support construction activities. Tensioning and pulling sites and wire-splicing sites (described in more detail below) would also be staged at 2- to 3-mile intervals along the Project ROW. Typically (with the exception of tensioning and pulling sites addressed below), temporary construction areas would be outside the ROW. These areas would be sited at regular intervals and at convenient distances (described below) from the facilities being constructed for the Project.

2.1.4.1.1 Tensioning and Pulling Sites

Tensioning and pulling sites would typically be approximately 2 to 3 miles apart. Land requirements for typical tensioning and pulling sites (listed in Appendix F) would be either entirely within the ROW or partially outside the ROW, depending on the structure type (e.g., mid-span or deadend). Where the transmission line turns (requiring a deadend structure type), the tensioning and pulling sites may extend outside of the ROW to maintain a straight line with the ground wire and conductor being pulled as shown in Figure 2.1-30 (located in Appendix A).

2.1.4.1.2 Multi-use Construction Yards

Multi-use construction yards would be used primarily for staging of construction personnel and equipment and for material storage to support construction activities (Figure 2.1-31 in Appendix A). The Applicant would locate multi-use construction yards outside the ROW and typically at intervals of approximately 25 miles. Additionally, they would be located within approximately 10 miles of the ROW or Project facility. Typical multi-use construction yards would be approximately 25 acres in size, fenced, and access-controlled.

The Applicant may arrange individual multi-use construction yards differently, but typical sites would include areas designated for a field office, crew parking, sanitation, waste management, fueling, equipment wash, material storage, equipment storage, and fly yard. The Applicant would base fuel trucks, maintenance trucks, and construction crews in multi-use construction yards. The Applicant would store any fuel, lubricants, antifreeze, detergents, paints, solvents, and/or other chemicals used during construction at the multi-use construction yards consistent with standard practices and relevant permits.

Portable concrete batch plants would be located within multi-use construction yards where needed. Concrete would be required for construction of foundations for transmission structures, foundations for transformers and electrical equipment at converter stations, and foundations at fiber optic regeneration sites. Concrete would be delivered to structure sites and ancillary facilities in concrete trucks with a capacity of up to 10 cubic yards. The Applicant would obtain concrete from commercial ready-mix concrete producers to the extent practicable. In locations where haul times exceed 45 minutes (a haul distance of approximately 25 to 30 miles), concrete would be dispensed from portable concrete batch plants located within a multi-use construction yard. Based on preliminary review of commercial ready-mix plants in proximity to the Project, the Applicant may require up to four temporary batch plants for the HVDC transmission line and two for the AC collection system (where the haul distance may exceed 25 to 30 miles).

2.1.4.1.3 Fly Yards

The Applicant would use helicopters for conductor stringing operations and/or for transport and erection of structure sections during construction. The Applicant would locate helicopter landing areas (fly yards) at approximately 5-mile intervals along the ROW. Approximately 20 percent of fly yards would be collocated within multi-use construction yards. All other fly yards would be located near the ROW. Typical fly yards would be approximately 5 acres or less in size.

The Applicant may arrange individual fly yards differently, but typical sites would include areas designated for helicopter landing, crew parking, sanitation, waste management, refueling, and temporary material staging. Fly yards would be operated and maintained consistent with standard practices and relevant permits.

2.1.4.1.4 Wire Splicing Sites

Typically, wire-splicing sites would be located within the ROW. Conductors and shield wires (wires) are strung into their supporting structures over a length of two reels. The wire from the two reels would be mechanically joined at the wire ends with a temporary steel wire-gripping sleeve (stringing sock) which would pass through the stringing blocks. After the wire is strung and secured, the stringing sock would be replaced with a compression splice connector. The splice connector installation would occur at the wire splicing site. Typical wire splicing sites include a wire splicing truck and a line truck to facilitate installation.

2.1.4.1.5 Fiber Optic Cable Regeneration Sites

As a data signal passes through fiber optic cable, it degrades with distance. This data signal must be regenerated or amplified every 50 to 55 miles at fiber optic regeneration sites. The facilities and land requirements for a regeneration site are shown in Figure 2.1-32 (located in Appendix A). Fiber optic cable would be buried using the two basic methods of direct burial installation: trenching and plowing. Trenching involves digging a trench, placing the cable in the trench, and backfilling with native soils. Trenches are often dug with backhoes using narrow buckets (18 inches wide or less) to a depth of approximately 42 inches and are visually inspected for rocks or debris that could potentially damage the cable. In some instances, conduit is laid in the trench and the cable pulled through the conduit. Plowing involves a cable-laying plow designed to simultaneously excavate a ditch and lay the cable. Native soil would be used to backfill the trench.

2.1.5 Operations and Maintenance

All transmission lines would be inspected regularly or as necessary using fixed-wing aircraft, helicopters, ground vehicles, all-terrain vehicles, and/or personnel on foot. The frequency of inspections and maintenance would be meet or exceed standards, such as those specified by the NESC and North American Electric Reliability Corporation (NERC). Applicable federal, state, and local permits would be obtained prior to conducting maintenance. Maintenance activities for facilities would be similar to activities during construction but generally smaller in scale and more localized.

The ROW would be maintained during operations and maintenance in accordance with a Project-specific Transmission Vegetation Management Plan developed by the Applicant, consistent with rules developed by NERC. A wire zone (Figures 2.1-18 and 2.1-27 located in Appendix A) typically consists of low-growing grasses, legumes, herbs, crops, ferns, and shrubs where the conductor is 50 feet or less from the ground to prevent accidental grounding contact with conductors. A border zone (i.e., to the edge of the ROW) is managed to consist of tall shrubs or short trees (up to 25 feet in height at maturity), grasses, and other low-growing vegetation. In most areas, accepted standard utility practices consistent with the Transmission Vegetation Management Plan, such as tree-trimming, tree removal, and/or brush removal, would be utilized to maintain vegetation within the ROW. In addition, vegetation clearing practices may vary based on dominant plant communities.

The Applicant expects that operations and maintenance of the Project would require 72 to 87 full-time workers. This would include up to 15 workers at each of the converter stations and 42 workers in Oklahoma and Arkansas for the HVDC transmission line.

2.1.5.1 Permitted Uses within the Right-of-Way

Land uses compatible with reliability and safety requirements for HVDC and AC facilities would be permitted in and adjacent to the ROW. Existing land uses such as agriculture and grazing, vehicle and pedestrian access, recreation uses, and pre-existing compatible land uses are generally permitted. Incompatible land uses within the ROW include construction and maintenance of inhabited dwellings and any use requiring changes in surface elevation that affect electrical clearances of existing or planned facilities.

Good utility practice, NERC rules, and the planned design, maintenance, and operations of the line were used to develop height restrictions of activities within the ROW that would maintain the minimum clearance requirements as determined from the NESC. Once a route has been established, the Applicant would review the route for non-standard activities that may require adjustments to minimum clearances.

Limitations on land uses would be described in the easement agreements; these limitations could be modified in the easement based on site-specific conditions and/or coordination with landowners. Limitations on uses within the ROW could include the following:

- A prohibition on placing a building or structure within the ROW
- Restrictions on timber or orchards within the ROW
- Restrictions on grading and land re-contouring within the ROW that would change the ground surface elevation within the ROW
- Restrictions and required coordination for the construction of future allowed facilities such as fences or irrigation lines within the ROW
- Restricted access during performance of maintenance activities

2.1.5.2 Safety and Reliability

Safety and reliability are primary concerns. The Project would be designed to meet or exceed applicable criteria and requirements outlined by organizations such as the Federal Energy Regulatory Commission (FERC), NERC, NESC, SPP, TVA, the American Society of Civil Engineers, and other applicable federal, state, or local requirements. Safety measures would meet or exceed applicable occupational safety and health standards. The transmission line would be protected with circuit interruption equipment (circuit breakers, disconnects, etc.). If the conductor were to fail, power would be automatically removed from the line. Lightning protection would be provided by overhead ground wires. Electrical equipment and fencing at the converter stations would be grounded. Vegetation management would occur to minimize potential hazards; trees would be trimmed or removed to prevent accidental grounding contact.

As is done with typical transmission line operations, the Applicant would turn over functional control of the Project to a Regional Transmission Organization (RTO)/Independent System Operation (ISO) or an RTO-like entity. For the Project, this could include SPP, TVA, or a third party. Functional control of a facility means that the RTO ensures the Applicant's tariff is administered transparently. In addition, a NERC compliance program would be established and maintained either by the Applicant or by a third party to which the compliance requirements are delegated. Coordination agreements—also known as seams agreements—would be negotiated and executed with all interconnection parties. Balancing area functions would be performed by the Applicant or a third party acting as the Transmission Operator on behalf of the Applicant.

2.1.6 Decommissioning

Decommissioning could occur at the end of the useful life and if the facilities were no longer required. However, a transmission system lifetime can exceed 80 years with proper maintenance. At the end of the service life of the Project, assuming that the facilities were not upgraded or otherwise kept in service, conductors, insulators, and structures could be dismantled and removed. The converter stations and regeneration stations, if not needed for other existing transmission line projects, could also be dismantled and removed. The station structures would be disassembled and either used at another station or sold for scrap. Access roads that have a sole purpose of providing maintenance crews access to the transmission lines could be decommissioned following removal of the structures and lines, or could be decommissioned with the lines in service if determined to no longer be necessary. The Applicant would consult with landowners to assess whether access roads may be serving a purpose for landowners, at which point in time, the Applicant may elect to leave the access roads in place. A Decommissioning Plan would be developed prior to decommissioning and would follow applicable governing requirements at that time.

2.1.7 Environmental Protection Measures

For the purpose of all analyses for the EIS, it is assumed that the Applicant would conduct each phase of the Project in compliance with applicable federal, state and local laws, regulations and permits related to construction, operations and maintenance and decommissioning of the Project. Appendix C presents an overview of potential federal and state permits and consultation that could be required for construction of the Project. Local permits and approvals would also be required for the Project.

The Applicant has developed general and resource-specific EPMs to avoid or minimize effects to environmental resources during construction, operations and maintenance, and/or decommissioning of the Project. The resource-specific EPMs include measures to protect land use; soils and agriculture; fish, vegetation, and wildlife; and waters, wetlands, and floodplains. The complete list of EPMs is presented in Appendix F. The EPMs would be made binding through the ROD and terms of participation agreements between DOE and the Applicant. The EPMs would be implemented through a combination of environmental-related plans; compliance with federal, state, and local environmental regulations; and permitting requirements. The specific environmental-related plans that the Applicant has identified and described in Appendix F include:

- Transportation and Traffic Management Plan
- Blasting Plan
- Restoration Plan
- Spill Prevention, Control and Countermeasures Plan
- Stormwater Pollution Prevention Plan
- Transmission Vegetation Management Plan
- Avian Protection Plan
- Construction Security Plan
- Cultural Resources Management Planning Documents including Historic Properties Treatment Plan and Unanticipated Discoveries Plan

The Applicant would identify certain areas as “environmentally sensitive” and take actions to avoid and/or minimize effects on these areas to the extent practicable. Environmentally sensitive areas may include: wetlands, certain water bodies, cultural resources, and wildlife habitat.

2.2 Transmission System Planning Processes

2.2.1 System Planning, Interconnections and Reliability

This section explains the processes applicable to the Applicant's requests for interconnections to the existing electrical grid, including the study and assessment of the upgrades and improvements needed for such interconnections. The details of the interconnections are provided in Sections 2.1.2.1.2, 2.1.2.1.3, and 2.4.3.1 for Oklahoma, Tennessee, and Arkansas, respectively. These interconnections are an integral part of the Project. The details of any required upgrades to the transmission systems in these states are provided in Section 2.5.2. These upgrades are being evaluated as connected actions. The Applicant's execution of interconnection agreements (which establish the basic terms and conditions of the interconnection but neither commit Clean Line to build the project nor to identify a specific route) with the two regional transmission organizations and TVA would neither have adverse environmental impacts nor limit the choice of reasonable alternatives.

2.2.1.1 Oklahoma/SPS/SPP Interconnection

Clean Line requested a Point of Interconnection in Oklahoma at the 345kV Hitchland Substation. This substation is owned by Southwestern Public Service (SPS), a subsidiary of Xcel Energy and member of the SPP RTO. This interconnection would be necessary to enable the AC to DC conversion process within the Oklahoma converter station. The interconnection between the proposed Oklahoma converter station and the SPS system would be controlled to a nominal value of zero megawatts.

For Clean Line to interconnect to the SPS system, a series of studies must be performed to review the potential interconnection and identify any upgrades to existing facilities or additions of new facilities to allow a reliable interconnection. SPS is currently performing a facilities study of the requested interconnection to the SPS 345kV system. Based on the SPS analysis completed to date, Clean Line expects that a new substation would be necessary to accommodate the interconnection due to space constraints at the existing Hitchland 345kV substation. To alleviate these space constraints, SPS has proposed a new substation nearby, tentatively named "Optima." Clean Line expects SPS to complete the facilities study by early 2015. After the completion of the facilities study for the interconnection, Clean Line's selected HVDC vendor will incorporate the facilities study results into its study work on the final converter station design. This final study work will identify specific technology solutions such as reactive power requirements and filter design that would be included in the final converter station design. Following completion of these studies, Clean Line anticipates that it would enter into an interconnection agreement with SPS and SPP for the Project.

For the purpose of ensuring integration of the Project into the SPP transmission planning process, and to ensure that the interconnection of the Project would not affect the security or reliability of the SPP system, Clean Line contracted Siemens PTI to conduct steady-state and dynamic power system studies to comply with SPP planning requirements under SPP Criteria 3.5. Clean Line and Siemens PTI presented the results of these studies to the SPP Transmission Working Group and SPP staff for review. Excel Engineering, an external consultant hired by SPP, reviewed the results and confirmed that Siemens PTI's studies were complete and correct. In November 2012, the SPP Transmission Working Group found that Clean Line's reliability study was "consistent with SPP planning processes and as having met [the Project's] coordinated planning requirements under SPP Criteria." The SPP Transmission Working Group indicated that Clean Line may need to update the study after selection of a vendor for the Project. These updates would ensure that the final design of the HVDC converter station complies with criteria set forth in the final interconnection agreement.

2.2.1.2 Arkansas/Entergy/MISO Interconnection

In response to comments received during the public scoping process, an intermediate converter station in Arkansas is being considered as a DOE Alternative (see Section 2.4.3.1). An AC interconnection would be required to deliver power from the intermediate converter station to the existing transmission system owned by Entergy Arkansas, a subsidiary of Entergy Corporation. Entergy Arkansas is part of the Mid-Continent Independent System Operator (MISO) system. Clean Line submitted the interconnection request to MISO in November 2013. Under MISO rules, interconnection requests involve three parties: the system operator (MISO), the transmission owner (Entergy Arkansas), and the interconnecting customer (Clean Line).

Clean Line began the interconnection process in Arkansas by requesting interconnection service from Entergy Arkansas for up to 500MW along the existing Arkansas Nuclear One–Pleasant Hill 500kV transmission line. Clean Line identified and proposed an AC interconnection consisting of a new 500kV transmission line connecting the proposed intermediate converter station to a new substation along the Arkansas Nuclear One–Pleasant Hill 500kV transmission line. Clean Line selected the Arkansas Nuclear One–Pleasant Hill 500kV Point of Interconnection to avoid the need for additional upgrades to the surrounding transmission system and to accommodate a 500MW injection. MISO performed a feasibility study of the request and delivered results to Clean Line in February 2014. The feasibility study showed that no network upgrades would be required to accommodate the interconnection.

Clean Line's next step in the MISO process is to enter the Definitive Planning Phase, which consists of an interconnection SIS and facilities study. The interconnection SIS and facilities study are anticipated to take six months in total to complete. Clean Line anticipates beginning the Definitive Planning Phase in 2015. Following completion of the Definitive Planning Phase process, Clean Line would enter into an interconnection agreement with Entergy Arkansas and MISO.

2.2.1.3 Tennessee Valley Authority Interconnection Process

Clean Line requested interconnection service in Tennessee at the TVA Shelby 500kV substation for interconnection of up to 3,500MW of power. To place this level of power injection in perspective, it is slightly higher than the generating capacity of TVA's only three-unit nuclear plant, and is described by Clean Line as capable of supplying electricity for over a million homes. Clean Line originally requested interconnection in late 2009, at which time TVA performed feasibility studies on the following three potential options: 500kV Shelby Substation, a combination of Cordova 500kV and Weakley 500kV substations, and a new substation that would have connected the Shelby–Lagoon Creek and Cordova–Haywood 500kV transmission lines. Based on studies of these options, Clean Line pursued interconnection at the Shelby Substation.

The final interconnection SIS, completed in March 2014, identified direct assignment facilities and network upgrades associated with the Project. Direct assignment facilities included additional bays, breakers, switches, line relays, and interchange meters to be installed within the Shelby Substation before interconnecting the Project. Direct assignment facilities are required to be constructed and in operations and maintenance to facilitate the energization of the interconnection. Network upgrade projects are those that TVA identified that would allow injection of up to 3,500MW to the TVA transmission system. Some network upgrades may be constructed after initial energization of the interconnection. The interconnection SIS identified scenarios that would be resolved by 30 network upgrades, including upratings, reconductoring, and terminal upgrades on 27 existing 161kV system elements and 3 existing 500kV system elements. The interconnection SIS also identified certain reliability scenarios that would be resolved by a new 500kV transmission line and associated substation upgrades. Following good utility practice, in accordance with a final interconnection agreement, and depending on the results of a Facilities Study, Clean Line may be asked to operate the Project in a way that restricts its full delivery capacity under some limited scenarios until completion of certain network upgrade projects. Additional details regarding these system upgrades are presented in Section 2.5.2.

The next step in the interconnection process is the performance of a Facilities Study in which TVA will determine the detailed designs, costs, and projected schedules for the identified direct assignment facilities and network upgrade projects. During the Facilities Study, TVA also will perform the transient stability analysis, which could identify additional Network Upgrades. TVA anticipates the Facilities Study work will take approximately 24 months, with an estimated completion date in mid-2016. Following completion of the Facilities Study, Clean Line would negotiate an interconnection agreement with TVA.

In addition, given the regional connection of the Shelby Substation to nearby transmission systems operated by other parties, TVA identified the need for two Affected System Impact Studies (ASIS) to evaluate any impacts from the injection of up to 3,500MW into the electric grid. Memphis Light, Gas and Water completed the first ASIS, which showed the need for two wavetraps (terminal equipment) at an existing 161kV substation. Clean Line is coordinating with MISO and Entergy to identify the scope of a second ASIS, expected to be completed within a year.

Prior to providing service as a wholesale interstate electric transmission utility in the state of Tennessee, Clean Line must obtain a certificate of public convenience and necessity (CCN) from the Tennessee Regulatory Authority (TRA) for the Project (Tennessee Code Annotated 65-4-201 and 208). Clean Line submitted an application for the CCN in April 2014 (Clean Line 2014a). To obtain the CCN, Clean Line must show that it has the managerial, technical, and financial ability to operate as a utility within the state of Tennessee, and Clean Line must also show that granting a CCN for the construction of the portion of the Project in Tennessee would serve the public interest.

2.3 Route and Alternative Development

This section briefly describes the process used to identify the proposed locations for each of the Applicant Proposed Project components and alternative routes for the HVDC transmission line. DOE independently reviewed and verified the Applicant-supplied information (per 40 CFR 1506.5[a]).

2.3.1 HVDC Route Development

Clean Line employed a multi-disciplinary team of professionals (referred to as the Clean Line Routing Team) to undertake the route identification process for the HVDC transmission line. Clean Line used a multi-stage approach to develop guidelines and criteria and to apply these guidelines and criteria to identify corridors and refine them. At each stage, Clean Line incorporated public stakeholder input on the development of criteria and the identification of corridors and routes. The Clean Line Routing Team began by identifying potential interconnection locations at the western and eastern endpoints of the Project (DOE 2013). Using these endpoints, the Clean Line Routing Team conducted a route development process that used progressively more detailed and restrictive siting criteria. Through this process, Clean Line identified the proposed converter station siting areas, the Applicant Proposed Route, and route alternatives for the HVDC transmission line.

The Clean Line Routing Team considered and utilized guidelines and criteria consistent with transmission line siting principles used by federal entities such as the Rural Utilities Service, Western, and Bonneville Power Administration.

These principles included identification of opportunity areas (e.g., existing linear corridors, areas of land consistent with or compatible with linear utilities, etc.) and sensitive resources that limited or conflicted with transmission line development (e.g., residences, schools, USFWS-designated critical habitat under the Endangered Species Act, etc.).

The Clean Line Routing Team applied general and technical guidelines intended to avoid conflicts with existing resources, developed areas, and existing incompatible infrastructure; maximize opportunities for paralleling existing compatible infrastructure; and consider land use and other factors. Clean Line's technical guidelines included considerations related to design and engineering of the transmission line. Details regarding the route development process described in the DOE Alternatives Development Report (DOE 2013) are provided in Appendix G of this EIS.

2.3.2 Converter Station Siting

The following section discusses the process that the Clean Line Routing Team used to identify each of the converter station siting areas in the Applicant Proposed Project. An additional converter station in Arkansas also is being evaluated as part of the DOE Alternatives. Information on this alternative is provided in Section 2.4.3.

2.3.2.1 Oklahoma Converter Station

The Clean Line Routing Team identified a western endpoint in Oklahoma based on its evaluation of wind resources, the existing high-voltage transmission system, land use, and environmental sensitivities. Clean Line began the identification process for the western converter station by studying a broad region of northwestern Oklahoma. Clean Line narrowed the study area by considering criteria such as wind resources, available AC transmission interconnection, regional land use compatibility, and environmental sensitivities. Clean Line identified the proposed western converter station siting area based on three primary factors: (1) proximity to a large area of concentrated high capacity factor wind resources; (2) proximity to a point on the existing or planned AC transmission system that would support the interconnection; and (3) proximity to large areas of land uses compatible with wind farm development and which are known to be relatively low in environmental sensitivities. Clean Line concluded that the Oklahoma Converter Station Siting Area best met these criteria.

2.3.2.2 Tennessee Converter Station

The Clean Line Routing Team identified an eastern endpoint in Tennessee based on its evaluation of existing transmission facilities capable of reliable interconnection and delivery of up to 3,500MW of energy to points in Tennessee and elsewhere in the Mid-South and Southeast, the level of potential upgrades required to accommodate the Project, historical transmission congestion, market access, land use, and environmental considerations. Clean Line began the identification process for the eastern converter station by studying a broad geographic region from central Arkansas to western Tennessee. Clean Line concluded that the Tennessee Converter Station Siting Area best met their site selection criteria.

2.4 Alternatives

In the Plains & Eastern EIS, DOE analyzes the potential environmental impacts of the Proposed Action, the range of reasonable alternatives, and a No Action Alternative. In addition, DOE describes below other alternatives to the Proposed Action identified during the EIS scoping process that DOE considered but eliminated from detailed analysis.

This EIS analyzes the potential environmental impacts of the entire Project. This ensures that any decision by DOE or another agency is fully informed. DOE, may decide to participate in any or all of the states in which Southwestern operates, namely Oklahoma, Arkansas, and Texas, However, DOE would not participate in the Project in Tennessee because that state is outside Southwestern's operational area. Other agencies, federal or state, may have jurisdiction over parts of the Project that are located in Tennessee. Some of these agencies could include, but not be limited to, TVA, USACE, and Tennessee state agencies.

2.4.1 No Action Alternative

This Plains & Eastern EIS analyzes a No Action Alternative, under which DOE would not participate with the Applicant in the Applicant Proposed Project or DOE Alternatives. Under the No Action Alternative, DOE assumes for analytical purposes that the Project would not proceed and none of the potential environmental effects associated with the Project would occur.

2.4.2 Applicant Proposed Route

As identified in Section 2.1.2.2, the Applicant has proposed a specific route for the HVDC transmission line from the Oklahoma Panhandle Region to interconnect with TVA's electrical system in western Tennessee. For purposes of analysis, the Applicant Proposed Route is described below in terms of seven regions, which were based on geographic similarities and common node points along the route (where the Applicant Proposed Route and HVDC alternative routes converge). Within each region, the Applicant Proposed Route is divided into links. These links represent sections of the Applicant Proposed Route between points where alternative routes intersect with it. The alternative routes (described in Section 2.4.3.2) diverge from the Applicant Proposed Route and provide an alternative to the corresponding links of the Applicant Proposed Route. The links are labeled on the figures of the Applicant Proposed Route (Figures 2.1-17a through 2.1-17f located in Appendix A).

In some regions the Applicant Proposed Route is outside the 1-mile-wide route corridors presented at the public scoping meetings (referred to as the Network of Potential Routes). Areas where this occurs are described below. Details regarding the route development process are described in the DOE Alternatives Development Report (DOE 2013) and are summarized in Appendix G of this EIS.

2.4.2.1 Region 1 (Oklahoma Panhandle)

Region 1 includes primarily grassland/herbaceous land cover. Region 1 begins at the converter station site in Texas County, Oklahoma, and continues east through Texas, Beaver, Harper, and Woodward counties in Oklahoma approximately 116 miles to the area north of Woodward, Oklahoma. The Applicant Proposed Route in Region 1 would parallel the existing Xcel/OG&E Woodward-to-Hitchland 345kV transmission line for the majority of its length. The Region 1 Applicant Proposed Route is shown on Figure 2.1-17a (located in Appendix A).

The AC collection system is located within Region 1 and within a 40-mile radius centered on the Oklahoma Converter Station Siting Area. To facilitate efficient interconnection of wind generation, it is expected that four to six AC collection transmission lines of up to 345kV from the Oklahoma converter station to points in the Oklahoma and Texas Panhandle regions would be constructed. The Clean Line Routing Team developed thirteen 2-mile-wide AC collection system route corridors between the Oklahoma Converter Station Siting Area and wind development zones. DOE, however, will not be making decisions on the locations on these transmission lines; their location will be driven by future wind development. The AC collection system routes analyzed as part of the Applicant Proposed Project are as follows:

- E-1 parallels section lines, a natural gas transmission pipeline, and the Guymon to Beaver 115-kV electrical transmission line for the majority of its length.
- E-2 parallels the Applicant Proposed Route (HVDC) and the OG&E/Xcel Energy Hitchland to Woodward 345kV transmission line for the majority of its length.
- E-3 parallels section lines, roads, and a natural gas transmission pipeline to the extent practicable.
- SE-1 parallels the Applicant Proposed Route (HVDC), the OG&E/Xcel Energy Hitchland to Woodward 345kV transmission line, section lines and county roads to the extent practicable.
- SE-2 parallels the Finney to Hitchland 345kV electrical transmission line and the Texas County to Spearman 115kV electrical transmission line to the extent practicable.
- SE-3 parallels the Applicant Proposed Route (HVDC), the OG&E/Xcel Energy Hitchland to Woodward 345kV transmission line, section lines and county roads to the extent practicable.
- SW-1 parallels the Finney to Hitchland 345kV electrical transmission line, the Hitchland to Porter 345kV electrical transmission line to the extent practicable.
- SW-2 parallels section lines, the Texas County to Moore County 115kV electrical transmission line for the majority of its length.
- W-1 parallels sections lines and county roads to the extent practicable.
- NW-1 parallels section lines, the Texas County to Moore County 115kV electrical transmission line, county roads, and U.S. Highway 412 to the extent practicable.
- NW-2 parallels sections lines and county roads to the extent practicable.
- NE-1 parallels county roads and section lines to the extent practicable.
- NE-2 parallels section lines, the Finney to Hitchland 345kV electrical transmission line, county roads, and Oklahoma State Route 94 to the extent practicable.

The AC collection system route corridors are shown on Figures 2.1-17a and 2.1-26 (located in Appendix A).

2.4.2.2 Region 2 (Oklahoma Central Great Plains)

Region 2 includes primarily grassland/herbaceous and cultivated crop land covers. Region 2 begins north of Woodward, Oklahoma, and continues southeast through Woodward, Major, and Garfield counties in Oklahoma, for approximately 106 miles to end approximately 16 miles southeast of Enid, Oklahoma. Attributes of the Applicant Proposed Route in Region 2 include:

- The Applicant Proposed Route parallels Western Farmers Electric Cooperative's existing 115kV transmission line, U.S. Route 60, section lines and parcel boundaries, and county roads to the extent practicable.
- A portion of the Applicant Proposed Route is outside the 1-mile-wide area of Link D-2 of the Network of Potential Routes presented at the public scoping meetings. The Clean Line Routing Team sited the Applicant Proposed Route outside the Network of Potential Routes in this area to avoid several center-pivot irrigation systems that were identified during scoping.

The Region 2 Applicant Proposed Route is shown on Figure 2.1-17b in Appendix A.

2.4.2.3 Region 3 (Oklahoma Cross Timbers)

Region 3 includes primarily grassland/herbaceous, deciduous forest, and pasture/hay land covers. Region 3 begins southeast of Enid, Oklahoma, and continues southeast through Garfield, Kingfisher, Logan, Payne, Lincoln, Creek, Okmulgee, and Muskogee counties in Oklahoma for approximately 162 miles and ends north of Webbers Falls, Oklahoma, at the Arkansas River. The eastern portion of Region 3 from Stillwater to the region's terminal point on the eastern end has more residential development than the other portions of Region 3. Attributes of the Applicant Proposed Route in Region 3 include:

- The Applicant Proposed Route parallels OG&E's Cottonwood Creek-to-Enid 138kV transmission line, section lines, county roads, parcel boundaries, gas pipeline, the KAMO Electric Cooperative, Inc. Stillwater-to-Ramsey 115kV transmission line, KAMO Electric Cooperative, Inc. Stillwater-to-Cushing 69kV transmission line, OG&E's Muskogee to Pittsburgh 345kV transmission line, Public Service Company (PSCo)-OK's Bristow to Silver City 161kV transmission line, and OG&E's Cushing to Bristow 138kV transmission line, and the OG&E's Beggs-to-Pecan Creek 138kV transmission line for the majority of its length.
- Portions of the Applicant Proposed Route are outside the 1-mile-wide area of Link F-7 of the Network of Potential Routes presented at the public scoping meetings. The Clean Line Routing Team sited the Applicant Proposed Route outside the Network of Potential Routes in response to scoping comments that identified additional residential areas and residences.

The Region 3 Applicant Proposed Route is shown on Figure2.1-17c in Appendix A.

2.4.2.4 Region 4 (Arkansas River Valley)

Region 4 includes primarily pasture/hay and deciduous forest land covers. Region 4 begins north of Webbers Falls in Muskogee County, in Oklahoma and continues east though Muskogee and Sequoyah counties in Oklahoma and Crawford, Franklin, Johnson, and Pope counties in Arkansas for approximately 127 miles and ends north of Russellville, Arkansas. Attributes of the Applicant Proposed Route in Region 4 include:

- The Applicant Proposed Route parallels several existing transmission lines across the Arkansas River. The Applicant Proposed Route continues into Arkansas parallel to OG&E's Muskogee-to-Fort Smith 345kV transmission, Southwestern's Gore-to-Alma 161kV transmission line, Interstate-40, Southwestern's Alma-to-Dardanelle 161kV transmission line, county roads, and parcel lines to the extent practicable.
- The Applicant Proposed Route includes the Lee Creek Variation, which refers to a route variation near the Oklahoma-Arkansas state line. It was developed by Clean Line to address concerns expressed regarding avoidance of a buffer zone around the Lee Creek Reservoir. It begins in Sequoyah County, Oklahoma, at a point approximately 1.9 miles west of the state line, where it proceeds east-northeast for approximately 2 miles, then east-southeast, ending in Crawford County, Arkansas, approximately 1.5 miles east of the state line, where it rejoins the Applicant Proposed Route.
- Portions of the Applicant Proposed Route are outside the 1-mile-wide area of Links H-I and H-5 of the Network of Potential Routes presented at the public scoping meetings. The Applicant Proposed Route was sited outside the Network of Potential Routes in this area to avoid residences and agricultural structures identified in comments submitted to DOE during scoping.

The Region 4 Applicant Proposed Route is shown on Figure 2.1-17d in Appendix A.

2.4.2.5 Region 5 (Central Arkansas)

Region 5 includes primarily pasture/hay, deciduous forest, and evergreen forest land covers. Region 5 begins north of Russellville, in Pope County, Arkansas, and continues east for 113 miles through Pope, Conway, Van Buren, Faulkner, Cleburne, White, and Jackson counties in Arkansas, and ends southwest of Newport, Arkansas. The Applicant Proposed Route in Region 5 parallels parcel boundaries and section lines, Entergy Arkansas Inc.'s Independence-to-Genpower Keo 500kV transmission line, the Cleburne County 69kV transmission line, and a natural gas transmission pipeline to the extent practicable.

The Region 5 Applicant Proposed Route is shown on Figure 2.1-17e in Appendix A.

2.4.2.6 Region 6 (Cache River, Crowley's Ridge Area, and St. Francis Channel)

With the exception of the Crowley's Ridge area, Region 6 primarily includes cultivated crop land covers. Region 6 begins southwest of Newport in Jackson County, Arkansas, and continues northeast through Jackson, Cross, and Poinsett counties in Arkansas, for approximately 55 miles and ends south of Marked Tree, Arkansas. Crowley's Ridge consists mostly of hardwood forest. Attributes of the Applicant Proposed Route in Region 6 include:

- The Applicant Proposed Route parallels the Entergy Arkansas Inc.'s Fisher-to-Cherry Valley 161kV transmission line, the St. Francis Levee, parcel boundaries, and county roads to the extent practicable.
- Portions of the Applicant Proposed Route in Region 6 are outside the 1-mile-wide area of Links L-3, L-4, and L-5 of the Network of Potential Routes presented at the public scoping meetings for the EIS. These deviations outside the Network of Potential Routes resulted from aligning the Applicant Proposed Route to follow an existing electrical transmission line into Cross County, Arkansas, to follow the Spoil Bank Central Canal within the St Francis Oak Donnick Floodway, and to avoid private airfields and aerial applicator operations in Poinsett County, Arkansas.

The Region 6 Applicant Proposed Route is shown on Figure 2.1-17f in Appendix A.

2.4.2.7 Region 7 (Arkansas Mississippi River Delta and Tennessee)

Region 7 includes primarily cultivated crop land covers. Region 7 begins south of Marked Tree, in Poinsett County, Arkansas, and continues east and southeast through Poinsett and Mississippi counties in Arkansas, across the Mississippi River and into Tipton and Shelby counties in Tennessee, for approximately 43 miles, ending near the Tipton-Shelby county line south of Tipton, Tennessee. Attributes of the Applicant Proposed Route in Region 7 include:

- The Applicant Proposed Route parallels Entergy Arkansas Inc.'s Marked Tree to Marion 161kV electrical transmission line, county roads, section lines, and parcel boundaries to the extent practicable.
- Portions of the Applicant Proposed Route are outside the 1-mile-wide area of Links M-2 and M-5 of the Network of Potential Routes presented at the public scoping meetings for the EIS. In Link M-2, the Clean Line Routing Team identified a route that more closely follows Entergy Arkansas Inc.'s Marked Tree-to-Marion 161kV electric transmission line. In Link M-5, the Clean Line Routing Team identified a route that more closely followed field lines and parcel boundaries and that avoided residential areas identified during aerial reconnaissance.

The Region 7 Applicant Proposed Route is shown on Figure 2.1-17f in Appendix A.

2.4.3 DOE Alternatives

The DOE Alternatives evaluated in this EIS include an intermediate AC/DC converter station in Arkansas and HVDC alternative routes in each region. The regions potentially affected by the alternatives (and the counties within each region) are provided in Table 2.4-1 and are shown in Figures 2.1-17a through 2.1-17f (located in Appendix A). The Arkansas Converter Station Alternative is discussed in Section 2.4.3.1. The HVDC alternative routes are described in Section 2.4.3.2. As identified previously in Section 2.4.2, the Applicant Proposed Route is divided into links, within each region. These links represent sections of the Applicant Proposed Route between points where alternative routes intersect with it. The alternative routes diverge from the Applicant Proposed Route and provide an alternative to the corresponding links of the Applicant Proposed Route. Table 2.4-1 includes information about the links of the Applicant Proposed Route to illustrate their relationship to the alternative routes.

Table 2.4-1:
Counties Potentially Affected by DOE Alternatives

Feature	Length (Miles)	State	Counties
Converter Station			
Arkansas Converter Station Alternative	N/A	Arkansas	Pope or Conway
Arkansas AC Interconnection	6.0	Arkansas	Pope or Conway
HVDC Alternative Routes			
Region 1 (Oklahoma Panhandle)			
Link 1 of the Applicant Proposed Route (no corresponding Alternative Route)	1.91	Oklahoma	Texas
Alternative Route 1-A	123.3	Oklahoma	Texas, Beaver, Harper, and Woodward
Corresponding Links (2, 3, 4, 5) of the Applicant Proposed Route	114.0	Oklahoma	Texas, Beaver, Harper, and Woodward
Alternative Route 1-B	52.1	Oklahoma	Texas and Beaver
Corresponding Links (2, 3) of the Applicant Proposed Route	54.0	Oklahoma	Texas and Beaver
Alternative Route 1-C	52.2	Oklahoma	Texas and Beaver
Corresponding Links (2, 3) of the Applicant Proposed Route	54.0	Oklahoma	Texas and Beaver
Alternative Route 1-D	33.6	Oklahoma	Beaver and Harper
Corresponding Links (3, 4) of the Applicant Proposed Route	33.7	Oklahoma	Beaver and Harper
Region 2 (Oklahoma Central Great Plains)			
Link 1 of the Applicant Proposed Route (no corresponding Alternative Route)	20.32	Oklahoma	Woodward
Alternative Route 2-A	57.3	Oklahoma	Woodward and Major
Corresponding Link (2) of the Applicant Proposed Route	54.6	Oklahoma	Woodward and Major
Alternative Route 2-B	29.9	Oklahoma	Major and Garfield
Corresponding Link (3) of the Applicant Proposed Route	31.3	Oklahoma	Major and Garfield
Region 3 (Oklahoma Cross Timbers)			
Alternative Route 3-A	37.7	Oklahoma	Garfield, Logan, and Payne
Corresponding Link (1) of the Applicant Proposed Route	40.1	Oklahoma	Garfield, Kingfisher, Logan, and Payne
Alternative Route 3-B	47.9	Oklahoma	Garfield, Logan, and Payne
Corresponding Links (1, 2, 3) of the Applicant Proposed Route	50.1	Oklahoma	Garfield, Kingfisher, Logan, and Payne

Table 2.4-1:
Counties Potentially Affected by DOE Alternatives

Feature	Length (Miles)	State	Counties
Alternative Route 3-C	121.9	Oklahoma	Payne, Lincoln, Creek, Okmulgee, and Muskogee
Corresponding Links (3, 4, 5, 6) of the Applicant Proposed Route	118.9	Oklahoma	Payne, Lincoln, Creek, Okmulgee, and Muskogee
Alternative Route 3-D	39.4	Oklahoma	Muskogee
Corresponding Links (5, 6) of the Applicant Proposed Route	35.2	Oklahoma	Muskogee
Alternative Route 3-E	8.5	Oklahoma	Muskogee
Corresponding Link (6) of the Applicant Proposed Route	7.8	Oklahoma	Muskogee
Region 4 (Arkansas River Valley)			
Link 1 of the Applicant Proposed Route (no corresponding Alternative Route)	8.31	Oklahoma	Muskogee
Alternative Route 4-A	58.6	Oklahoma and Arkansas	Sequoyah County, Oklahoma, and Crawford and Franklin counties, Arkansas
Corresponding Links (3, 4, 5, 6) of the Applicant Proposed Route	60.6	Oklahoma and Arkansas	Sequoyah County, Oklahoma, and Crawford and Franklin counties, Arkansas
Alternative Route 4-B	78.9	Oklahoma and Arkansas	Sequoyah County, Oklahoma, and Crawford and Franklin counties, Arkansas
Corresponding Links (2, 3, 4, 5, 6, 7, 8) of the Applicant Proposed Route	81.5	Oklahoma and Arkansas	Sequoyah County, Oklahoma, and Crawford and Franklin counties, Arkansas
Alternative Route 4-C	3.4	Arkansas	Crawford
Corresponding Link (5) of the Applicant Proposed Route	2.2	Arkansas	Crawford
Alternative Route 4-D	25.4	Arkansas	Crawford and Franklin
Corresponding Links (4, 5, 6) of the Applicant Proposed Route	25.4	Arkansas	Crawford and Franklin
Alternative Route 4-E	36.9	Arkansas	Franklin, Johnson, and Pope
Corresponding Links (8, 9) of the Applicant Proposed Route	38.9	Arkansas	Franklin, Johnson, and Pope
Region 5 (Central Arkansas)			
Alternative Route 5-A	12.7	Arkansas	Pope
Corresponding Link (1) of the Applicant Proposed Route	12.3	Arkansas	Pope
Link 2 of the Applicant Proposed Route (no corresponding Alternative Route)	6.45	Arkansas	Pope
Alternative Route 5-B	71.2	Arkansas	Pope, Conway, Faulkner, White
Corresponding Links (3, 4, 5, 6) of the Applicant Proposed Route	67.4	Arkansas	Pope, Conway, Van Buren, Cleburne and White
Alternative Route 5-C	9.2	Arkansas	White
Corresponding Links (6, 7) of the Applicant Proposed Route	9.4	Arkansas	White
Alternative Route 5-D	21.7	Arkansas	White and Jackson
Corresponding Link (9) of the Applicant Proposed Route	20.5	Arkansas	White and Jackson
Link 8 of the Applicant Proposed Route (no corresponding Alternative Route)	1.61	Arkansas	White
Alternative Route 5-E	36.4	Arkansas	Van Buren, Faulkner, and White
Corresponding Links (4, 5, 6) of the Applicant Proposed Route	33.3	Arkansas	Van Buren, Cleburne, and White
Alternative Route 5-F	22.4	Arkansas	Cleburne and White
Corresponding Links (5, 6) of the Applicant Proposed Route	18.8	Arkansas	Cleburne and White

Table 2.4-1:
Counties Potentially Affected by DOE Alternatives

Feature	Length (Miles)	State	Counties
Region 6 (Cache River, Crowley's Ridge Area, and St. Francis Channel)			
Link 1 of the Applicant Proposed Route (no corresponding Alternative Route)	6.12	Arkansas	Jackson
Alternative Route 6-A	16.2	Arkansas	Jackson and Poinsett
Corresponding Links (2, 3, 4) of the Applicant Proposed Route	17.7	Arkansas	Jackson and Poinsett
Alternative Route 6-B	14.1	Arkansas	Jackson and Poinsett
Corresponding Link (3) of the Applicant Proposed Route	9.7	Arkansas	Jackson and Poinsett
Link 5 of the Applicant Proposed Route (no corresponding Alternative Route)	1.87	Arkansas	Poinsett
Alternative Route 6-C	23.2	Arkansas	Poinsett
Corresponding Links (6, 7) of the Applicant Proposed Route	24.9	Arkansas	Poinsett and Cross
Alternative Route 6-D	9.2	Arkansas	Cross and Poinsett
Corresponding Link (7) of the Applicant Proposed Route	8.6	Arkansas	Cross and Poinsett
Link 8 of the Applicant Proposed Route (no corresponding Alternative Route)	3.91	Arkansas	Poinsett
Region 7 (Arkansas Mississippi River Delta and Tennessee)			
Alternative Route 7-A	43.2	Arkansas and Tennessee	Poinsett and Mississippi counties, Arkansas, and Tipton County, Tennessee
Corresponding Link (1) of the Proposed Route	28.7	Arkansas and Tennessee	Poinsett and Mississippi counties, Arkansas, and Tipton County, Tennessee
Link 2 of the Applicant Proposed Route (no corresponding Alternative Route)	1.08	Tennessee	Tipton
Alternative Route 7-B	8.6	Tennessee	Tipton and Shelby
Corresponding Links (3, 4) of the Applicant Proposed Route	8.3	Tennessee	Tipton and Shelby
Alternative Route 7-C	23.8	Tennessee	Tipton and Shelby
Corresponding Links (3, 4, 5) of the Applicant Proposed Route	13.2	Tennessee	Tipton and Shelby
Alternative Route 7-D	6.2	Tennessee	Tipton and Shelby
Corresponding Links (4, 5) of the Applicant Proposed Route	6.6	Tennessee	Tipton and Shelby

2.4.3.1 Arkansas Converter Station

During the scoping period, DOE received comments from stakeholders in Arkansas who were concerned that the state would endure impacts from the Project without receiving any of the benefits (e.g., ability to accept increased amounts of renewable energy, tax revenues from property and ad valorum taxes associated with new facilities, and increased number of jobs). Based on these comments, DOE requested that Clean Line evaluate the feasibility of an alternative that would add a converter station in Arkansas. The Arkansas converter station would be an intermediate converter station; it would not replace the Oklahoma or Tennessee converter stations. Based on Clean Line's feasibility evaluation, an Arkansas converter station could be sited in either Pope County or Conway County, Arkansas. This alternative converter station would be similar to the Oklahoma and Tennessee converter stations, except that it would likely require a smaller land area, encompassing approximately 40 to 50 acres. The facility dimensions and land requirements are summarized in Table 2.4-2. Based on preliminary design and studies, it would be capable of interconnecting 500MW. With the implementation of this alternative, the delivery capability of the Project would be increased to 4,000MW.

The interconnection for the Arkansas converter station would include an approximate 6-mile 500kV AC transmission line (the interconnection requirements are discussed in Section 2.2.1) to an interconnection point along the existing Arkansas Nuclear One-Pleasant Hill 500kV AC transmission line by way of a direct tap or small switchyard. The interconnection facilities would be located within a small switching/tap station of approximately 5 acres in size; this area would be fenced and retained during operations and maintenance of the converter station. An additional 5 acres would be required during construction of the converter station and 500kV AC interconnection for materials staging and equipment storage. Tensioning and pulling sites, wire-splicing sites, and multi-use construction yards would all occur within the AC interconnection siting area. The design and layout of the interconnection facilities are dependent on the results of ongoing interconnection and engineering studies (see Section 2.2.1).

The 500kV AC line would consist of an arrangement of three electrical phases each with a three-conductor bundle (i.e., three subconductors) in a triangle configuration about 18 to 24 inches on each side. Each conductor would be an approximate 1- to 2-inch-diameter aluminum conductor with a steel reinforced core, or a very similar configuration. The Applicant would design minimum conductor height above the terrain, assuming no clearance buffers, per Rule 232D of the NESC, Edition 2012, requiring 29 feet for general areas and vehicular traffic (for a 500kV AC line).

Table 2.4-2:
Arkansas Converter Station Alternative and Associated Facilities Dimensions and Land Requirements

Facility	Construction Dimensions[1]	Operation Dimensions[1]
Arkansas Converter Station Alternative-Pope or Conway County, Arkansas	40 to 50 acres of land would be required, plus an additional 5 to 10 acres for construction.	40 to 50 acres of land would be required for the station; approximately 40 acres would be fenced.
Arkansas Converter Station Access Road	All weather access roads 20 feet wide by less than 1 mile long would be required. Construction of the access roads may disturb an area up to 35 feet wide.	20-foot-wide paved roadways.
ROW	One 500kV ROW 150–200 feet wide x 6 miles long (assumes 6 mile or less long).	One 500kV ROW 150–200 feet wide x approximately 6 miles long.
500kV—Lattice Structures	Structure assembly area, 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile500kV.	Structural footprint 28 feet x 28 feet (typical for lattice structures) 75 to 180 feet tall, 5 to 7 structures per mile.
500kV—Tubular Pole Structures	Structure assembly area 150 feet wide (ROW width) x 150 feet long (within ROW), 5 to 7 structures per mile.	Structural footprint 7 feet x 7 feet (typical for tubular pole structures), 75 to 180 feet tall, 5 to 7 structures per mile.
AC Interconnection Point	500kV AC: a 5-acre site where the alternative AC transmission line would interconnect with an existing 500kV transmission line. An additional 5 acres would be required during construction.	The 5-acre site would be fenced. Permanent access road to the fenced area. Power supply to fenced area.

1 Final design and/or dimensions may differ from typical dimensions expressed here.

Descriptions of ROW easements, structure types, and access for the HVDC alternative routes would be the same as described in Sections 2.1.2.2.1, 2.1.2.2.2, and 2.1.2.4. Construction practices for the HVDC alternative routes or Arkansas converter station alternative would be the same as described in Section 2.1.4. Impacts of these alternatives could nonetheless vary due to differences in affected environment and the scale of the alternatives compared to the

Applicant Proposed Project. The impacts, and variations of impacts from the Applicant Proposed Project, are described in Chapter 3 and summarized in Section 2.6.

2.4.3.2 HVDC Alternative Routes

DOE developed alternative routes as described in Section 2.3.1. These alternatives were discussed and evaluated with Clean Line for feasibility. Eventual selection of a route alignment for the HVDC transmission line could either follow the Applicant Proposed Route for the entire length or could bypass specific links of the Applicant Proposed Route by selecting specific alternative routes.

2.4.3.2.1 Region 1 (Oklahoma Panhandle)

DOE and Clean Line identified four HVDC alternative routes for Region 1. The Region 1 HVDC alternative routes are shown on Figure 2.1-17a in Appendix A:

- 1-A parallels county roads and section lines for the majority of its length and parallels existing transmission lines for some short distances.
- 1-B parallels section lines for the majority of its length.
- 1-C is made up of portions of HVDC Alternative Routes 1-A and 1-B.
- 1-D follows sections lines for the majority of its length.

2.4.3.2.2 Region 2 (Oklahoma Central Great Plains)

DOE and Clean Line identified two HVDC alternative routes for Region 2. The Region 2 HVDC alternative routes are shown on Figure 2.1-17b in Appendix A:

- 2-A parallels OG&E's Woodward-to-Cleo's Corner 345kV electrical transmission line and the Cimarron River floodplain for the majority of its length.
- 2-B parallels section lines and parcel boundaries and OG&E's Cottonwood Creek-to-Enid 138kV transmission line for the majority of its length.

A portion of Proposed Alternative Route 2-B is outside the 1-mile-wide area of Link D-1 of the Network of Potential Routes presented at the public scoping meetings. HVDC Alternative Route 2-B is outside of the Network of Potential Routes in this area to avoid a private airstrip identified through review of Federal Aviation Administration (FAA) data and aerial imagery.

Additionally, there is only one route option in the western portion of Region 2 because the city of Woodward, the city of Moreland, Boiling Springs State Park, potentially high value lesser prairie-chicken habitat and rough terrain limit the potential opportunities for other route alternatives.

2.4.3.2.3 Region 3 (Oklahoma Cross Timbers)

DOE and Clean Line identified five HVDC alternative routes for Region 3. The Region 3 HVDC alternative routes are shown on Figure 2.1-17c in Appendix A:

- 3-A parallels county roads and parcel boundaries to the extent practicable.
- 3-B parallels parcel boundaries, section lines, and the KAMO Electric Cooperative, Inc. Stillwater-to-Cushing 69kV transmission line to the extent practicable.
- 3-C parallels OG&E's Cushing-to-Bristow 138kV transmission line, roads, section lines and property boundaries to the extent practicable.
- 3-D begins northwest of Boynton and joins HVDC Alternative Route 3-C approximately 1 mile to the southeast.
- 3-E begins north of Warner, Oklahoma.

Portions of HVDC Alternative Routes 3-C and 3-D are outside the 1-mile-wide area of Link F-8 of the Network of Potential Routes presented at the public scoping meetings. HVDC Alternative Routes 3-C and 3-D are sited outside the Network of Potential Routes in response to comments by the Oklahoma Department of Wildlife Conservation (ODWC) regarding the presence of federal grassland conservation easements and potential high-value greater prairie-chicken habitat.

2.4.3.2.4 Region 4 (Arkansas River Valley)

DOE and Clean Line identified five HVDC alternative routes for Region 4. The Region 4 HVDC alternative routes are shown on Figure 2.1-17d in Appendix A:

- 4-A parallels parcel boundaries and the Nicut-to-Brushy Switching Station 69kV transmission line in Crawford County, Arkansas, to the extent practicable.
- 4-B is located partially within the Ozark National Forest in Crawford County, Arkansas.
- 4-C is a short route that parallels parcel lines to the extent practicable in the Van Buren, Arkansas area.
- 4-D is an alternative in the areas of Cedarville, Van Buren, and Mulberry, Arkansas.
- 4-E parallels parcel boundaries and the Dardanelle-to-Ozark 161kV transmission line to the extent practicable.

Portions of HVDC Alternative Route 4-A are outside the 1-mile-wide area of Links G-2 and G-5 of the Network of Potential Routes presented at the public scoping meetings to avoid residences and a municipality (Cedarville, Arkansas).

Portions of HVDC Alternative Route 4-B are outside the 1-mile-wide area of Links G-2 and G-6 of the Network of Potential Routes presented at the public scoping meetings. Alternative Route 4-B was sited outside the Network of Potential Routes in this area to avoid residences and a municipality (Cedarville, Arkansas) and to respond to comments received during scoping that requested an alternative route through the Ozark National Forest. As presented in Section 2.14, DOE has identified HVDC Alternative Route 4-B as a non-preferred alternative.

Portions of HVDC Alternative Route 4-C are outside the 1-mile-wide area of Link G-4 of the Network of Potential Routes presented at the public scoping meetings for the EIS. Alternative Route 4-C was sited outside the Network of Potential Routes in response to comments received by DOE during the EIS scoping period regarding the residential area north of Van Buren.

Portions of HVDC Alternative Route 4-D are outside the 1-mile-wide area of Link G-5 of the Network of Potential Routes presented at the public scoping meetings for the EIS to avoid residences. These residences were identified in comments submitted to DOE during the EIS scoping period and through comments received by Clean Line during Clean Line's stakeholder meetings.

2.4.3.2.5 Region 5 (Central Arkansas)

DOE and Clean Line identified six HVDC alternative routes for Region 5. The Region 5 HVDC alternative routes are shown on Figure 2.1-17e in Appendix A:

- 5-A is a short alternative that provides a route north of Dover, Arkansas.
- 5-B parallels an existing natural gas transmission pipeline, electrical transmission lines, parcel boundaries, and the Entergy Arkansas, Inc.'s Independence-to-Genpower Keo 500kV transmission line to the extent practicable.
- 5-C is a short alternative that provides a route northeast of Letona, Arkansas.
- 5-D parallels the Entergy Arkansas, Inc.'s Independence-to-Genpower Keo 500kV transmission line, parcel boundaries, and natural gas transmission pipelines to the extent practicable.
- 5-E parallels existing transmission lines to the extent practicable through Faulkner County, Arkansas.
- 5-F provides an alternative to the south of Letona, Arkansas.

2.4.3.2.6 Region 6 (Cache River, Crowley's Ridge Area, and St. Francis Channel)

DOE and Clean Line identified four HVDC alternative routes for Region 6. The Region 6 HVDC alternative routes are shown on Figure 2.1-17f in Appendix A:

- 6-A parallels parcel boundaries and roads to the extent practicable to provide a southern alternative river crossing location for the Cache River.
- 6-B parallels parcel boundaries, State Route 14, and existing transmission lines to provide a northern alternative river crossing location for the Cache River.
- 6-C parallels parcel boundaries and local roads to the extent practicable to provide alternative crossing of Crowley's Ridge and the St. Francis-Oak Donnick Floodway.
- 6-D is a short alternative that parallels a levee to the extent practicable to provide an alternative crossing location for the St. Francis-Oak Donnick Floodway.

Portions of HVDC Alternative Route 6-A are outside of the 1-mile-wide area of Link L-4 of the Network of Potential Routes presented at the public scoping meetings. HVDC Alternative Route 6-A was sited outside the Network of Potential Routes in this area to follow parcel lines and traverse less forested wetlands.

Portions of HVDC Alternative Route 6-B are outside the 1-mile-wide area of Links L-2 and L-3 of the Network of Potential Routes presented at the public scoping meetings. HVDC Alternative Route 6-B was sited outside the Network of Potential Routes in this area to follow an existing electrical transmission line south of Amagon, Arkansas, and to avoid private airfields, aerial spraying, and agricultural operations in Poinsett County.

2.4.3.2.7 Region 7 (Arkansas Mississippi River Delta and Tennessee)

The Project includes elements (transmission line routes and facilities and the converter station and interconnections) in Tennessee. The EIS includes an impacts and alternatives analysis of all Project components; including those located in Tennessee. As explained in Section 1.1.1, DOE's participation in the Project would be limited to states in which Southwestern operates; namely Oklahoma, Arkansas, and possibly Texas, but not Tennessee.

DOE and Clean Line identified four HVDC alternative routes for Region 7. The Region 7 HVDC alternative routes are shown on Figure 2.1-17f in Appendix A:

- 7-A parallels existing canals, county roads, section lines, parcel boundaries, and field lines to the extent practicable to provide an alternative Mississippi River crossing location to the north. 7-A also parallels TVA's Shelby-to-Sans Souci 500kV transmission line.
- 7-B parallels property lines and local roads to provide an alternative in Tipton County, Tennessee.
- 7-C parallels local roads and TVA's Covington-to-Northeast Gate 161kV transmission line and provides a southern route into the converter station.
- 7-D parallels TVA's Shelby-to-Sans Souci 500kV electrical transmission line and provides a northern route into the converter station.

Portions of HVDC Alternative Route 7-A are outside the 1-mile-wide area of Link M-1 of the Network of Potential Routes presented at the public scoping meetings. HVDC Alternative Route 7-A was sited outside the Network of Potential Routes in this area to avoid a center pivot irrigation system and a perpendicular crossing of an airfield.

Portions of HVDC Alternative Route 7-B are outside the 1-mile-wide area of Link M-5 of the Network of Potential Routes presented at public scoping meetings. This alternative was sited outside the Network of Potential Routes in this area in response to scoping comments that requested the analysis of routes that were south of Millington, Tennessee.

Portions of HVDC Alternative Route 7-C are outside the 1-mile-wide area of Link M-5 of the Network of Potential Routes presented at the public scoping meetings. This alternative was sited outside the Network of Potential Routes in this area in response to comments that requested the analysis of routes south of the Millington Regional Airport that also would avoid Munford, Tipton, and Atoka.

HVDC Alternative HVDC Route 7-D is outside the Network of Potential Routes presented at public scoping meetings. This alternative was sited outside the Network of Potential Routes in this area in response to comments expressing concerns about the existing and planned airspace north of the Millington Regional Airport; this alternative is a greater distance from the airport than the Applicant Proposed Route and follows the TVA Shelby-to-Sans Souci 500kV existing transmission line for portions of its length.

2.4.4 Alternatives Considered but Eliminated from Detailed Analysis

DOE considered several additional potential alternatives, in part based on public scoping comments, but eliminated them from detailed analysis as discussed below.

2.4.4.1 Alternative Transmission Line Routes

During the iterative planning and siting process for the transmission line, a number of route alternatives were proposed and studied. These alternatives were evaluated for their feasibility and ultimately eliminated from further study and consideration based on route-specific factors and public scoping comments. Route alternatives that were studied and eliminated and the rationales for their elimination are discussed in the DOE Alternatives Development Report (DOE 2013). Excerpts from the DOE Alternatives Development Report (including the main body of the report and select appendices; including the Tier IV Routing Study) are provided in Appendix G of this EIS.

2.4.4.2 Underground HVDC Transmission Line

During public scoping, some commenters suggested that the HVDC transmission line be installed underground for either the entire length or for discrete segments to minimize visual impacts associated with construction and operations and maintenance. To date, underground electric transmission cable technology is not commercially available at the very high voltage and capacity levels (i.e., +/- 600kV and 3,500 to 4,000MW) planned for the Project. The highest achieved cable ratings for undergrounding HVDC, thus far, are ±500kV at about 2,000MW (KCC 2013). While there is research underway for underground high-voltage transmission cable technology that could conceivably be applied to the voltage and capacity levels of the Project, this research has yet to produce commercially available, proven technology, and DOE does not foresee that such technology will become available within the time frame for construction of the Project.

In addition, based on current understanding, even if such technology were to become available, other constraints would make it infeasible to install a conductor (i.e., the transmission line) of this voltage and capacity underground. Such conductors cannot be directly buried. They must be mechanically protected by being installed within a buried duct bank, conduit, or tunnel. Frequent access points would be required from the surface into these duct banks, conduits, or tunnels to allow for splicing, monitoring, and maintenance. Heat dissipation from the underground conductors would be a significant challenge to the installation. Also, the large insulation requirements would result in extreme weights for an underground conductor relative to an overhead conductor, so only short segments could be installed at any one time, significantly increasing the cost and time required for completing the construction. The diagnosis and repair of outages could be time-consuming, which would affect emergency response times, could result in additional ground disturbance and excavation to locate and repair the problems.

Based on this analysis, DOE concluded that undergrounding all or portions of the Project is not a reasonable alternative and has eliminated it from further analysis.

2.4.4.3 Local Generation and Distribution

During public scoping, commenters suggested utilizing distributed generation as an alternative to the Applicant Proposed Project. Distributed generation involves the use of small-scale power generation technologies that are usually installed at or near the location to the load being served by the generated power. Distributed generation does not require long-range transmission lines. Distributed generation systems range in size from approximately 5 kilowatts to 10MW, in contrast to utility-scale generation that ranges from 10MW to more than 1,000MW per site. Examples of distributed generation resource technologies include residential and roof-top photovoltaic, energy storage devices, microturbines, and fuel cells.

This alternative was eliminated from further analysis because Section 1222 of the EPAct does not authorize the Secretary of Energy to participate with other entities in distributed generation, and the alternative does not meet the DOE-issued RFP for new or upgraded transmission projects. As such, the alternative would not meet the purpose and need for agency action because distributed generation as studied by DOE does not meet the utility-scale generation required. DOE has determined that distributed generation would not meet the need of utility-scale generation and would still require the Project to meet the needs of the agency's goal. DOE has established policies and programs related to distributed generation (http://www.energy.gov/eere/wipo/renewable-energy-distributed-generation-policies-and-programs).

2.4.4.4 Energy Conservation Programs

During public scoping, commenters suggested energy conservation programs as an alternative to the Applicant Proposed Project. Commenters suggested that mandatory conservation and demand response programs be used to eliminate the need for more generation and transmission. This alternative would include regulated energy use at the consumer level to decrease the overall energy demand. This alternative was eliminated from detailed consideration because Section 1222 of the EPAct does not authorize the Secretary of Energy to participate with other entities in energy conservation programs. As such, the alternative would not meet the purpose and need for agency action because energy conservation programs, as studied by DOE, would not meet the utility-scale generation required. DOE has determined that energy conservation programs would not meet the need of utility-scale generation and would still require the Project to meet the needs of the agency's goal. DOE has established policies and programs related to energy conservation programs (http://www.energy.gov/eere/efficiency).

2.5 Connected Actions

Connected actions are those that are "closely related" to the proposal. Actions are considered connected if they automatically trigger other actions which may require environmental impact statements, cannot or will not proceed unless other actions have been taken previously or simultaneously, or are interdependent parts of a larger action and depend on the larger action for their justification (40 CFR 1508.25). Connected actions are analyzed together with the Applicant Proposed Project and DOE Alternatives in this EIS.

2.5.1 Wind Energy Generation

The construction and operations and maintenance of reasonably foreseeable wind power facilities are evaluated as connected actions in the Plains & Eastern EIS. Wind power facilities that would interconnect with the Project are anticipated to be located in parts of the Oklahoma Panhandle and Texas Panhandle within an approximate 40-mile radius of the western converter station. As identified in Section 2.1.2.3, the Applicant based the 40-mile radius assumption on preliminary studies of engineering constraints and wind resource data, industry knowledge, and economic feasibility. The Applicant anticipates that these wind energy generators will be the primary customers using the transmission capacity of the Plains & Eastern transmission line. To achieve full utilization of the 3,500MW delivery capacity of the Applicant Proposed Project, the Applicant anticipates actual wind farm build-out to be approximately 4,000MW. With the addition of the Arkansas converter station alternative, the Applicant anticipates the delivery capacity of the Project to increase to 4,000MW, and associated wind farm build-out to be approximately 4,550MW (Clean Line 2014b). The Oklahoma Panhandle region contains an excellent wind resource (DOE 2011) and the Applicant has determined that adequate electrical interconnection facilities are available to support a new converter station are present in this region. An analysis of the wind resource in Oklahoma's Panhandle region by the

National Renewable Energy Laboratory shows that large areas of wind resources with average annual wind speeds greater than 8 meters/second are prevalent in that part of the state (NREL 2011).

Neither the Applicant nor DOE knows the exact location of wind power facilities that would be connected to the Project. However, it is reasonably foreseeable that future wind farms would be located in a reasonable proximity to the Project's Oklahoma converter station and in areas with high wind resource potential and suitable land use(s). This EIS provides an analysis of potential impacts from wind development within an area of an approximate 40-mile radius of the Oklahoma converter station. Clean Line identified 12 Wind Development Zones (WDZs) in its *Wind Generation Technical Report* (Clean Line 2014b) based on available wind resources and existing land uses within the 40-mile radius. Table 2.5-1 presents the size and potential maximum generation capacity for each WDZ analyzed in this EIS for potential wind energy generation. Figures 2.1-2 and 2.1-17a in Appendix A provide illustrations of the WDZs in relation to the locations of the various Project components.

Table 2.5-1:
Size and Potential Maximum Generation Capacity of Wind Development Zones

WDZ	Approximate Total Size (acres)	Potentially Suitable Areas for Wind Development (acres)	Approximate Maximum Wind Development (megawatts)
A	109,000	101,000	800
B	125,000	108,000	900
C	160,000	123,000	1,000
D	69,000	43,000	300
E	47,000	43,000	300
F	112,000	82,000	700
G	186,000	159,000	1,300
H	116,000	67,000	500
I	105,000	85,000	700
J	92,000	44,000	400
K	92,000	84,000	700
L	165,000	144,000	1,200

Where construction and operations and maintenance of individual wind power facilities require permits or authorizations, site-specific environmental review, possibly including NEPA review, may be conducted prior to the construction and operations and maintenance of individual wind farm projects.

2.5.2 Related Substation and Transmission Upgrades

In addition to the transmission lines and related facilities analyzed as part of the Project, the EIS also analyzes facility additions and upgrades to existing third-party transmission systems that would be required to enable the Project to transmit power. The additions and upgrades in Oklahoma and Tennessee are evaluated as connected actions in the EIS. No transmission network upgrades would be required to accommodate the interconnection in Arkansas.

Oklahoma

The Applicant Proposed Project includes construction and operations and maintenance of a converter station in Texas County, Oklahoma. The Oklahoma converter station would be interconnected to the existing transmission system. This interconnection is necessary to enable the AC to DC conversion process within the Oklahoma converter station. The interconnection between the proposed Oklahoma converter station and the SPS system would be controlled to a nominal value of zero (0) MW; meaning that there would be no net energy exchange. Based on the SPS analysis completed to date, the Applicant expects that a new substation would be necessary to accommodate the interconnection due to space constraints at the existing 345kV Hitchland Substation. To alleviate these space constraints, SPS has proposed a new substation nearby, tentatively named "Optima." This new substation, which represents the connected action, would be located within a few miles of the Oklahoma converter station in Texas County, Oklahoma, within the area identified on Figure 2.1-3 in Appendix A as the AC Interconnection Siting Area. Additional background and details are provided in Section 2.2.1.1.

Arkansas

A DOE Alternative would include construction and operations and maintenance of an intermediate converter station in Arkansas to enable injection and delivery of up to 500MW of power into the Arkansas electrical grid. Clean Line selected the Arkansas Nuclear One–Pleasant Hill 500kV Point of Interconnection. The Midcontinent Independent System Operator (MISO) performed a feasibility study of the request and concluded in February 2014 that no network upgrades were required to accommodate the interconnection (MISO 2014). No connected actions would therefore be associated with substation or transmission upgrades in Arkansas.

Tennessee

The Applicant Proposed Project includes construction and operations and maintenance of a converter station in either Shelby or Tipton County, Tennessee to enable injection of up to 3500MW of power into the Shelby Substation. As described in Section 2.2.1.3, TVA completed its Interconnection SIS to determine whether any upgrades (or modifications) to its transmission system would be necessary to protect grid reliability while accommodating Clean Line's request for interconnection at 3500MW.

TVA's Interconnection SIS has identified the following connected actions as necessary to enable the injection of 3500MW from the Plains & Eastern Clean Line: (a) upgrades to existing infrastructure and (b) construction of a new 500kV AC transmission line, approximately 37 miles long, in western Tennessee, including necessary modifications to existing substations on the terminal ends of the new line. Upgrades to existing infrastructure would include upgrading terminal equipment at three existing 500kV substations and three existing 161kV substations; making appropriate upgrades[4] to increase heights on 16 existing 161kV transmission lines to increase line ratings, and replacing the conductors on eight existing 161kV transmission lines.

TVA's Interconnection SIS estimates that completion of all upgrades would take 8 years to complete after TVA completes the Facilities Study. TVA anticipates tiering from this EIS when completing its review of potential environmental impacts as required by NEPA. TVA would evaluate both upgrades to existing infrastructure and construction of a new 500kV transmission line under their NEPA procedures. It is likely that upgrades to existing infrastructure would fall under categories of actions that are expected to result in few, if any, environmental impacts. TVA would likely evaluate potential impacts associated with construction and operations and maintenance of a new 500kV AC transmission line under a separate NEPA review once the location and design have been identified. For this reason, and because specific route information is not available, the new transmission line is not analyzed in detail in this EIS, but is discussed qualitatively in the connected action section in Chapter 3 for each resource.

[4] Most upgrades to existing transmission lines would occur in central and western Tennessee.

The total length of multiple existing transmission lines that could require some degree of upgrade is approximately 350 miles; most of these lines are located in central and western Tennessee. However, the upgrades would likely not be necessary along the full length of each line; i.e., the total length of existing transmission lines requiring modification would be less than 350 miles. The detailed identification of the necessary upgrades to each transmission line and construction of a new transmission line (as discussed above) is the subject of an interconnection facilities study begun by TVA in 2014 and anticipated to be completed in mid-2016. More detail regarding the typical upgrade activities is provided below.

This EIS assumes that impacts to resources would not occur where the existing terminal equipment at substations would be upgraded; these existing substations are assumed to have permanent access roads that would be used for upgrades, and upgrade activities would not increase the overall footprints of disturbance. The EIS evaluates the following likely upgrades to existing transmission lines:

1. Removing physical objects that interfere with line clearance
2. Replacing and/or modifying existing structures to increase clearance
3. Installing intermediate structures
4. Replacing the existing conductor with another that can accommodate higher power flows
5. Modifying the existing conductor to increase ground clearance
6. Adding fill rock or dirt around the base of existing structures
7. Working with the local power companies to modify their lines where they cross under TVA's lines

The various modification/upgrade activities are described in more detail below.

Typical modifications to existing conductors, installations of intermediate structures, additions of structure extensions, or replacements of existing structures are performed with standard transmission line construction and maintenance equipment such as crane trucks, bulldozers, bucket or boom trucks, and forklifts. Disturbance is usually limited to an approximate 100-foot radius around a transmission line structure.

Modifications to existing conductors include: conductor slides, cuts, and/or installation of floating deadends to increase ground clearance by increasing the height of conductor where it sags to its minimum clearance, or "belly," between structures. A slide involves relocating the conductor clamp on the adjacent structure a certain distance toward the area of concern (i.e., "sliding" the clamp). A cut involves cutting the conductor, removing a small piece of it, and then splicing the conductor ends back together. A floating deadend shortens the vertical (or "suspension") insulator string that attaches a conductor to a "suspension" (or "tangent") structure to raise the height of its conductor. A suspension structure is one that is designed to provide primarily vertical support for a conductor, but not to take the full tension of the conductor, which would require that the structure also provide significant horizontal support.

If the existing conductor is not rated to carry the new electrical load required for the transmission line, the conductor must be replaced. Reels of replacement conductor are delivered to various staging areas along the transmission line ROW and temporary H-frame clearance poles are installed at road crossings to reduce interference with traffic. Bucket trucks are utilized for worker access to the insulators supporting the conductors. Pulleys are attached to the insulators at the conductor clamp points. The new conductor is connected to the old conductor and pulled down the line through the pulleys. A bulldozer and specialized tensioning equipment is used to pull conductors to the proper tension. Workers then clamp the wires to the insulators and remove the pulleys. The length of continuous conductor wire replaced in a single "pull" varies and is limited to a maximum of 5 miles. Pull point locations depend on the type of structures supporting the conductor as well as the length of conductor being installed. Pull points are typically located along the most accessible path on the ROW (adjacent to road crossings or existing access roads). The area of disturbance at each pull point typically ranges from 200 to 300 feet along the line ROW.

Rock or soil "surcharge" is sometimes added to the base of a transmission structure when height and/or loading modifications are made to the structure. These modifications can create uplift on the structure foundation, therefore requiring the surcharge to maintain structure stability, particularly during inclement weather conditions or high conductor loading. The surcharge is typically delivered to structures by dump trucks and placed around the structure base using tracked equipment. Ground disturbance is typically limited to the immediate vicinity of the structure.

Transmission line upgrade activities are planned in a manner to maximize the use of existing access roads and to avoid non-essential stream crossings and activities in wetlands. Other sensitive environmental resources are also avoided to the extent practicable. Where necessary, standard erosion control measures such as the installation of silt fences are implemented. After the completion of the activity, the disturbed area is revegetated using native or non-invasive, low-growing plant species in appropriate areas. Areas such as pastures, agricultural fields, and lawns are restored to their former condition.

2.6 Summary of Impacts by Resource

The impacts analyzed in Chapter 3 of this EIS are summarized in Tables 2.6-1, 2.6-2, and 2.6-3. Table 2.6-1 provides a summary of potential environmental impacts from construction and operations of the proposed converter stations, including the Arkansas Converter Station Alternative Siting Area and AC interconnection. Table 2.6-2 provides a summary of the potential environmental impacts of construction and operations of the AC collection system. These impacts are provided as a range of impacts that could occur among the thirteen different AC collection system routes. Table 2.6-3 provides a summary of the potential environmental impacts of construction and operations of the HVDC transmission line, including any specific difference in impacts between the Applicant Proposed Route and the HVDC alternative routes. Unless specifically identified, potential impacts would be expected to be similar for the Applicant Proposed Route and the HVDC alternative routes.

Chapter 3 also provides the potential environmental impacts for each resource area that could occur from decommissioning of the Project components. Generally, the impacts of decommissioning the Project would be similar to those presented for construction. The Applicant would follow the same general and resource-specific EPMs during decommissioning that would be implemented during construction. In addition, the Applicant would develop a Decommissioning Plan prior to any decommissioning actions for review and approval by the applicable state and federal agencies.

Impacts are presented for the following resource categories: Agriculture; Air Quality and Climate Change; Electrical Environment; Environmental Justice; Geology, Paleontology, Minerals, and Soils; Groundwater; Health, Safety, and Intentional Destructive Acts; Historic and Cultural Resources; Land Use; Noise; Recreation; Socioeconomics; Special Status Wildlife and Fish, Aquatic Invertebrate, and Amphibian Species; Surface Water; Transportation; Vegetation Communities and Special Status Plant Species; Visual Resources; Wetlands, Floodplains, and Riparian Areas; and Wildlife and Fish.

Impacts in the table are presented in terms of direct, indirect, temporary, short-term, long-term, and permanent impacts for each resource area. Direct impacts occur at the same time and place as the Project. Indirect impacts are effects that may occur later in time, or further away from the Project, but are still reasonably foreseeable. Impacts are also characterized by time frame: temporary, short-term, long-term, or permanent. Temporary impacts would occur during construction, with the resource returning to preconstruction conditions once construction is complete. Short-term impacts would continue beyond the completion of construction and last from 2 to 5 years, depending on the resource affected. Long-term impacts would last beyond 5 years and could extend for the life of the Project; these impacts pertain to resources requiring longer recovery periods to return to preconstruction conditions. Permanent impacts are those that would be expected to continue even after decommissioning of the Project.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
AGRICULTURAL RESOURCES	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction The Oklahoma converter station would be located on undeveloped rangeland; approximately 94.8% of the land cover in the siting area is grassland/herbaceous. Construction of the converter station would convert 45 to 60 acres of rangeland to an industrial land use. During construction, an additional 5 to 10 acres would be used as temporary laydown areas for equipment. An additional 4.24 acres of rangeland would be converted to access roads (2.42 acres long term, 1.82 acres temporary). The Oklahoma AC interconnection would be approximately 2.7 miles long. The agricultural land cover in the representative ROW is currently composed of 58 acres of grasslands. Work in the ROW would include assembly of transmission structures, wire splicing, and tensioning and pulling. Outside the ROW, two additional tensioning and pulling sites of (2.58 acres each, for a total of 5.16 acres) and approximately 25 acres of multi-use construction yards would be required. Construction may affect livestock control and distribution if a gate is left open or a fence is damaged. Vehicular access during construction would increase the likelihood of livestock injury or death from collisions. Operations and Maintenance Once construction has been completed, only the 45- to 60-acre converter station, the AC interconnection pole structures, and a 20-foot-wide paved access road would remain; all other temporary construction areas would be returned to their previous use, primarily rangeland. Approximately 45 acres would be fenced. Within the AC interconnection ROW (200 feet wide), only the transmission structures would remain with a total footprint of up to less than 1 acre. All other land in the ROW could be returned to previous land uses, primarily grazing. Roads not otherwise needed for maintenance and operations would be restored to preconstruction conditions.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction The land cover in the Tennessee Converter Station Siting Area is approximately 80.1% agricultural land cover (53.6% cultivated crops and 26.5% pasture/hay). No center-pivot irrigation or other irrigation infrastructure is known to occur. Although the exact location has not yet been determined, construction of this converter station would convert 45 to 60 acres of currently undeveloped land to an industrial land use. During construction, an additional 5 to 10 acres would be used as temporary laydown areas for equipment. An additional 4.24 acres of rangeland would be converted to access roads (2.42 acres long term, 1.82 acres temporary). The Tennessee AC interconnection would be located entirely within the Tennessee Converter Station Siting Area and would be approximately 0.20 mile long. During construction, work in the representative ROW would convert approximately 5 acres of primarily cultivated crops and pasture/hay to an industrial use. Work in the representative ROW would include assembly of transmission structures, wire splicing, and tensioning and pulling. Outside the representative ROW, two additional tensioning and pulling sites (2.58 acres each, for a total of 5.16 acres) and approximately 25 acres of multi-use construction yards would be required. Construction may affect livestock control and distribution if a gate is left open or a fence is damaged. Vehicular access during construction would increase the likelihood of livestock injury or death from collisions.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
	Operations and Maintenance Once construction has been completed, only the 45- to 60-acre converter station, the AC interconnection transmission structures, and 20-foot-wide paved access road would remain; all other temporary construction areas would be returned to their previous use, primarily cultivated crops and pasture/hay. Approximately 45 acres would be fenced. Within the AC interconnection siting area ROW (200 feet wide), only the transmission structures would remain with a total footprint of less than 0.02 acre. All other land in the ROW could be returned to previous land uses, primarily cultivated crops and pasture/hay. Roads not otherwise needed for maintenance and operations would be restored to preconstruction conditions.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The land cover in the Arkansas Converter Station Alternative Siting Area is composed of approximately 4,563.4 acres (20.9%) pasture/hay, approximately 701.2 acres (3.2%) grassland/herbaceous land, and approximately 19.6 acres (0.1%) cultivated crops. The Arkansas AC interconnection would be approximately 6 miles long, and during construction, approximately 146.5 acres of currently primarily pasture/hay land cover would be temporarily converted to an industrial use. Construction of the converter station and AC interconnection would directly affect livestock grazing by temporarily reducing forage and/or displacing livestock in up to approximately 175 acres of land. If any crop land is in the construction area, crops grown in these areas would be lost and crops in adjacent areas may have reduced yields if there are disturbances to irrigation structures or in aerial spraying. The Applicant would avoid or minimize adverse effects to surface and subsurface irrigation and drainage systems (e.g., tiles). Operations and Maintenance Once construction has been completed, only the 40- to 50-acre converter station and 20-foot-wide paved access road would remain; all other temporary construction areas would be returned to their previous use, primarily rangeland. Approximately 40 acres would be fenced. A 5-acre site where the alternative AC transmission line would interconnect with the existing 500kV transmission line would also remain as an industrial use. Although most of this land is not currently used for agricultural purposes, up to 20.9% is used as pasture/hay, 3.2% is grassland/herbaceous, and 0.1% is cultivated crops. If any of these lands are used for long-term structures, they would be removed from agricultural use until decommissioning. Within the Arkansas AC interconnection (200 feet wide by 6 miles long), only the transmission structures and most access roads would remain. Roads not otherwise needed for maintenance and operations would be restored to preconstruction conditions.
AIR QUALITY AND CLIMATE CHANGE	
All Converter Stations and AC Interconnections	Construction Emissions for constructing each of the converter stations and AC interconnections are estimated to be approximately the same because the converter station sizes and construction processes are similar. While there would be minor temporary impacts on air quality in the vicinity of ongoing construction activities, emissions would be below National Ambient Air Quality Standards for all emissions. Operations and Maintenance The converter stations and AC interconnection would emit negligible air pollutants. Standard operations and maintenance of the converter stations and AC interconnection would not emit air pollutants, but maintenance activities would emit small amounts of pollutants associated with combustion of fossil fuels for worker vehicles and equipment.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
ELECTRICAL ENVIRONMENT	
All Converter Stations	Construction There would be no electrical effects associated with construction of the converter stations, because these facilities would not be energized during construction. Electrical facilities need to be energized to create electrical effects such as electric and magnetic fields, audible noise, and radio and television interference. Operations and Maintenance For the converter stations, the dominant sources of electrical effects would be the AC interconnections. Some types of substation and switching station equipment can potentially be a source of electrical effects (e.g., power transformers can produce audible noise; converter equipment can produce radio noise, etc.). These effects can be reduced or eliminated by the use of filtering equipment, sound walls, and other methods, so the dominant sources of electrical effects are associated with the overhead transmission lines.
All AC Interconnections	Construction No electrical effects would be associated with construction of AC interconnections because these facilities would not be energized during construction. Oklahoma Converter Station AC Interconnection For the Oklahoma converter station AC interconnection, calculated AC electric fields would be below public guidelines at the ROW edges. However, for one of the three possible configurations (i.e., the double circuit Danube configuration), calculated electric fields at the ROW edge are above guidelines for workers with implanted medical devices. While a variety of electronic devices are known to affect the operation of pacemakers and other implanted medical devices, transmission lines have not been reported as a significant source to produce functional disturbances to these devices. The consequences of brief reversible pacemaker malfunction are mostly benign (typically the implanted device will resume a normal mode of operation if the patient moves away from the source of the interference). An exception would be an individual who has a sensitive pacer and depends on it completely for maintaining all cardiac rhythms. For such an individual, a malfunction that compromised pacemaker output or prevented the unit from reverting to the fixed pacing mode, even brief periods of interference, could be life-threatening. The precise coincidence of events (i.e., pacer model, field characteristics, biological need for full function pacing, and occupation involving work under transmission lines) would generally appear to be a rare event. Since no loading would be present, no AC magnetic field would be generated as a result of the transmission line. Calculated audible noise would be below the public guideline at the ROW edges for two of three possible configuration types (the other configuration type—double circuit monopole— is slightly higher than the public guideline). Calculated radio noise would below guidelines at which reception quality may be less than satisfactory during fair but not rainy weather conditions. While it is difficult to determine whether the TV noise level produced by a transmission line would cause unacceptable interference, new digital broadcast system technology would provide better coverage and immunity to transmission line noise than analog television signals. Maximum ozone levels would be far below the EPA standard. Tennessee Converter Station AC Interconnection For the Tennessee converter station AC interconnection, calculated AC electric fields would be below public guidelines at the ROW edges and within the ROW. However, for the lattice configuration, calculated electric fields at the ROW edge would be above guidelines for workers with implanted medical devices if the ROW width is 150 feet (but would comply where the ROW width is 200 feet). Calculated AC magnetic fields would be below public guidelines in the ROW for all configurations. Calculated audible noise would be above the public guideline at the ROW edges for all configurations. Calculated radio noise is below Federal Communications Commission and Institute of Electrical and Electronic Engineers exposure guidelines during fair but not rainy weather conditions. While it is difficult to determine whether the TV noise level produced by a transmission line would cause unacceptable interference, new digital broadcast system technology should provide better coverage and immunity to transmission line noise than analog television signals. Maximum ozone levels would be far below the EPA standard. Arkansas Converter Station Alternative AC Interconnection For the Arkansas converter station AC interconnection, calculated AC electric fields would be below public guidelines at the ROW edges. However, for the lattice configuration, calculated electric fields within the ROW would be slightly above the transmission line ROW guidelines. For all configurations, calculated electric fields would exceed the guidelines for workers with implanted medical devices within the ROW and at most ROW edges. Calculated AC magnetic fields would be below public guidelines at the ROW edges for both configurations, as well

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
	as within the ROW for workers with implanted medical devices. Calculated audible noise would be at or above public guidelines at the ROW edges for both configurations. Calculated radio noise would be below Federal Communications Commission and Institute of Electrical and Electronic Engineers exposure guidelines during fair but not rainy weather conditions. While it is difficult to determine whether the TV noise level produced by a transmission line would cause unacceptable interference, new digital broadcast system technology should provide better coverage and immunity to transmission line noise than analog television signals. Maximum ozone levels would be far below the EPA standard.
ENVIRONMENTAL JUSTICE	
All Converter Stations	Construction/Operations and Maintenance There would be no impacts to areas where no minority or low-income populations were identified. For areas where minority and/or low-income populations were identified, it is expected that any impacts would affect all populations equally.
GEOLOGY, PALEONTOLOGY, SOILS, AND MINERALS	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction Subsidence from karst is a possible geologic hazard of concern within the Oklahoma Converter Station Siting Area. Implementation of EPMs and appropriate engineering design, including geotechnical investigations, would avoid or minimize the potential impacts from karst. No known fossil bed sites were identified in the Oklahoma Converter Station Siting Area. About 40% of the siting area is located in the shallow bedrock, so grading and excavation activities could cause direct impacts to paleontological resources if fossils are at or near the ground surface in rock outcrops and/or areas of shallow bedrock. Designated Farmland. Eight% (73 acres) of the Oklahoma AC interconnection siting area consists of prime farmland. Depending on the specific siting of the AC interconnection line within this area, impacts could include exposing prime farmland to conditions of increased erosion potential, and soils with high compaction potential would be susceptible to compaction from construction vehicles and equipment. Either impact could result in a decrease in the productivity of such soils and a loss of fertile topsoil. Soil Limitations. All of the soils within the Oklahoma Converter Station and AC Interconnection Siting Areas would be susceptible to compaction and have moderate to high wind erosion potential. Bedrock or other restrictive layers are encountered within 60 inches of the ground surface in 42% of the Oklahoma converter station siting area and in 50% of the AC interconnection representative ROW. Soil Contamination. No areas of potential soil contamination were identified; therefore, no construction-related impacts are anticipated. Operations and Maintenance Impacts from geological hazards or to mineral resources are not anticipated because the area is located in an area of low seismic risk, soil liquefaction risk is expected to be low, and no mineral resources are located within the siting areas. Operation and maintenance of the converter station would have long-term and potential permanent impacts (lack of access to potential mineral resources) to a 45-acre fenced area and a conservative estimate of 2.4 acres associated with a new paved access road. Additional impacts to 65 acres of land would occur from the AC interconnection line ROW. Transmission structures would impact a conservative estimate of 0.4 acre.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction The Tennessee converter station and AC interconnection would be constructed to withstand probable seismic events in the moderate to high seismic hazard zones. Soils within the Tennessee Converter Station Siting Area have high liquefaction potential, which could contribute to unstable conditions and potential structural damage during seismic events. Appropriate placement and design of Project components following completion of geologic/geotechnical investigations during engineering design would minimize risks related to soil liquefaction. The Applicant would implement EPMs to minimize the direct effects of landslides in this area of moderate susceptibility and low incidence. About 30% of the siting area is located in shallow bedrock, and blasting may be required. Impacts would be minimized by appropriate engineering design and through implementation of the Blasting Plan. Designated Farmland. Sixty-two percent (459 acres) of the siting area consists of designated farmland. Depending on the specific siting of the converter station and AC interconnection line within this area, impacts could

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
	include exposing prime farmland to conditions of increased erosion potential, and soils with high compaction potential would be susceptible to compaction from construction vehicles and equipment. Either impact could result in a decrease in the productivity of such soils and a loss of fertile topsoil. Soil Limitations. Soils susceptible to compaction and water erosion dominate the Tennessee siting area. The siting area includes 77 acres (10%) of land with steep slopes and 161 acres (22%) of land with hydric soils. Depending on the specific siting of the converter station, these areas could be avoided or impacted during construction activities. Construction could expose erosion-prone soils to conditions of increased erosion potential; and soils with high compaction potential would be susceptible to compaction from construction vehicles and equipment. Soil Contamination. One National Pollutant Discharge Elimination System (NPDES) site and one Toxics Release Inventory (TRI) site were identified in the siting area. The NPDES site indicates a stone and gravel operation where a permit was granted in 2008 for the discharge of stormwater. The TRI site is the 500kV Shelby Substation. These sites indicate a records inventory and do not raise a concern at this time in regards to areas of soil contamination. Operations and Maintenance The Project components would be operated and maintained in an area of moderate to high seismic hazard, and expected ground motions from an earthquake would be moderate to high. The Project components would be constructed to withstand probable seismic events and constructed in accordance with applicable federal and state regulations to prevent accidents and to ensure adequate protection for the public and the Project. Soils within the siting areas have high liquefaction potential. Geotechnical investigations would be completed in these areas during engineering design. Soils within the siting areas have high liquefaction potential. Geotechnical investigations would be completed in these areas during engineering design. The placement of Project components would be governed in part by site conditions, construction requirements, and EPMs, which would minimize risks related to soil liquefaction. Operations and maintenance would have long-term and potentially permanent impacts (lack of access to potential mineral resources) to a 45-acre fenced area and a conservative estimate of 2.4 acres would be associated with a new paved access road. Transmission structures would impact a conservative estimate of 0.1 acre. The Tennessee converter station may irreversibly convert prime farmland in the Shelby and Tipton counties portions of the Project.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The converter station and AC interconnection would be located in an area of low to moderate seismic hazard, and one active surface fault that traverses the siting area. Soils have high liquefaction potential and about 60% of the soils within the AC interconnection have high liquefaction potential. To reduce impacts from seismic hazard and liquefaction, the Applicant would implement the same measures as described for the Tennessee Converter Station and AC Interconnection Siting Areas. The areas have moderate susceptibility and low incidence with respect to landslides. Potential landslide impacts would be reduced or mitigated using the same techniques as described for the Tennessee Converter Station and AC Interconnection Siting Areas. Impacts from blasting would be minimized by following provisions of the Blasting Plan, and the Applicant would train personnel in the practices, techniques, and protocols required by federal and state regulations and applicable permits to protect potential paleontological resources from grading and excavation activities. Designated Farmland. The converter station siting area is located within 8,197 acres of designated farmland, and the AC interconnection siting area within 9,624 acres of designated farmland. The converter station would require 40 to 60 acres of land. The AC interconnection representative ROW includes 146 acres, 105 acres (or 72%) within designated farmland. Depending on the specific siting of the converter station and AC interconnect line within these areas, impacts could include exposing designated farmland to conditions of increased erosion potential, and soils with high compaction potential would be susceptible to compaction from construction vehicles and equipment. Either impact could result in a decrease in the productivity of such soils and a loss of fertile topsoil. Soil Limitations. Twenty-seven percent of the Arkansas Converter Station Alternative Siting Area is within lands with steep slopes (15 to 30 %). Soils with moderate to high wind and water erosion potential compose 46 and 10%, respectively, of siting area. Bedrock or other restrictive layers are encountered within 60 inches of the ground surface for 82% of the siting area. Seventeen percent (25 acres) of the AC Interconnection representative ROW is within lands with steep slopes (15 to 30 %). Soils with moderate to high wind and water erosion potential compose 16 and 36%, respectively, of the

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
	AC interconnection representative ROW. Bedrock or other restrictive layers are encountered within 60 inches of the ground surface for 73% of the AC interconnection representative ROW. Soil Contamination. Five sites were identified in the Arkansas Converter Station Alternative AC Interconnection Siting Area. All are private farmstead or ranch locations. Implementation of EPMs would minimize potential contamination of soils. Operations and Maintenance The area has moderate susceptibility and low incidence with respect to landslides. The Project components would be in an area of low to moderate seismic hazard. The soils within the siting areas have high liquefaction potential. Impacts from seismic hazards and liquefaction would be minimized utilizing the same measures as described for the Tennessee Converter Station Siting Area and AC Interconnection Siting Area. The converter station site would permanently impact (lack of access to potential mineral resources) 40 acres of fenced land and 2.4 acres for the paved access road and could take about 22 acres of designated farmland out of production. The AC transmission line ROW is estimated to impact 146 acres of land. Transmission line structures are conservatively estimated to permanently impact 0.6 acres of land.
GROUNDWATER	
All converter station siting areas	Construction Common impacts from all converter stations include (1) potential for contamination from spills or leaks of fuels and lubricants, (2) small and short-term changes in infiltration rates in areas of land disturbance, (3) minor impacts to water availability from water demands, and (4) potential damage to wells and associated piping systems in construction areas.
Oklahoma Converter Station and AC Interconnection Siting Areas	Oklahoma Converter Station No groundwaters of special interest are underneath the Oklahoma Converter Station Siting Area or the associated AC interconnection. No wells or wellhead protection area are located within the station siting area and a single industrial well, which would likely be avoided, is within the ROW of the AC interconnection. Construction would not include work below the water table. Water needed to support construction would likely come from groundwater. Water demand would not be expected to have an impact on the availability of groundwater for other uses. Operations and Maintenance No impacts on groundwater are expected.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction The converter station and the AC interconnection line would not be located in an area with designations of special interest. No wellhead protection area or wells occur within the siting areas. Water to support construction would be expected to come from groundwater. Construction of the converter station would not likely encounter groundwater, but transmission line structures might. Operations and Maintenance No impacts on groundwater are expected.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The Arkansas converter station alternative and AC interconnection siting areas would be located over an area that has no principal aquifer. No wellhead protection area or wells are present in the siting areas. Water to support construction would likely not come from groundwater because surface water is the predominant source of water in both Pope and Conway counties. Construction actions could possibly encounter groundwater. Operations and Maintenance No impacts on groundwater are expected.
HEALTH, SAFETY, AND INTENTIONAL DESTRUCTIVE ACTS	
All Project Components	Construction/Operations and Maintenance The Project would introduce hazards that could affect worker and public health and safety. Natural events, external events or accidents (e.g., aircraft mishaps or fires) or intentional destructive acts or mischief could impact such infrastructure and have related effects on the health and safety of construction workers and the public. The Project would involve the transportation and handling of hazardous materials. The implementation of EPMs associated with management of hazardous materials would keep risks to a minimum.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
HISTORIC AND CULTURAL RESOURCES	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction The Oklahoma Converter Station and AC Interconnection Siting Areas contain no previously recorded archaeological sites or other historic properties. Cultural resources surveys would be performed prior to construction of the Project to ascertain whether any unrecorded eligible properties for listing on the NRHP are present and to assess the possible impacts of construction on such resources if present. DOE intends to establish the timing and protocols for cultural resources surveys in a programmatic agreement. Operations and Maintenance No impacts have been identified.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction Same as Oklahoma Converter Station and AC Interconnection Siting Areas (row above). Operations and Maintenance No impacts have been identified.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The Arkansas Converter Station Alternative and AC Interconnection Siting Areas contain 23 previously recorded archaeological sites, including 2 that have been recommended as eligible for the NRHP and 21 that have no eligibility recommendation. There are also three previously recorded historic buildings, none of which has been evaluated for NRHP eligibility. The number of previously recorded cultural resources suggests a moderate to high sensitivity for the presence of sites that may be affected. The Project design would attempt to avoid impacts to NRHP-eligible cultural resources. If avoidance is not possible, appropriate mitigation of adverse impacts to NRHP-eligible cultural resources would be performed in consultation with the appropriate SHPOs and interested Indian Tribes. Operations and Maintenance No impacts have been identified.
LAND USE	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction The Oklahoma converter station would be located on undeveloped rangeland; approximately 95% of the land cover in the siting area is grassland/herbaceous. Construction of this converter station would convert 45 to 60 acres of rangeland to a utility land use. The Oklahoma AC interconnection would be approximately 2.7 miles long and would temporarily convert approximately 61 acres of primarily undeveloped rangeland to a utility land use. Operations and Maintenance After construction is complete, only the 45- to 60-acre converter station and 20-foot-wide paved access road would remain; all other temporary construction areas would be returned to their previous use, primarily rangeland. Approximately 45 acres would be fenced. Within the 2.7-mile-long AC interconnection ROW, only the transmission structures would remain. All other land in the ROW could return to previous land uses, primarily grazing. Access roads that are not needed for operations and maintenance of the Project would be restored.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
Tennessee Converter Station and AC Interconnection Siting Areas	Construction The land cover in the Tennessee Converter Station Siting Area is approximately 54% cultivated crops, 27% pasture/hay, and 11% deciduous forest. No center-pivot irrigation or other irrigation infrastructure is known to occur. Although the exact location has not yet been determined, construction of this converter station would convert 45 to 60 acres of this land to a utility land use. Operations and Maintenance After construction is complete, only the 45- to 60-acre converter station, the AC interconnection structures, and 20-foot-wide paved access road would remain; all other temporary construction areas would be returned to their previous use, primarily cultivated crops and pasture/hay. Approximately 45 acres would be fenced. Access roads that are not needed for operations and maintenance of the Project would be restored.
Arkansas Converter Station Alternative	Construction The land cover in the Arkansas Converter Station Alternative Siting Area consists of evergreen forest (36.1%), deciduous forest (24.8%), and pasture/hay (20.9%). Although the exact location of the converter station has not yet been determined, construction of this converter station would convert 40 to 50 acres of undeveloped land to a utility land use. The Arkansas AC interconnect would be approximately 6 miles long and during construction, approximately 146.5 acres of currently primarily pasture/hay land cover would be temporarily converted to industrial utility land use. Operations and Maintenance After construction is complete, only the 40- to 50-acre converter station and 20-foot-wide paved access road would remain; all other temporary construction areas would be returned to their previous use, primarily rangeland. Approximately 40 acres would be fenced. A 5-acre site where the alternative AC transmission line would interconnect with the existing 500kV transmission line would also remain as a utility land use. Within the 6-mile-long Arkansas AC interconnection ROW, only the transmission structures would remain. Access would be restricted during the performance of maintenance activities. Access roads that are not needed for operations and maintenance of the Project would be restored.
NOISE	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction Noise levels associated with individual pieces of equipment at 50 feet away would generally range between 55 and 85 dBA maximum sound level (L_{max}). Maximum instantaneous construction noise levels would range from 91 to 95 dBA equivalent sound level (L_{eq}) at 50 feet from any work site. No noise sensitive areas would be located within DOT noise threshold distances, so no exceedances of the DOT guidelines are expected. Operations and Maintenance The predicted sound level at the nearest noise sensitive area would be below the EPA environmental noise guidelines.
Tennessee Converter Station and AC Interconnection Siting Areas	Same as Oklahoma Converter Station and AC Interconnection Siting Areas (row above).
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction Same as Oklahoma Converter Station and AC Interconnection Siting Areas (row above). Operations and Maintenance The predicted sound level at the nearest noise sensitive area would be below the EPA environmental noise guidelines. Six noise sensitive areas (NSAs) would be located within 659 feet of the Arkansas interconnection line, which corresponds to the threshold distance to the 55 dBA L_{dn} EPA guideline threshold for the 500kV single circuit AC transmission line, assuming operating conditions that would generate the highest noise emissions. These six NSAs may experience adverse noise impacts, which are in excess of the EPA guideline threshold. However, impacts would be less under different weather conditions or if the transmission line is located at an altitude less than 3,000 feet.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
RECREATION	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction No impacts to any recreation resources are expected because there are no recreational resources in these areas. Operations and Maintenance No impacts expected.
Tennessee Converter Station	Construction No impacts to any recreation resources are expected because there are no recreational resources in these areas. Operations and Maintenance No impacts expected.
Arkansas Converter Station Alternative	Construction Converter station construction could impact recreational areas if the final location for the converter station is within or adjacent to the Cherokee Wildlife Management Areas (WMA) or the Rainey WMA. Construction could temporarily disturb 45 to 60 acres. Final locations for the converter station have not been determined. It is assumed that the Cherokee and Rainey WMAs would be avoided and the Arkansas Converter Station and AC interconnection would not impact recreation resources. Operations and Maintenance Impacts to recreational areas would only occur if the final location for the converter station is within or adjacent to the Cherokee WMA or the Rainey WMA. The operations and maintenance of the converter station are not expected to permanently preclude the use of or access to any existing recreation areas or activities, although some direct short-term impacts to these resources, such as noise, visual disturbance, or restricted access, would likely diminish the quality of a recreational visit.
SOCIOECONOMICS	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction Population and community service impacts would be minor, short term, and temporary. Economic condition impacts would be positive, minor, short term, and temporary. Construction of the converter station is expected to cost approximately $250 million and employ an average of 138 workers over a 32-month construction period, resulting in estimated total employee earnings of $16.2 million. Impacts have the potential to be more substantial in Region 1, where housing resources are more limited, if construction is concurrent with construction of the HVDC transmission line and AC collection system; this potential shortage would be further exacerbated if Project construction coincides with construction of wind projects. Tax revenue impacts would be positive, short term, and temporary from sales, use, and lodging taxes. Operations and Maintenance Operations and maintenance of each of the converter stations is expected to support up to 15 workers, with total estimated annual earnings of approximately $1 million. Annual ad valorem or property tax revenues generated by the Oklahoma converter station would range from $3.2 million to $4.6 million.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction Population and community service impacts would be minor, short term, and temporary. Economic conditions impacts would be positive, minor, short term, and temporary. Construction of the converter station is expected to cost approximately $250 million and employ an average of 138 workers over a 32-month construction period, resulting in estimated total employee earnings of $16.2 million. Tax revenue impacts would be positive, short term, and temporary from sales, use, and lodging taxes. Operations and Maintenance Operations and maintenance of each of the converter stations is expected to support up to 15 workers, with total estimated annual earnings of approximately $1 million. In Tennessee, the converter station would result in estimated annual ad valorem tax revenues of $5.6 million and $3.4 million for Shelby and Tipton counties, respectively.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction Same as for Tennessee converter station. Operations and Maintenance Operations and maintenance of each of the converter stations is expected to support up to 15 workers, with total estimated annual earnings of approximately $1 million. Operations and maintenance of the Arkansas converter station would generate annual property or ad valorem tax revenues in either Pope or Conway counties, depending on where it is located. The Arkansas converter station would result in estimated annual ad valorem or property tax revenues of about $0.9 million in either county.
SPECIAL STATUS WILDLIFE AND FISH, AQUATIC INVERTEBRATE, AND AMPHIBIAN SPECIES	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction No mortality impacts to any of the special status species are expected. Construction would disturb approximately 45 to 60 acres of grasslands and croplands sat the Oklahoma converter station and associated AC interconnection. The habitat loss is unlikely to have substantial long-term direct impacts to special status wildlife populations in the area. No direct or indirect impacts to special status fish, aquatic invertebrate, and amphibian species or their habitat would occur because no waterbodies are located within the footprint of the converter station. Operations and Maintenance Because the converter station area would be a developed site with approximately 45 acres fenced, the routine presence of staff would not have any impacts to any special status wildlife species. The expected risk of collision mortality from the AC interconnection line to avian species is low. No direct or indirect impacts to special status fish, aquatic invertebrate, and amphibian species or their habitat would occur because no waterbodies are located within the footprint of the converter station.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction No mortality impacts are expected to either the northern long-eared bat or Indiana bat. Potential impacts are expected to be very limited because the siting area is largely croplands and pasture land. No loss of bat habitat is expected so long as construction does not require removal of any potential roost trees that may occur in forested areas. The only special status fish or aquatic invertebrate species identified near the converter station include the pallid sturgeon (federally endangered) and blue sucker (state threatened), which occur within the Mississippi River. Although the Mississippi River is more than 10 miles from the siting area, construction activities could impact tributaries draining into the Mississippi River. If the converter station is built adjacent to Big Creek or Bull Branch. Construction activities could introduce sediment, herbicides, and/or fuel and lubricants into the aquatic system that could travel to the Mississippi River. Operations and Maintenance No impacts to either the northern long-eared bat or Indiana bat are expected. If the converter station is built adjacent to Big Creek or Bull Branch, riparian clearing maintenance, road maintenance activities, and facilities operations could result in increased risk of chemical spills and contamination and increased sedimentation that could travel to the Mississippi River.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The siting areas contain a high proportion of forested habitat that could potentially be used by the Indiana bat and northern long-eared bat for summer-roosting and foraging. The occurrence and use of forested habitat by the northern long-eared bat and Indiana bat, and possibly by the Ozark big-eared bat and gray bat as foraging, within the Project ROI is likely restricted to the spring through fall. To the extent that construction of the converter station and associated AC interconnection transmission lines avoids forested areas, impacts to bat habitat (i.e., removal of roost trees or temporary disturbance of roost sites) would be minimized or avoided. No bald eagle nesting or winter roost sites are known to exist within the siting areas, but any potential sites would be identified prior to construction and appropriate measures would be implemented to avoid potential impact to nests or winter roosts. No direct impacts to special status fish, aquatic invertebrate, and amphibian species or their habitat because no waterbodies are located within the footprint of the construction area or along the interconnection area.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
	Operations and Maintenance No impacts to any of the special status bat species are expected from operations and maintenance of the facility. The vegetation in the ROW underneath the AC transmission lines would be maintained in a low stature to prevent interference with electrical conductors. Any trees removed during construction would not be allowed to regrow, including any trees that had been used as bat roost trees. The transmission lines could pose a risk to wintering bald eagles in the region, although there is no suitable habitat within the siting area that would attract eagles from surrounding wintering areas, so the potential risk of collisions with the transmission lines is considered low. No direct or indirect impacts to special status fish, aquatic invertebrate, and amphibian species or their habitat would occur because no major waterbodies are located within the footprint of the construction area or along the interconnection area.
SURFACE WATER	
Common impacts to all converter station and AC interconnection siting areas	Common impacts include (1) potential for runoff and receiving water contamination from spills or leaks of fuels and lubricants, (2) changes in runoff rates in areas of land disturbance, (3) possible disturbance of drainage features, including intermittent or perennial streams, from construction of facilities and access roads; and (4) impacts to water availability from water demands.
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction Limited surface water features consisting of 1.6 miles of intermittent stream beds, no perennial streams, and no major waterbodies are present in the siting areas. The length of intermittent streams within the representative 200-foot-wide ROW for the AC interconnection is 0.2 mile. Water needed to support construction would likely not come from surface water. Operations and Maintenance No impacts on surface water are expected.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction Limited surface water features consisting of a few drainage features, including 0.25 mile of perennial streams, 4.4 miles of intermittent streams, and no major waterbodies are present within the siting areas. The 200-foot representative ROW for the AC interconnection would encompass no perennial or intermittent streams. Water needed to support the construction would likely not come from surface water. Operations and Maintenance No impacts on surface water are expected.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The siting areas are large with many drainage features, including 12.82 miles of perennial streams and about 57.88 miles of intermittent streams, but no major waterbodies. The 200-foot representative ROW for the AC interconnection would encompass 0.04 mile of perennial streams and 0.3 mile of intermittent streams. The Applicant would avoid surface waters to the extent practicable in selecting the ultimate construction site for the station. Water to support construction of the converter station and interconnection would likely come from surface water; which is expected to be obtained from a municipal provider. Operations and Maintenance No impacts on surface water are expected.
TRANSPORTATION	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction No decrease in level of service is expected for any roadway segments in the siting areas. No railroads are located in the siting areas. No impacts to airports, airstrips, or navigation aids are expected. Operations and Maintenance Negligible impacts to transportation.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
Tennessee Converter Station and AC Interconnection Siting Areas	Construction Conservative modeling of construction traffic predicts a potential decrease in the level of service from A to B (9 segments) and from B to C (5 segments) for segments of the multiple roadways. Decreases from levels of service LOS-C to LOS-D are predicted for six segments of the some local roadways centered in the area of Munford, Atoka, and Millington, Tennessee. The decrease from LOS-C to LOS-D is only a one-level drop in operation level and would be minimally noticeable to motorists. The scenario that peak traffic would be distributed entirely to the roadway segments with resulting decreases to LOS-D is a worst-case scenario; actual impacts to these roadway segments are expected to be less than predicted. No railroads are located within the siting area. Equipment and buildings associated with the converter station are expected to be less than 85 feet in height; these would not affect nearby airports. Transmission line structures for the AC interconnection are not anticipated to exceed 180 feet and may be subject to FAA review due to their proximity to the Millington Regional Jetport and local topography considerations. Operations and Maintenance Negligible impacts to transportation.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction Construction traffic could result in decreases in the level of service from LSO-A to LOS-B for segments of the multiple roadways. All roadways would continue to operate an acceptable LOS-C or better in the converter station siting area. No railroads, airports, airstrips, or navigation aids would be affected. Operations and Maintenance Negligible impacts to transportation.
VEGETATION COMMUNITIES	
Common impacts to all converter station and AC interconnection siting areas	Construction may cause the direct impact of vegetation removal and the indirect impacts of reduction of plant vigor from mechanical damage, fragmentation, and the introduction of invasive species. Operations and maintenance of the Project would result in the continued absence of vegetation from the footprint of the facilities for the life of the Project. Operations and maintenance of the AC transmission lines for the interconnections would impact vegetation directly through mowing and pruning in the ROW and indirectly through herbicide applications that may impact non-target plant species.
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction The dominant vegetation for the siting area is grassland and herbaceous cover (605 acres). Forty-five to 60 acres of land would be cleared and graded for the station facility footprint, plus an additional 5 to 10 acres of land for the overall construction. Vegetation would not be allowed to grow on these 45-60 acres for the life of the project and during construction of the project for the additional 5-10 acres. Clearing and grading activities for the access road would cause removal of approximately 4 acres of vegetation for the life of the Project. A maximum 200-foot-wide by 2.7-mile-long interconnection ROW would result in approximately 65.5 acres of long-term impacts, including the initial clearing of the existing vegetation. The structural footprint for the lattice structures would require less than 1 acre of long-term impact to vegetation. Operations and Maintenance Vegetation removed during the construction of the converter station or access road would not be replaced during the operations phase of the Project. Vegetation within the ROW of the AC interconnection would be maintained during the operations and maintenance phase of the Project. The projected acreage of vegetation to maintain in the AC interconnection ROW is 65.5 acres.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction The dominant vegetation for the siting area for the Tennessee converter station includes cultivated crop lands (394 acres) and pasture/hay (195 acres). Forty-five to 60 acres of land would be cleared and graded for the station facility footprint, plus an additional 5 to 10 acres of land for the overall construction. Vegetation would not be allowed to grow on these 45-60 acres for the life of the project and during construction of the project for the additional 5-10 acres. Clearing and grading activities for the access road would cause the removal of approximately 4 acres of vegetation for the life of the Project. A maximum 200-foot-wide by 0.2-mile-long interconnection ROW would result in approximately 4.8 acres of long-

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
	term impacts to vegetation. The structural footprint for the lattice structures would require less than 1 acre of permanent impact to vegetation. Two tensioning sites would be needed, resulting in approximately 5 acres of potential temporary impact to vegetation.
	Operations and Maintenance Vegetation removed during the construction of the converter station or access road would not be replaced during the operations phase of the Project. Vegetation within the ROW of the AC interconnection would be maintained during the operations and maintenance phase of the Project. The projected acreage of vegetation to maintain in the AC interconnection ROW is 4.8 acres.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The dominant land cover type is evergreen forest (7,894 acres), followed by deciduous forest (5,425.4 acres), and pasture/hay lands (4,563.4 acres). There are also 363 acres of wetlands within the overall siting area. Forty-five to 50 acres of land would be cleared and graded for the station facility footprint, plus an additional 5 to 10 acres of land for the overall construction. Vegetation would not be allowed to grow on these 45-50 acres for the life of the project and during construction of the project for the additional 5-10 acres. Clearing and grading activities for the road would cause removal of approximately 4 acres of vegetation for the life of the Project. The following impacts would be expected: • Transmission line ROW: A maximum 200 foot-wide by 6-mile-long ROW would impact 121 acres of vegetation. • Lattice or monopole structures: Approximately 1 acre of vegetation removal. • Tubular pole structures: Less than 1 acre of vegetation removal. • AC Interconnection Siting Area: A 5-acre site would be required for the interconnection to an existing 500kV transmission line. An additional 5-acre area would be required during construction, resulting in a potential for 10 total acres of impact, split between 5 acres of long-term vegetation impacts and another 5 acres of temporary impact. Operations and Maintenance Vegetation removed during the construction of the converter station or access road would not be replaced during the operations phase of the Project. Vegetation within the ROW of the AC interconnection would be maintained during the operations and maintenance phase of the Project. The projected acreage of vegetation to maintain in the ROW is 121 acres.
VISUAL RESOURCES	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction Short-term visual intrusion of construction vehicles, equipment, materials, and a work force in staging areas, and final converter station location. Vehicles, heavy equipment, structure components, ancillary facility components and materials, and workers would be visible during construction and would create short-term and local contrast within the areas of the ROW for the AC interconnection. Lighting of construction yards and work areas would create temporary visual impacts to night skies. Operations and Maintenance Facilities would contrast with the rural landscape and be visible on the horizon from large distances; however, the area is already impacted by numerous vertical structures such as wind turbines and existing transmission lines. There are no notable visual resources, so visual concern is low. Overall visual impacts would be low due to existing modification to the landscape and low number of sensitive viewers.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction Same as described for the Oklahoma converter station. Operations and Maintenance Two key observation points were identified for the siting area. Depending on the observation point, the Project would result in moderate or strong contrast and moderate-high visual impacts.
Arkansas Converter Station Alternative and AC Interconnection	Construction Short-term visual intrusion of construction vehicles, equipment, materials, and a work force in staging areas, and final converter station location. Vehicles, heavy equipment, structure components, and workers would be visible during converter station construction and modification, access and spur road clearing and grading, structure

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
Siting Areas	erection, and cleanup and restoration. Affected viewers would be aware of the existing structures in the area adjacent to the Project and the temporary nature of Project construction impacts, which would decrease both scenic quality and viewer concern to the impact.
	Operations and Maintenance The surrounding landscape of the siting area is primarily rural and agricultural and other than rural residences, does not contain a high number of sensitive resources that would be impacted. When visible in the foreground, the facilities associated with the converter station would result in high contrast on the rural landscape, but given low numbers of sensitive viewers in the area, it would have an overall low-moderate impact.
WETLANDS, FLOODPLAINS, AND RIPARIAN AREAS	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction The Oklahoma Converter Station and AC Interconnection Siting Areas are dominated by grassland/herbaceous vegetation (605 acres). No wetland resources or 100-year floodplains were identified within the siting areas. Potential impacts to riparian areas are unlikely. Less than 2 miles of intermittent stream beds, no perennial streams, and no major waterbodies are present within the siting areas. Operations and Maintenance No impacts to wetlands, floodplains, or riparian areas are expected.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction The Tennessee Converter Station and AC Interconnection Siting Areas include approximately 6 acres of wetlands. The construction effort would avoid wetlands and waters of the United States to the extent practicable. Where impacts appear unavoidable, those wetland sites would receive a formal wetland delineation and appropriate consultation with the USACE. No 100-year floodplains occur with the siting area. Only 0.25 mile of perennial streams, 4.4 miles of intermittent streams, and no major waterbodies are present within the siting area. Potential impacts to riparian areas are unlikely. Operations and Maintenance If wetlands and riparian areas can be avoided during construction activity, then they should also be avoided during all operations and maintenance activities.
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	Construction The Arkansas Converter Station Alternative Siting Area and AC Interconnection Siting Areas include approximately 96 acres of palustrine wetlands, 76 acres of lacustrine wetlands, and 191 acres of riverine wetlands (a total of 363 acres of wetlands). The converter station would ultimately only disturb approximately 60 acres of lands and it is very unlikely that these 60 acres would be focused on the wetland resources documented within the siting area. The construction effort should avoid wetlands and waters of the United States to the extent practicable. One floodplain could be impacted in the siting area. An estimated 73 acres of 100-year floodplain are contained with the siting area, and specific placement of the converter station infrastructure would determine the ultimate acreage impacted. The Arkansas Converter Station Alternative siting areas includes almost 13 miles of perennial streams and about 58 miles of intermittent streams. Riparian areas may be associated with many, if not all, of these surface water features. Considering the small size of the disturbance within the siting areas (approximately 60 acres vs. 20,000-acre siting area), these surface water features would likely be avoided, but where not, riparian areas could be affected. Operations and Maintenance Wetlands, floodplains and riparian areas associated with perennial streams have all been documented within the siting area, but ultimately only 60 acres of land would be disturbed. Therefore, these resources would likely be avoided during siting and would thus incur no impacts during operations and routine maintenance.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
WILDLIFE AND FISH	
Oklahoma Converter Station and AC Interconnection Siting Areas	Construction Wildlife species would be exposed to Project-related mortality or injury. Grasslands and croplands are capable of restoring to pre-disturbance levels in a short timeframe (defined as less than 5 years). As a result, the majority of Project-related impacts to grasslands and croplands habitats would be short term in nature (i.e., those areas would restore to pre-construction conditions within 5 years or less) However, some permanent loss of grassland and croplands habitats would also occur as a result of the Project's permanent footprint. The grassland and cropland habitats found within the Oklahoma Converter Station and AC Interconnection Siting Areas are relatively common throughout the ROI; therefore, disturbance of 45–60 acres would not result in a significant impact to local wildlife. No perennial streams and no major waterbodies are located within the siting area. Coldwater Creek, a perennial stream, is within 1 mile of the siting area. Increased sedimentation is not likely to affect Coldwater Creek; however, if construction occurs near established intermittent waterways, there is potential for sediment to travel downstream and cause potential impacts to fish and aquatic invertebrate species.
	Operations and Maintenance Operation and maintenance activities would result in long-term impacts to the habitats. Some permanent loss of habitat would occur as a result of the Project's permanent footprint (i.e., some areas would be encompassed permanently by Project structures such as the converter station, transmission line structures, access roads, etc.).The permanent loss of habitat is unlikely to have substantial long-term impacts to wildlife populations in the area because the type of habitats affected are common in the region and found elsewhere in the vicinity of the Project ROI. Operation and maintenance activities would not result in long-term impacts to fish and aquatic species because no major waterbodies or perennial streams are within the siting area, and downslope streams are approximately 1 mile away.
Tennessee Converter Station and AC Interconnection Siting Areas	Construction Croplands and pasture/hay lands are the dominant habitat types found in the siting areas. However, hardwood forests and riparian areas are also present. Croplands and pasture lands are capable of restoring to pre-disturbance levels in a short timeframe (defined as less than 5 years). As a result, the majority of Project-related impacts to these areas would be short-term in nature. However, some permanent loss of habitats would still occur as a result of the Project's permanent footprint. Furthermore, because forests and riparian areas are also present, these types of habitats could also be potentially impacted as well. Forested and riparian areas could take decades to restore to pre-construction conditions if they are disturbed or cleared. There are no major waterbodies or streams located within the siting area. The Tennessee Converter Station Siting Area and AC Interconnection Siting Area borders Big Creek, a perennial stream, listed as impaired in 2010 for aquatic resources (fish, shellfish, and wildlife values). Impacts fish and aquatic species would likely be less if the facilities were located within the croplands and pasture/hay lands, and greater if they were located in forested areas due to the effects of long-term habitat loss from vegetation clearing, the extensive time necessary for forests to regenerate to pre-disturbance conditions and provide sediment retention, shade, and cover, and the impacts associated with edge effects in forested habitats that do not provide sedimentation retention, shade, and cover. Operations and Maintenance Operation and maintenance activities would result in long-term impacts to the habitats. Some permanent loss of habitat would occur as a result of the Project's permanent footprint (i.e., some areas would be encompassed permanently by Project structures such as the converter station, transmission line structures, access roads, etc.). The permanent loss of habitat is unlikely to have substantial long-term impacts to wildlife populations in the area because the type of habitats affected are common in the region and found elsewhere in the vicinity of the Project ROI. However, species that are near or at carrying capacity may experience a reduction in population size due to this permanent loss of potential feeding and breeding A perennial stream flows adjacent and downslope along the western side of the siting areas. Additionally, a perennial stream flows through the middle of the siting area. Placement of roads and structures that could result in increased sedimentation from operations and maintenance activities could result in long-term direct and indirect impacts to fish and aquatic invertebrate species or their habitat.

Table 2.6-1:
Summary of Potential Environmental Impacts—Converter Stations and AC Interconnections

RESOURCE	IMPACT
Arkansas Converter Station Alternative and AC Interconnection Siting Areas	**Construction** The siting area contains a variety of habitats that range from forested areas to pasture lands. The Project could result in long-term impacts to wildlife habitats (due to the timeframes necessary for these forests areas to restore to pre-construction conditions). Because the pasture/hay fields that could potentially be impacted are capable of restoring to pre-disturbance levels in a short timeframe (defined as less than 5 years), most impacts to these types of habitats would be short-term in nature. However, some permanent loss of pasture/hay field habitats would still occur as a result of the Project's permanent footprint Impacts to wildlife would likely be less if the facilities were located within the pasture lands, and would be greater if they were located in forested areas due to the effects of long-term habitat loss, the extensive time necessary for forests to regenerate to pre-disturbance conditions, and the impacts associated with edge effects in forested habitats. Construction would not likely result in any direct impacts to fish and aquatic invertebrate species or their habitat because no waterbodies are located within the siting area. Indirect construction impacts should be minimal. However, if either siting area is upslope of any waterbodies, there is a potential for runoff to enter the waterway, causing potential indirect impacts to fish and aquatic invertebrate species. **Operations and Maintenance** The permanent loss of habitat is unlikely to have substantial long-term impacts to wildlife populations in the area because the type of habitats affected are common in the region and found elsewhere in the vicinity of the Project ROI. Direct impacts to fish and aquatic invertebrate species or their habitat are not expected because no waterbodies are located within the footprint of the interconnection area.

Table 2.6-2:
Summary of Potential Environmental Impacts—AC Collection System

RESOURCE	IMPACT
Agricultural Resources	**Construction** Cultivated crops would be directly affected by removal of vegetation and potential removal of agricultural structures such as irrigation systems, barns, and silos. Agricultural production may be temporarily diminished. The Applicant would avoid or minimize adverse effects to surface and subsurface irrigation and drainage systems (e.g., tiles). Potential impacts to cultivated crops would vary based on the design and location of the proposed transmission line structures and access roads relative to existing agricultural operations. During construction, 325 to 1,365 acres of primarily grassland and cultivated crops would be disturbed depending on which AC collection system route is constructed. Construction of the AC collection system would directly affect livestock grazing by temporarily reducing forage and displacing livestock from grassland/herbaceous and pasture. Construction may affect livestock control and distribution if a gate is left open or a fence is damaged. Vehicular access during construction would increase the likelihood of livestock injury or death from collisions. Construction and operations and maintenance of the proposed transmission lines could affect the economic value of livestock production in the representative ROW by increasing ranchers' costs and decreasing available forage. The Project could affect net earnings from livestock production in the following ways: • Decreased forage from land taken out of production • Increased management costs associated with controlling additional noxious and invasive vegetation species introduced by Project construction equipment • Increased management costs associated with moving livestock around project-related structures and easements **Operations and Maintenance** Potential impacts to cultivated crops would vary based on the design and location of the AC collection system structures and access roads relative to existing agricultural operations. Long-term disturbance would result in 1.8 to 7.8 acres of primarily grassland/herbaceous and cultivated crops depending on which AC collection system route is constructed.

Table 2.6-2:
Summary of Potential Environmental Impacts—AC Collection System

RESOURCE	IMPACT
	Most agricultural activities such as livestock grazing and cultivating crops could be returned to the ROW upon the completion of construction.
Air Quality and Climate Change	Construction Construction activities would result in air quality and greenhouse gas emissions. Emissions are not anticipated to cause or significantly contribute to a violation of an applicable ambient air quality standard or contribute substantially to an existing or projected air quality violation. Operations and Maintenance There would be negligible amounts of air pollutants from maintenance activities. Operations and maintenance of the AC collection system would not emit pollutants; however, maintenance activities would emit small amounts of pollutants associated with combustion of fossil fuels for worker vehicles and equipment.
Electrical Environment	Construction No electrical effects would be associated with construction of the AC collection system because these facilities would not be energized during construction. Operations and Maintenance Calculations with respect to electrical fields, magnetic fields, audible noise, radio noise, television noise, and ozone were performed for each of the configurations and the results are as follows: • Calculated AC electric field levels at the ROW edges would be below guidelines for public exposure (established by non-regulatory organizations such as the Institute of Electrical and Electronics Engineers [IEEE], American Conference of Governmental Industrial Hygienists [ACGIH], and the International Committee on Non-Ionizing Radiation Protection [ICNIRP]). Within the ROW, calculated electric field levels would be below some guidelines for transmission line ROWs, but exceed some public exposure guidelines. For the single circuit lattice structure configuration, calculated electric field levels exceed guidelines for workers with implanted medical devices at the ROW edges if the ROW width is only 150 feet, but comply if the width is 200 feet. • Calculated magnetic field levels at the ROW edges are below guidelines for public exposure (established by non-regulatory organizations such as the IEEE, ACGIH, and ICNIRP) and within the ROW are below guideline for workers with implanted medical devices. • Calculated audible noise levels at the ROW edges are below the EPA guideline for noise. • Calculated radio noise levels at 50 feet from the outside conductor comply with the IEEE threshold during fair weather conditions but are slightly above that threshold during rainy weather. • Television noise could cause interference. No interference from corona-generated noise expected for digital signals broadcast at frequencies above 1 gigahertz from satellites. • Maximum ozone levels are far below the EPA standard. • Based on an evaluation of research and guidelines recommended by various agencies, it is unlikely that the AC collection system would pose a known threat to human health. • Overall, the likelihood of annoyance to landowners by audible noise from the line or interference with AM radio or television reception is small.
Environmental Justice	Construction/Operations and Maintenance No long-terms impacts to low-income or minority populations are anticipated.
Geology, Paleontology, Soils, and Minerals	Construction Designated Farmland. AC Collection System Route SW-1 would impact the least amount (9 acres) of designated farmland. AC Collection System Routes E-2, NW-1, NW-2, SE-1, and SE-3 would impact the greatest amount (502 to 671 acres) of designated farmland. Soil Limitations. Depending on the AC collection system routes that are implemented, construction would result in: • Disturbance of 128 to 1,125 acres of karst and 43 to 138 acres of shallow bedrock • 127 to 1,209 acres of soils with high compaction potential • 76 to 779 acres of soils with moderate to high wind erosion potential • 0 to 46 acres of soils with slopes of 15% to 30%

Table 2.6-2:
Summary of Potential Environmental Impacts—AC Collection System

RESOURCE	IMPACT
	• Temporary disturbance to soils from access roads Soil Contamination. One facility/site with known contamination was identified within the AC Collection System Route SW-2. That location would likely be avoided. Operations and Maintenance Impacts to soils generally depend on the length and area covered by the routes, which generally correlates with the amount of access roads and ROW. Other impacts depend on farmland and soil limitation parameters that might be affected. Impacts to soils would be limited to the actual transmission line structure footprints and from occasional use of the ROW for maintenance access. Impacts from access roads might expose soils to erosion and compaction. Impacts caused by new structures would be permanent during operations and maintenance and the access impacts would be temporary and minimal.
Groundwater	Construction Common impacts among the AC collection system routes include (1) potential for contamination from spills or leaks of fuels and lubricants, (2) short-term changes in infiltration rates in areas of land disturbance, (3) minor impacts to water availability from water demands (low demand as compared to availability), and (4) potential damage to wells and associated piping systems in construction areas. The deepest foundations for transmission line structures would be in the range of 30 to 44 feet below ground. Based on the typical depths to groundwater in the five counties in which the AC collection system routes would be located, it is expected that construction of foundations for transmission line structures would not reach groundwater. Five of the representative ROWs associated with AC Collection System Routes E-1, E-2, E-3, SE-1, and SE-3 would encompass 14 to 174 acres of nutrient-vulnerable groundwater, but do not cross areas with special source groundwater. The total number of wells (private domestic, public water supply, agricultural, and industrial) within the ROWs range from 0 to 8. Operations and Maintenance No impacts to groundwater.
Health, Safety, and Intentional Destructive Acts	Construction/Operations and Maintenance The Project would introduce hazards that could affect worker and public health and safety. Natural events, external events or accidents (e.g., aircraft mishaps or fires) or intentional destructive acts or mischief could impact such infrastructure and have related effects on the health and safety of construction workers and the public. The Project would involve the transportation and handling of hazardous materials. The implementation of EPMs associated with management of hazardous materials would keep risks to a minimum.
Historic and Cultural Resources	Construction AC Collection System Routes NE-1, NE-2, SE-1, SE-2, and SW-1 contain no previously recorded archaeological sites or other historic properties. AC Collection System Routes E-1, E-2, E-3, and SE-3 each contain one previously recorded archaeological site that has not been evaluated for NRHP eligibility. None contain previously recorded historic buildings. AC Collection System Routes NW-1 and NW-2 each contain two previously recorded archaeological sites, neither of which has been evaluated for NRHP eligibility. AC Collection System Route NW-1 contains no previously recorded historic buildings. The NRHP-listed Tracey Woodframe Grain Elevator is located in the vicinity of AC Collection System Route NW-2. AC Collection System Route SW-2 contains three previously recorded archaeological sites, none of which have been evaluated for NRHP eligibility. The route contains no previously recorded historic properties. AC Collection System Route W-1 contains two previously recorded archaeological sites, neither of which has been evaluated for NRHP eligibility. The route contains no previously recorded historic properties. A cultural resources survey within AC collection system would be performed prior to construction of the Project to assess the possible impacts of construction on such resources if present. Operations and Maintenance No impacts would be expected.

Table 2.6-2:
Summary of Potential Environmental Impacts—AC Collection System

RESOURCE	IMPACT
Land Use	Construction The majority of the impacts to land use would be temporary. Construction would temporarily prevent the use of rangeland and cultivated crops in the ROW. Depending on the AC collection system route, disturbance of primarily grassland and cultivated crops would range from 325 to 1,365 acres. There are 0 to 2 structures present in ROWs. Operations and Maintenance It is anticipated that all existing roads and existing roads with repairs/improvements would be retained for operations and maintenance of the Project. It is estimated that approximately 75% of the new overland roads with no improvements and 90% of the new overland roads with clearing and new bladed roads would be retained for operations and maintenance access. These roads would be up to 20 feet wide. Access roads that are not needed for operations and maintenance would be restored. All other land in the ROW could return to most previous land uses if they are compatible with operations and maintenance of the Project. Some uses may be impeded in the ROW, such as using farming equipment near the pole structures or crop-dusting planes that would not be able to approach the transmission lines. Land uses that would not be permitted in the ROW include buildings or structures, changing the grading and land contours, and some restrictions and coordination for infrastructure such as fences and irrigation lines. In addition, access would be restricted during the performance of maintenance activities. All of the tensioning and pulling areas could return to existing uses once construction has been completed.
Noise	Construction Depending on the route, noise sensitive areas may experience short-term and temporary elevated noise levels. Operations and Maintenance Operations and maintenance would include the use of trucks, lifts, or other equipment as needed on a periodic basis along the AC collection system. Depending on the route, some noise sensitive areas could experience adverse noise impacts under certain operational and weather conditions.
Recreation	Construction Construction is not expected to permanently preclude the use of or access to any existing recreation areas or activities since no recreation resources have been identified within the representative ROW for any routes. The southern boundaries of the Optima National Wildlife Refuge (NWR) and the Optima WMA are located to the north of AC Collection System Route E-1. At the closest point, the Optima NWR and the Optima WMA are approximately 1,500 feet from this route, and about 1.5 miles from the Optima lake shoreline, which is within the NWR and WMA areas. The boundaries of the Schultz Lake State Park and Schultz WMA are located to the north of AC Collection System Route SE-1. At the closest point, the Schultz Lake State Park and Schultz WMA are approximately 0.5 mile from the route. Long-term indirect impacts would result from vegetation clearing and structure erection and could have impacts on recreational visitors due to changes in for the scenic landscapes provided by the Optima NWR and Optima WMR and Schultz Lake State Park and Schultz WMA. Operations and Maintenance No impacts to recreation resources are anticipated from operations and maintenance of any of the AC collection system routes because no recreation resources are located within the representative ROW.
Socioeconomics	Construction Population and community service impacts would be short term and temporary. Economic condition impacts would be positive, short term, and temporary. Impacts have the potential to be more substantial in Region 1, where existing housing resources are more limited, if construction is concurrent with construction of the HVDC line and Oklahoma converter station; this potential shortage would be further exacerbated if Project construction coincides with construction of wind projects. Tax revenue impacts would be short term and temporary from sales, use, and lodging taxes, ranging from $0.2 million to $2.5 million per route alternative. Operations and Maintenance Operations and maintenance are unlikely to affect regional agricultural production and employment, but could have localized impacts. Some short-term adverse impacts on residential property values (and saleability) might occur on

Table 2.6-2:
Summary of Potential Environmental Impacts—AC Collection System

RESOURCE	IMPACT
	an individual basis as a result of the Project. However, these impacts would be highly variable, individualized, and are difficult to predict. Positive tax revenue impacts (less than $1 million per route) would be expected from annual ad valorem or property taxes.
Special Status Wildlife and Fish, Aquatic Invertebrate, and Amphibian Species	Construction Habitat loss and fragmentation of existing grassland habitat is one of the primary threats to the lesser prairie-chicken (LEPC). The highest quality LEPC habitat (based on Crucial Habitat Assessment Tool [CHAT]-1 and CHAT-2) occurs on the eastern side of the AC collection system area. To the extent that the AC transmission lines and access roads cross contiguous areas of native grasslands, construction of the AC collection system may contribute to the loss of potential LEPC habitat. These impacts could be minimized with routes that follow existing ROWs, areas of cultivated fields, and grassland areas already fragmented by other activities that are areas of low quality prairie chicken habitat. The Sprague's pipit also uses native grasslands and could be similarly affected by loss of habitat and fragmentation. Special status fish, aquatic invertebrate, and amphibian species potentially occurring within the AC collection system routes include populations of the Arkansas River shiner. The Beaver River and Palo Duro Creek, which are crossed by several routes, may provide aquatic habitat for the Arkansas River shiner. Potential direct impacts include grading, access roads, herbicide use, and handling of fuel and lubricants where the Beaver River and Palo Duro Creek would be crossed by the routes. Operations and Maintenance Potential impacts to special status wildlife species include mortalities from collisions with transmission lines and structures and possible electrocutions, disturbance impacts from routine maintenance activity, and loss of habitat by behavioral avoidance of areas surrounding vertical structures (i.e., transmission structures and lines). There is a potential risk of mortalities to whooping cranes and golden eagles from collisions with transmission lines and structures. The prairie chicken is a low flier and typically avoids areas surrounding tall structures. Routine maintenance and inspection work is unlikely to impact special status wildlife species other than a temporary displacement while work is performed. However, any avoidance of areas by the LEPC due to the potential for increased predation rates (due to consolidation of raptors and corvids along the AC collection lines) would constitute a loss of habitat. The use of both access roads and the ROW for repair and maintenance activities could result in both direct and indirect impacts to the Arkansas River shiner or its potential habitat in the Beaver River and Palo Duro Creek. The potential application of herbicides could result in indirect impacts, and to a lesser extent, direct impacts.
Surface Water	Construction Common impacts include (1) potential for runoff and receiving water contamination from spills or leaks of fuels and lubricants, (2) short-term changes in runoff rates in areas of land disturbance, (3) possible disturbance of drainage features, including intermittent or perennial streams, from construction of access roads; and (4) impacts to water availability from water demands. Depending on the route, potential impacts could occur to the following surface water resources: (1) the 200-foot ROWs contain 0 to 0.51 mile of perennial streams, 0.25 to 2.15 miles of intermittent streams, 0 to 0.18 mile of major waterbodies, and 0 to 2.61 acres of reservoirs, lakes or ponds; (2) AC Collection System Route SE-3 crosses Wolf Creek, designated a Texas ecologically unique stream segment; (3) six of the routes cross impaired water segments of Beaver River or Palo Duro Creek; and (4) the depth to water table is great enough that pumping and discharge of groundwater during construction is unnecessary. Operations and Maintenance Operations and maintenance would not impact surface water.
Transportation	Construction Only minor decreases in the level of service for area public roadways in the ROI would be expected. These decreases would be temporary. Operations and Maintenance None of the routes would result in impacts to traffic, railroads, or airports/airfields.

Table 2.6-2:
Summary of Potential Environmental Impacts—AC Collection System

RESOURCE	IMPACT
Vegetation Communities	Construction Impacts include the initial clearing of vegetation in the ROW and the removal of vegetation in the locations of lattice structure placements. The range of potential impacts from vegetation clearing in the ROW ranges from 325 acres to 1,365 acres. There would be 1.9 acres to 7.8 acres of permanent vegetation loss at structural foundation placements. Operations and Maintenance There would be some degree of regular mowing and trimming of vegetation in any of the routes. None of the routes have forested land cover, so there would be little to no change in the structural form of the vegetation. Depending on the route, the projected acreage of vegetation to maintain in the ROW is between 325 and 1,365 acres.
Visual Resources	Construction There would be short-term visual intrusion of construction vehicles, equipment, materials, and a work force in staging areas, along access roads, and along the new transmission line ROW. Vehicles, heavy equipment, structure components, and workers would be visible during transmission line construction and modification, access and spur road clearing and grading, structure erection, conductor stringing, and cleanup and restoration. However, disturbance from construction activities would be transient and of short duration as activities progress along the transmission line route. Affected viewers would be aware of the temporary nature of Project construction impacts, which may decrease their concern to the impact. The structures and cables (transmission lines) would cause the major long-term change in scenery. Operations and Maintenance The routes are located in a sparsely populated area in a landscape that is primarily flat agricultural lands offering open panoramic views. The region does not contain a high number of sensitive viewers or sensitive resources, so impacts would be expected to be low-moderate. The routes are located in a largely open and undeveloped landscape, and the introduction of large vertical elements such as a transmission line, would have the potential to affect viewers over a large viewing area. Thirteen viewing locations were identified for the routes.
Wetlands, Floodplains, and Riparian Areas	Construction Impacts may vary from short term to long term, and potentially there may be permanent loss of wetland acreage. Potential impacts to wetlands for the various routes range from 0 acre to 20.1 acres. Potential impacts to floodplains range from 0 to 54.6 acres. Riparian areas could be associated with surface water features, which range from 0 to 0.5 mile of perennial streams, 0.3 to 2.9 miles of intermittent streams, 0 to 0.2 mile of major waterbodies, and 0 to 2.6 acres of reservoirs, lakes, and ponds Operations and Maintenance Impacts may result from use of heavy machinery through wetlands, floodplains, and riparian areas. These impacts can cause soil compaction and mechanical damage or removal of vegetation. These impacts are anticipated to cover a range from temporary to potentially more severe and long-term/permanent. The use of vegetation management would be necessary to protect the Project infrastructure and enhance safety. However, the trimming, mowing, or removal of vegetation can cause changes to plant diversity and function in all three ecosystem types (i.e., wetlands, floodplains, and riparian areas). Vegetation maintenance in wetlands and riparian areas should be kept to a minimum. Additionally, the use of herbicides can cause few to severe impacts to vegetation in areas where they are applied.
Wildlife and Fish	Construction/Operations and Maintenance Some routes would have an elevated risk of avian collision during the migration seasons compared to the other routes, as well as a higher potential for disturbances to important wildlife areas due to these routes proximity to important wildlife areas (i.e., Optima NWR and Optima WMA). There would be no substantial difference between the other routes considered with regard to the types of wildlife impacts that would likely occur as a result of the route location and position; however, longer routes would likely have a greater impact due to the greater length and extent of areas impacted. The length of the various AC collection system routes range from 13 to 56 miles. There is potential for mortality, injury, and disturbance to fish and aquatic invertebrates, and aquatic habitat loss and modification where waterbodies (e.g., perennial, intermittent) would be crossed by routes.

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
Agricultural Resources	Construction Construction could affect livestock grazing by temporarily reducing forage and displacing livestock in the ROW. Croplands would be directly affected by removal of vegetation and agricultural structures such as irrigation systems, barns, and silos. Agricultural production may be temporarily diminished. Potential temporary impacts to center-pivot irrigation could occur primarily in Regions 1, 2, 6, and 7. The operation of center-pivot irrigation could be limited in construction areas. During construction, access roads, temporary work areas, and other graded areas could temporarily disrupt the slope and flow patterns of water on flood-irrigated fields. Operations and Maintenance Maintenance may occasionally disrupt agricultural activities and production on a localized basis. Potential indirect impacts to agricultural production from interference with aerial applications of fertilizer, insecticide, and herbicide, could occur. Most of the land within the ROWs could return to previous uses after construction. Land uses that would not be permitted in the ROW include buildings or structures, changes to grading and land contours, and some restrictions for infrastructure such as fences and irrigation lines. Maintenance activities may cause temporary impacts within the ROW such as damage to crops.
Air Quality and Climate Change	Construction Construction-related emissions would be below thresholds for all criteria pollutants across all alternatives. Temporary construction impacts to air quality include emissions near sensitive areas such as residences or schools for short periods of time. Locations of residences and schools are shown in Figure 1.0-2 located in Appendix A of the EIS. The only two schools within the ROI are within AC Collection System Route E-1, located within the town of Hardesty. Air quality emissions would be elevated during construction, however typically Project construction would move relatively rapidly along a given ROW, with temporary impacts lasting for only a few days or weeks in a given area. Operations and Maintenance Operations and maintenance would emit negligible air pollutants associated with combustion of fossil fuels for worker vehicles and equipment.
Electrical Environment	Construction No electrical effects would be associated with construction because the transmission line would not be energized yet. Operations and Maintenance Calculated DC electric fields are below public guidelines (such as IEEE, ACGIH, and ICNIRP) at the ROW edges if the ROW width is 200 feet. Calculated DC electric fields also conform to occupational standards within the ROW, except for the dedicated neutral return configurations. Calculated DC magnetic fields are below public guidelines (IEEE, U.S. Food and Drug Administration, ACGIH, and ICNIRP) at the ROW edges for all configurations. Calculated audible noise is below the public guideline at the ROW edges if the ROW width is 200 feet. Calculated radio noise is below Federal Communications Commission and IEEE exposure guidelines. It is unlikely that the proposed HVDC transmission line would pose a known threat to human health.
Environmental Justice	Construction/Operations and Maintenance There would be no impacts to areas where no minority or low-income populations were identified. For areas where minority and/or low-income populations were identified, it is expected that any impacts would affect all populations equally.
Geology, Paleontology, Soils, and Minerals	Construction/Operations and Maintenance Long-term impacts from the Project include the conversion of geology, mineral resources access, and soils resources (especially farmland) to a utility use, primarily for access roads, and transmission line pole structure locations. Impacts include potential damage to Project infrastructure and equipment from seismicity, landslides, subsidence, or soil liquefaction. Blasting may be necessary in areas of shallow bedrock. Impacts to soil resources from construction activities are associated with clearing, grading, excavation, and other activities necessary for construction that could expose erosion-prone soils to conditions of increased erosion potential; and soils with high compaction potential would be susceptible to compaction from construction vehicles and equipment. Impacts to soils would also include the potential for loss of soil productivity. Inadvertent spills of fluids used during construction, such as fuel, lubricants, antifreeze, and herbicides could directly impact soils through contamination; and excavation activities during construction might uncover previously unknown areas of contaminated soils. Seismic hazards are low for the entire Project except for the eastern portion of the ROI in Region 5 and all of Regions

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
	6 and 7 in the area of the New Madrid Seismic Zone. Areas of high to very high soil liquefaction potential are present in the Project Regions 4, 5, 6, and 7. Subsidence from karst is a possible geologic hazard of concern within Regions 1, 2, 4, and 5. Areas of high susceptibility for landslides are present in Project Regions 4, 5, and 7.
Groundwater	Construction Typical construction impacts include: • Potential for Groundwater Contamination—Contamination could occur as a result of the accidental release of hazardous substances, primarily fuels and lubricants, which would be used for construction equipment and be present in construction staging or storage yards. Compliance with permit requirements and implementation of EPMs, including spill prevention and response planning, would minimize the potential for groundwater contamination. • Changes to Infiltration Rates—Soils disturbed and loosened during construction could represent areas of increased precipitation infiltration, possibly increasing local groundwater recharge rates over the short term. After construction, impermeable facility surfaces would represent areas of decreased infiltration rates over the long term. The area of impermeable surfaces resulting from the Project would be small. In accordance with the Applicant's EPMs, soils would be returned to pre-activity conditions, therefore resulting in *de minimis* long-term impacts to infiltration rates. • Effects on Water Availability—Water demands to support the Project could come from groundwater resources (more likely in areas where total water use is typically from groundwater sources such as Regions 1, 2, and 6) and result in less groundwater being available for other uses. Water demand associated with the Project is not expected to have noticeable effects on groundwater resources beyond those resulting from existing water usage. • Physical Damage to Well Systems—Well system damage could occur as a result of direct impacts from equipment traffic or during excavations, and could also occur at locations more remote from construction if blasting was used at excavation sites. The Applicant's EPMs would minimize these occurrences and require repairs of any damages and, in the case of any damage, arrange for temporary water supply, if necessary. Pre-construction planning, working with property owners to identify well system locations, and adjusting construction sites to avoid well systems are among the actions that would be taken to minimize the potential for damaging well systems. Operations and Maintenance Potential impacts to groundwater would be very minor. The quantities of hazardous materials present (primarily fuels and lubricants in maintenance vehicles and equipment) would be much less than during construction and water demands of facilities would be limited to that required to support the small number of employees.
Health, Safety, and Intentional Destructive Acts	Construction/Operations and Maintenance Construction and operational activities for large infrastructure projects, such as a transmission line and associated facilities can pose hazards that affect worker and public health and safety. In addition, natural events, external events or accidents (e.g., aircraft mishaps or fires) or intentional destructive acts or mischief could impact such infrastructure and have related effects on the health and safety of construction workers and the public. The Project may involve the transportation and handling of hazardous materials. Management (i.e., transportation, storage, handling, use, and disposal) of such hazardous materials during the construction and operations and maintenance phases would be undertaken in a manner to avoid or minimize health and safety impacts to workers and nearby members of the public. The implementation of EPMs associated with management of hazardous materials would keep risks to a minimum. The transmission lines and associated facilities could be susceptible to natural events such as extreme weather. Based on accident statistics for the construction and operational utility industries, the estimated construction workforce Project would experience 125 non-fatal recordable incidents during the 42-month construction period. Using the average construction workforce of 965 workers, it is estimated that there would be approximately 0.3 fatalities during the 42-month construction phase. It is likely that no fatalities would occur. During the assumed 80-year operational period of the Project, the average operations workforce would experience 2.0 non-fatal recordable incidents annually. The construction and operational impacts of the HVDC alternative routes would be roughly equivalent to those of the Applicant Proposed Project.

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
Historic and Cultural Resources	Construction Potential impacts would be experienced primarily during construction. Potential construction impacts to belowground (archaeological) resources could occur as a result of ground disturbances at site locations. Potential project impacts to aboveground historic and cultural resources such as buildings and structures would most likely be limited to visual alterations in the historical setting of the resource. Such alterations would be introduced through the erection of transmission structures, and stringing of conductors. Potential Project impacts to aboveground historic and cultural resources would be long-term for the life of the Project. Construction could also cause temporary impacts to historic and cultural resources through the generation of dust, noise, and vibration, but such effects would be transient in nature. Operations and Maintenance Additional ground disturbance impacts to archeological resources are unlikely to occur during operations and maintenance. Once built, the Project facilities are not likely to be substantially altered through routine operations and maintenance.
Land Use	Construction Land use impacts consist primarily of the conversion of existing land uses (primarily rangeland, cropland, and pasture/hay) to a utility use. Typical temporary impacts include the use of some areas for temporary work areas and loss of access to areas in or adjacent to work areas. Construction would prevent the use of rangeland and cultivated crops in the ROW in a specific location and may change the contour of the land and affect irrigation infrastructure. Yields from cropland, pasture/hay, and timberlands could potentially also be temporarily affected in the construction areas. There are 28 structures within the representative ROW for the Application Proposed Route, including 18 agricultural structures, 2 industrial structures (oil/gas infrastructure), 2 commercial structures, 2 residential structures, 2 abandoned structures, and 2 other structures (use unknown). Alternative routes with fewer structures than the corresponding links of the Applicant Proposed Route include HVDC Alternative Routes 2-B (one fewer agricultural structure), 6-C (three fewer agricultural structures), 7-A (one fewer structure [use unknown]), and 7-D (two fewer agricultural structures). All other alternative routes contain more structures within the representative ROW than the corresponding links of the Applicant Proposed Route. These structures would have to be permanently removed if the Project features could not avoid them. The USFS has expressed several concerns regarding HVDC Alternative 4-B. According to the USFS, the ROW would create linear breaks in National Forest land and could adversely affect timber production. The USFS has also stated that, in places, HVDC Route Alternative 4-B would undermine the use for which the National Forest land was originally acquired, that is conservation of natural resources. Operations and Maintenance Long-term impacts from the Project include the conversion of land to a utility use, primarily for access roads and transmission line structure locations. Most of the land within the transmission ROWs could return to previous uses after construction, although uses incompatible with the operation of the transmission line, such as tall trees for timber, would be removed permanently from the ROW. Land uses that would not be permitted in the ROW include buildings or structures, changes to grading and land contours, and some restrictions for infrastructure such as fences and irrigation lines. Maintenance activities may cause temporary impacts within the ROW such as damage to crops.
Noise	Construction Temporary impacts include elevated sound levels at noise sensitive areas such as residences or schools for short periods of time. Locations of residences and schools are shown in Figure 1.0-2 located in Appendix A of the EIS. The only two schools within the ROI are within AC Collection System Route E-1, located within the town of Hardesty. Sound levels would be elevated during construction of the HVDC transmission lines. Operations and Maintenance Sound from operation of the HVDC transmission lines results from corona effects, which can result in audible noise. Corona noise is greatest on HVDC transmission lines when the lines are dry. There are two noise sensitive areas expected to exceed federal guidelines near the Applicant Proposed Route in Region 3.
Recreation	Construction Construction of the Project is not expected to permanently preclude the use of or access to any existing recreation areas or activities. Temporary impacts include the use of some recreational areas for temporary work areas and loss of access to recreation areas in or adjacent to work areas. Direct short-term impacts may include noise, visual

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
	disturbance, restricted access, and diminished quality of recreational impacts that are crossed by the representative ROW. The main differences in potential recreation impacts between the Applicant Proposed Route and the HVDC alternative routes occur in Regions 3, 4, and 5. The Applicant Proposed Route Link 1 in Region 3 would not cross Lake Carl Blackwell, while corresponding Alternative Routes 3-A and 3-B could impact approximately 23 acres of the lake. The Applicant Proposed Route Link 6 could potentially impact 4 acres of the Webbers Falls Lock and Dam Reservoir lands while the corresponding HVDC alternative routes in Region 3 could potentially impact 1 acre of the Webbers Falls Lock and Dam Reservoir lands. The Applicant Proposed Route in Region 4 could potentially impact 2 acres of the Ozark Lake WMA and 4 acres of the Frog Bayou WMA, while the corresponding HVDC alternative routes in Region 4 would not. Applicant Proposed Route Link 1 in Region 4 could potentially impact 17 acres of the Webbers Falls Lock and Dam Reservoir lands. There is no HVDC alternative route to this link of the Applicant Proposed Route. The Lee Creek Variation (Applicant Proposed Route in Region 4, Link 3) would cross the Nationwide Rivers Inventory segment of Lee Creek, while the Alternative Routes 4-A and 4-B would also cross the Nationwide Rivers Inventory segment of Lee Creek. HVDC Alternative Route 4-B could impact approximately 230 acres of the Ozark National Forest, while the Applicant Proposed Routes in Region 4 would only potentially impact approximately 2 acres. The Applicant Proposed Route in Region 5 could potentially impact 77 acres of the Cherokee WMA while the alternative routes in Region 5 would not. The representative ROW for HVDC Alternative Routes 6-C and 6-D does not include any natural areas or recreational land compared to the corresponding link of the Applicant Proposed Route, which includes approximately 0.5 acre of the Singer Forest Natural Area within the St. Francis Sunken Lands WMA. Operations and Maintenance Most of the land within the HVDC transmission line ROWs could return to previous uses after construction. Recreation uses would be permitted in the ROW; however; buildings or structures, and some restrictions for infrastructure such as fences would not be permitted. Maintenance activities may cause temporary impacts within the ROW such as restricted access.
Socioeconomics	Construction Construction of the Project would generate regional economic activity through Project-related expenditures on materials and supplies. The Project would also employ construction workers who would spend much of their income locally and support jobs and incomes elsewhere in the economy. Approximately 26% of the construction workforce is expected to be hired locally (i.e., workers who normally reside within daily commuting distance of their job site), with the remaining 74% temporarily relocating to communities along the ROI for the duration of their employment. There is a potential shortage of temporary housing and RV spaces in Region 1 that would be further exacerbated if the construction schedules for the Oklahoma converter station, AC collection system, and HVDC transmission line were to overlap. This availability could be further reduced by other outside activities in the ROI such as other construction projects, community-sponsored events, and hunting and other recreational activities, as well as connected actions, specifically the development of wind generation facilities and the Optima Substation. The Applicant proposes to prepare and implement a workforce housing strategy designed to minimize potential impacts to housing availability. Some short-term adverse impacts on residential property values (and marketability) might occur on an individual basis as a result of the Project. However, these impacts would be highly variable, individualized, and are difficult to predict. Minor, short-term increases in demand from construction workers and family members temporarily relocating to local communities within the ROI are not expected to affect the levels of service provided by existing law and fire personnel, health care and medical facilities, or educational facilities. Minor increases in population resulting from operations and maintenance of the Project are also not expected to affect the provision of community services. Construction of the Applicant Proposed Route would generate sales, use, and lodging tax revenues during the construction period, with an estimated 90% of total construction costs expected to be for materials subject to sales and use tax. Total estimated state sales and use tax revenues range from $2.1 million in Tennessee to $34.6 million in Oklahoma; the estimated total for Arkansas would be $32.3 million. Local spending by construction workers would also generate sales and lodging tax revenues. Substituting one or more of the HVDC alternative routes for the corresponding links of the Applicant Proposed Route would not substantially affect the regional economic impact estimates. The largest net increases in the number of people who would temporarily relocate to each region, relative to the Applicant Proposed Route would occur in Region 1 with the addition of 16 people (HVDC Alternative Route 1-A) and

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
	in Region 7 where 14 and 19 more people could be added (HVDC Alternative Routes 7-C and 7-A, respectively). The majority of the HVDC alternative routes would not affect the peak number of school age children temporarily relocating to the affected regions. In other cases, there would be a potential increase of one to two school-age children relative to the Applicant Proposed Route for that region. Relative to the Applicant Proposed Route, the largest changes in estimated sales and use tax revenue that would accrue to the respective state would occur in counties in Region 5 and range from a decrease of $2.75 million (-100%) in Cleburne County, Arkansas, to an increase of $2.55 million (100%) in Faulkner County, Arkansas. Changes in estimated sales and use tax that would be paid to each county would range from a decrease of about $0.7 million in Cleburne County, Arkansas (Region 5), to an estimated increase of $0.5 million in Shelby County, Tennessee (Region 7). Operations and Maintenance Operations would have similar, but smaller regional economic benefits than construction. Operation of Project facilities would generate ad valorem or property tax revenues in the counties where they would be located. Operation-related expenditures would generate sales and use tax revenues. Estimates of annual county tax revenues in Oklahoma range from $0.1M to $2.4M. Estimates of annual county tax revenues in Arkansas range from $0.2M to $0.6M. Estimates of annual county tax revenues in Tennessee range from $0.2M to $0.3M. Substituting one of more of the HVDC alternative routes for the corresponding link of the Applicant Proposed Route would not affect estimated operations and maintenance employment for the HVDC and AC transmission lines. Potential impacts to population, economic conditions, housing, and community services from operations and maintenance related to estimated operations and maintenance employment would be the same or very similar to those described above for the Applicant Proposed Route.
Special Status Wildlife and Fish, Aquatic Invertebrate, and Amphibian Species	Construction/Operations and Maintenance Impacts to special status wildlife species in Region 1 from the Applicant Proposed Route or alternative routes include potential habitat loss and fragmentation of existing habitat of LEPC habitat mapped focal areas (CHAT-1) or connectivity zone habitat (CHAT-2) HVDC Alternative Route 2-A in Region 2 is parallel to the Cimarron River for a portion of the route. This portion of the Cimarron River is known to be used by the interior least tern. Therefore construction of this alternative route could disturb habitat or individuals. HVDC Alternative Route 3-C in Region 3 has slightly more forested land than other alternative routes or the Applicant Proposed Route and therefore could potentially impact the American burying beetle. HVDC Alternative Route 4-B in Region 4 includes forested lands and is closer to the Ozark Plateau region than other alternative routes and the Applicant Proposed Route. The Ozark Plateau region contains cave hibernacula for special status bat species. Because of the amount of forested areas, there is a potential for greater mortality impacts to the American burying beetle during construction. The increase in forested land in closer proximity to areas of caves known to be or potentially used by bats increases the potential impacts (e.g., disturbances to or loss of roost trees) to the special status bat species along this route Similarly, HVDC Alternative Route 4-D also contains more forested land than other alternative routes and the Applicant Proposed Rout in Region 4. Therefore, there could be construction impacts to the American burying beetle and the special status bat species along this route. Direct construction impacts that could potentially affect special status fish, aquatic invertebrate, and amphibian species and their habitats include vegetation clearing, grading, access roads, herbicide use, and handling of fuel and lubricants at stream and river crossings. Vegetation clearing has the potential to increase sedimentation and decrease cover. Increased sedimentation can directly or indirectly suffocate, bury, or limit feeding of fish, aquatic invertebrate, and amphibian species. Grading and access roads have the potential to increase sedimentation, decrease cover, and increase runoff. Increased runoff can alter stream and river hydrology and provide a mechanism for delivery of sediment, herbicides, and fuel and lubricants to streams and rivers. Herbicide use and handling of fuel and lubricants have the potential to concentrate in body tissues of fish, amphibians, and filter-feeding mussels, which can result in death. During the construction phase of the Project, all general EPMs and those specific to special status fish, aquatic invertebrates, and amphibians would be implemented to avoid or minimize impacts to special status fish aquatic invertebrates, and amphibians. For all regions except Region 2, there would be no difference in impacts between the Applicant Proposed Route and the HVDC alternative routes. For Region 2, HVDC Alternative Route 2- has more acres of waters designated by the USFWS as critical habitat for the Arkansas River shiner within the ROI than the corresponding link of the Applicant

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
	Proposed Route. Both the HVDC Alternative Route 2-A and the corresponding of the Applicant Proposed Route cross the Cimarron River at separate locations where it is USFWS designated critical habitat, but HVDC Alternative Route 2-A is within the critical habitat for more acres. Potential impacts in the operations and maintenance phase of the HVDC transmission line would be similar to the potential impacts in the construction phase; however, impacts would be at a lesser extent than in the construction phase, but occur throughout the life of the Project. During the operations and maintenance phase, the use of both access roads and the ROW for repair and maintenance activities could result in both direct and indirect impacts to the Arkansas River shiner or its potential habitat in the Beaver River and Palo Duro Creek. In addition, the potential application of herbicides during operations and maintenance of the Project could result in indirect impacts, and to a lesser extent, direct impacts. During the operations and maintenance phase of the Project, both general EPMs and those specific to fish aquatic invertebrates, and amphibians would be implemented to avoid or minimize impacts to special status fish, aquatic invertebrates, and amphibians.
Surface Water	Construction Typical impacts include: • Potential for Surface Water Contamination—Contamination could occur as a result of the accidental release of hazardous substances, primarily fuels and lubricants, which would be used by construction equipment and be present in construction staging or storage yards. Permit compliance and implementation of EPMs, including spill prevention and response planning, would minimize the potential for surface water contamination. • Changes to Runoff Rates—Soils disturbed and loosened during construction could represent areas of increased precipitation infiltration, possibly decreasing local runoff rates over the short term. Surfaces compacted during construction and impermeable facility surfaces remaining after construction would represent areas of increased runoff rates. The area of impermeable surfaces resulting from the Project would be small. In accordance with the Applicant's EPMs, soils would be returned to pre-activity conditions, therefore resulting in *de minimis* long-term impacts to runoff rates. • Direct Impacts or Disturbances to Surface Water or Drainage Channels—Surface waters and drainage channels would be avoided as practicable in the placement of transmission line facilities, with transmission lines spanning such features as necessary. Access roads may not always have the same means of avoidance and would be most likely to involve disturbance of drainage features. Preplanning of the crossing methods would minimize the length of the drainage feature affected and enhance the ability to maintain flow characteristics. • Effects on Water Availability—Water demands to support the Project could come from surface water resources (more likely in areas where total water use is typically from surface water sources such as Regions 3, 4, and 5) and result in less surface water being available for other uses. The Project's water demand is not expected to have noticeable effects on surface water resources beyond those resulting from existing water usage. There are differences in the amount of surface water used between regions and in the numbers of surface water features within the representative ROWs for each of the HVDC alternative routes. Water demands from the Project are not expected to be a concern, primarily because the highest demand would occur during the short-term construction phase and regions with low surface water availability are areas where groundwater use already dominates. The specific locations of each structure or access road have not yet been determined; therefore, the EIS does not identify which surface water features would be completely avoided or which could be affected by Project. Areas with the greatest amount of surface water in the ROW, such as Region 3 with the most perennial streams, reservoirs, lakes, and ponds, would be the most likely to potentially impact surface waters Operations and Maintenance Potential impacts would be minimal. The quantities of hazardous materials present (primarily fuels and lubricants in maintenance vehicles and equipment) would be much less than during construction, herbicides used to maintain ROWs and access roads would be applied in accordance with label instructions and any federal, state, and local regulations to minimize the potential for spreading, and water demands of facilities would be limited to that required to support the small number of employees.

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
Transportation	Construction Typical temporary impacts during construction include increased traffic from workers commuting to the construction sites, as well as increased traffic from the hauling of materials and equipment to the construction sites. Construction traffic also has the potential to impact bus and emergency routes for roadways near the construction areas. Temporary travel delays involving major roads (interstate highways, federal highways, and state highways) and railroads may also occur for HVDC transmission line installation at crossings. Construction activities that take place adjacent to major roadways also have the potential to cause temporary adverse impacts to traffic from vehicles entering and leaving the roadway and could involve lane closures. Roadway pavement or other infrastructure might be damaged by heavy vehicles delivering equipment and materials to construction areas. Transmission line structures and lines could become a hazard if they are located too close to airport operations or military airspace operating areas. River traffic may be controlled, in coordination with the USACE, during the short time required to span the conductor across Project construction activities have the potential to impact river traffic at the crossings of the Arkansas and Mississippi rivers. River traffic would not be impacted during Project operations and maintenance.
	Operations and Maintenance Long-term impacts are not expected because any increase in traffic during the operations and maintenance phase would be negligible. Transportation resources would be returned to previous operating conditions following construction.
Vegetation Communities	Construction Construction may cause the direct impact of vegetation removal and the indirect impacts of reduction of plant vigor from mechanical damage, fragmentation, and the introduction of invasive species. Impacts to vegetation may also vary in duration from short-term to long-term, with some impacts potentially permanent in nature. Removal of vegetation during construction may vary across the spectrum from short-term to permanent. Short-term removals and mechanical damage to vegetation may occur in areas of temporary construction access roads, construction laydown areas, and tensioning areas. It is likely that vegetation impacts in croplands would be short-term based on the seasonal replanting of these landscapes. Long-term to permanent impacts to vegetation would involve those areas of the ROW where vegetation is removed for new access roads and transmission structural foundations. Long-term impacts are also expected through those portions of the ROW with forested land cover due to the need to minimize canopy height for line safety. Long-term impacts may also result from vegetation removal in the portions of the Project ROW dominated by shortgrass prairie due to the difficulty of revegetation in drier climatic conditions. Operations and Maintenance Operation and maintenance of the Project is likely to impact vegetation directly through mowing and pruning in the ROW, and indirectly through herbicide applications that may impact non-target plant species.
Visual Resources	Construction Construction would result in the short-term visual intrusion of construction vehicles, equipment, materials, and a work force in staging areas, along access roads, and along the new transmission line ROW. Vehicles, heavy equipment, structure components, and workers would be visible during transmission line construction and modification, access and spur road clearing and grading, structure erection, conductor stringing, and cleanup and restoration. However, disturbance from construction activities would be transient and of short duration as activities progress along the transmission line route. Affected viewers would be aware of the temporary nature of Project construction impacts as well as existing structures in the area adjacent to the Project, which may decrease their concern to the impact. Operations and Maintenance Long-term impacts from the Project include the intrusion of transmission structures, access roads and cleared ROW that may introduce contrast into the surrounding landscape setting. Sensitive viewers in Regions 1, 2, and 6 that are characterized primarily by flat croplands and grasslands with scattered vegetation are anticipated to have greater visibility of the Project due to long viewing distances associated with an open landscape with panoramic views. In addition, the tall vertical geometric structures of the Project components would result in strong contrast with the relatively flat landscape with the regions. Sensitive viewers in Regions 3, 4, 5 and 7 that are characterized by varying terrain ranging from gently rolling to hilly to rugged with a greater occurrence of dense wooded areas are anticipated to have shorter viewing distances. Project components are more likely to be partially to completely screened by existing terrain and/or vegetation in all distance zones.

Table 2.6-3:
Summary of Potential Environmental Impacts—HVDC Transmission Line

RESOURCE	IMPACT
Wetlands, Floodplains, and Riparian Areas	Construction Potential impacts would primarily occur during construction. Short-term impacts may include mechanical damage/crushing of vegetation from use of heavy machinery, compaction of soils, sedimentation and turbidity from construction activities, alteration of hydrology from access road construction and excavations for structure foundations, contamination from herbicide runoff and from accidental spills of hazardous substances. Potential impacts are similar between the Applicant Proposed Route and the corresponding HVDC alternative routes. Some differences are apparent, however. For wetland resources, all HVDC alternative routes for Regions 2 and 3 have potential to impact more wetland acreage than the corresponding Applicant Proposed Route links in those regions. For floodplain resources, all HVDC alternative routes for Regions 2 and 7 contain more floodplain acreage and greater potential for impacts within the 200-foot-wide representative ROW as compared to Applicant Proposed Route links in those regions. Finally, all the HVDC alternative routes for Regions 2 and 4, and most of the HVDC alternative routes for Region 1 (except HVDC Alternative Route 1-C), Region 3 (except HVDC Alternative Route 3-C), and Region 6 (except HVDC Alternative Route 6-A), would cross more riparian area resources and have the potential for more impact acreage than the corresponding Applicant Proposed Route links. Operations and Maintenance The potential long-term impacts may include placement of fill at foundation footprint locations or for permanent access roads, long-term conversion of forested wetlands or riparian areas to shrubby or herbaceous cover types within the ROW, changes to hydrology from construction of permanent access roads or support structures and other ancillary infrastructure, and introduction of invasive species from construction equipment.
Wildlife and Fish	Construction Potential impacts would include direct mortality or injury of individuals from vegetation clearing, collisions with vehicles, potential exposure to hazardous materials (e.g., accidental spills and pesticides), wildfires, or increased predation rates; disturbance of suitable habitats or disruption of normal behaviors; and habitat loss or degradation (both temporary and permanent loss/degradation of habitat). Potential impacts to fish and aquatic invertebrate species would include direct mortality and injury of individuals (e.g., via crushing during crossing construction, sedimentation, potential exposure to hazardous materials, blasting); disturbance from suitable aquatic habitats or disruption of normal behaviors; aquatic habitat loss or degradation (both temporary and permanent loss/degradation of aquatic habitat); and introduction of non-native aquatic plants and animals. Operations and Maintenance Potential impacts include the fragmentation of habitats; isolation of sub-populations and loss of meta-population dynamics; degradation of habitat quality due to edge effects as well as invasive plant species; consolidation of predatory avian species along the line (e.g., raptors and corvids), and ongoing mortality of individual birds due to collision and electrocution risks. The majority of the Project would pass through and impact habitat types that contain low vegetation, which would typically recover quickly and would not need to be permanently cleared or maintained during the Project's operations and maintenance (e.g., grassland and cropland habitats). However, Regions 4 and 5, as well as Regions 3 and 7 to a lesser extent, would cross through and impact forested habitats. The Project would result in the permanent conversion of these forested habitats within the ROW to grasslands and/or shrublands (i.e., habitats that contain low vegetation types). This would constitute a permanent loss of forested habitats, as well as create a permanent edge effect along the Project's ROW in forested habitats. This could change the species composition and use of these once forested areas (i.e., transitioning to an edge habitat community). Potential impacts to fish and aquatic invertebrate species include mortality and injury of individual fish and aquatic invertebrates from sedimentation and potential exposure to hazardous materials (e.g., oils, fuels, herbicides); aquatic habitat degradation and loss from the presence of crossing structures, sedimentation, and non-native aquatic plants and animals; avoidance of aquatic habitats near project structures and roads; and temporary disturbance during maintenance activities.

2.7 Summary of Best Management Practices

As identified in Section 2.1.7, the Applicant has developed and would implement EPMs, included in Appendix F, to avoid or minimize effects to environmental resources from construction, operations and maintenance, and/or decommissioning, as appropriate. This EIS assumed the implementation of the EPMs throughout the impact analysis for each resource area in Chapter 3.

In addition, some resource sections also include best management practices (BMPs). For these resources, implementation of the EPMs would not be able to completely avoid or minimize all potential adverse effects resulting from construction, operations and maintenance, and decommissioning of the Project. In those instances, the following BMPs could be implemented to further avoid or minimize potential adverse effects. Table 2.7-1 provides a summary listing of the BMPs identified by each resource area analyzed in Chapter 3 (those resource areas that did not identify any BMPs are not included in the table). The Applicant has not committed to implementing BMPs though it is possible that certain BMPs will be required through the ROD or participation agreements.

Table 2.7-1:
Summary of Best Management Practices

RESOURCE AREA	BEST MANAGEMENT PRACTICE
Air Quality and Climate Change	• The quantity of sulfur hexafluoride (SF_6) emissions from maintenance activities (and potential leaks in equipment) would be minimized through the use of hermetically sealed equipment, leak detection programs, and sulfur hexafluoride recycling programs.
Geology, Paleontology, Minerals, and Soils	• If signs of contaminated soils are uncovered during construction activities, work would be stopped in the area of potentially contaminated soils until appropriate Project representatives could be consulted.
Health, Safety, and Intentional Destructive Acts	• Develop and implement a Health and Safety Plan that describes regulatory requirements, procedures, and practices for conducting activities to help ensure a safe working environment, which for purposes of health and safety measures should include: o Fire prevention, suppression, and emergency responder contact procedures o Natural disaster and severe weather reporting and contact procedures o Law enforcement contact procedures o Procedures for addressing hazardous materials spills and other mishaps • The Applicant will develop and implement a communications program. Section 3.1.2 describes the elements of this plan, which for purposes of health and safety should include: o Liaison and public outreach activities with local airports, aviation communities, aviation regulatory bodies, and aerial agricultural spraying operations o Local media and public outreach procedures for applicable hazard communication notices.
Land Use	• In existing forested areas where temporary work areas require tree clearing, replant temporary work areas with appropriate tree species. • In addition to EPM LU-5, make reasonable efforts to avoid displacing structures on private property.
Noise	• Investigate noise complaints in accordance with the Applicant's communications program.
Socioeconomics	• The Applicant will prepare and implement a workforce housing strategy that would minimize potential impacts to housing availability. This strategy would consider Project component construction schedules, workforce required, and other outside influences.
Special Status Wildlife and Fish, Aquatic Invertebrate, and Amphibian Species	DOE and the Applicant are preparing a Biological Assessment of potential impacts on special status species protected under the ESA as part of the Section 7 consultation between DOE and the USFWS. The Section 7 consultation review is a parallel but separate process conducted pursuant to the requirements of ESA and the applicable implementing regulations. Through this process, additional protective measures may be identified and adopted to avoid and/or minimize impacts to special status species.
Transportation	• Accommodate existing and future planned transportation facility projects to the extent practicable into the final Project design and coordinate with appropriate jurisdictions to avoid or minimize disruptions to trails, streets, or drainage/irrigation structures.

Table 2.7-1:
Summary of Best Management Practices

RESOURCE AREA	BEST MANAGEMENT PRACTICE
	• In identified areas of traffic impact, conflicts between the Project traffic and background traffic such as movements of normal heavy trucks (dump trucks, concrete trucks, standard size tractor-trailers or flatbeds, etc.) would be minimized by scheduling (essential deliveries only) to the extent practicable during peak traffic hours/times and scheduling remaining heavy truck trips during off-peak traffic hours/times. • To the extent practicable, staging activities and parking of equipment and vehicles would occur primarily within private ROW on private land. • Implement the communications program described in Section 3.1.2.
Wetlands, Floodplains, and Riparian Areas	DOE, in consultation with the USACE, has identified the following BMPs: • In addition to protection of intermittent and perennial streams, ephemeral streams would also be included in the Applicant's streamside management zones. This BMP would add to EPM W-3. • Where tree removal is necessary in the ROW, this removal would be accomplished at ground level leaving root wads in place to aid in the stabilization of soils. • Limit, to the extent practicable, the amount of vegetation removed along streambanks and minimize the disruption of natural drainage patterns. • All permanent and temporary crossings of waterbodies would be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of aquatic species. The crossings would also be constructed to withstand expected high flows. The crossings would not restrict or impede the passage of normal or high flows. • Excavated trenches that are to be backfilled would separate the upper 12 inches of topsoil from the rest of the excavated material. The topsoil would be used as the final backfill.
Wildlife and Fish	For general wildlife and fish populations and habitat: • All vegetation clearing would comply with both state and federal spatial and timing windows, and would not occur during the avian breeding season applicable to each respective region. • Identify, control, and minimize the spread of non-native, invasive species and noxious weeds to the extent practicable, including ensuring that in-water equipment and vehicles are cleaned between waterbodies to minimize the chance of transferring non-native species between waterbodies. This BMP would expand EPM FVW-2.

2.8 Summary of Unavoidable Adverse Impacts

2.8.1 Definition

Unavoidable adverse impacts could occur during construction, operations and maintenance, and decommissioning of the Project. These impacts would be expected after implementation of the EPMs and those BMPs that DOE includes in a ROD or participation agreement; however, in all cases, the impacts would have been minimized through implementation of these measures. The following sections provide a brief summary of the unavoidable adverse impacts that could occur for each environmental resource area as provided in Chapter 3.

2.8.2 Agricultural Resources

Unavoidable adverse impacts could occur if the Project could not avoid agricultural structures. Yields from lands used for crops, pasture/hay, and grazing livestock would be temporarily affected in the construction areas, and land used for transmission structures, long-term access roads, and converter stations would be removed from agricultural production until the Project was decommissioned.

2.8.3 Air Quality and Climate Change

No unavoidable adverse impacts to air quality are anticipated to result from the Project.

2.8.4 Electrical Environment

Potential unavoidable adverse impacts to the electrical environment include the electrical effects (electric and magnetic fields, radio and television noise, audible noise, ozone, and air ions) associated with the operation of overhead HVDC and/or AC transmission lines. These effects are present within, and to a more limited extent outside of, the transmission line ROW. Outside of the ROW, calculated electrical effects for the Project are limited to levels that comply with associated standards and guidelines.

2.8.5 Environmental Justice

No unavoidable adverse impacts associated with environmental justice are anticipated to result from the Project.

2.8.6 Geology, Paleontology, Minerals, and Soils

2.8.6.1 Geology, Paleontology, and Minerals

Appropriate engineering design and adherence to applicable design standards would reduce the risk from geological hazards, but damage to Project components could occur if a rare, major geologic event such as a large magnitude earthquake or landslide occurred.

Despite EPMs and appropriate engineering design, scientifically valuable fossils may be disturbed and lost during construction activities. If this occurred, the small loss of fossil material would be offset to a degree by material that is recovered and preserved for scientific study purposes.

Mineral resources may exist directly underneath the route ROWs and/or converter station sites, in which case some resources could be less accessible for the life of the Project. The types of mineral resources that would be more affected are near-surface mineral material deposits (e.g., common sand, gravel, and stone). Oil and gas resources would be less affected because recovery of the resources would be possible, even with a minimum stand-off of 250 feet from the edge of the route ROWs and converter station sites using a vertically installed well, without the use of directional drilling. With directional drilling such areas could be accessed at considerable distance from the Project.

2.8.6.2 Soils

Removal of vegetation during construction grading and excavation activities could result in the exposure of soils to erosion and compaction of soils susceptible to compaction. Transmission line structures and converter station sites would permanently impact agricultural soils and remove them from productivity during construction and operations and maintenance. Access roads used during construction would temporarily remove agricultural soils from productivity, and the use of unpaved access roads during all Project phases could result in the exposure of soils to erosion and compaction. There would be potential depletion of soil productivity including erosion and loss of fertile topsoil, and potential erosion of exposed areas and compaction of areas traversed by equipment and vehicles.

2.8.7 Groundwater

Although the water needed for the Project is expected to come from municipal water systems, some of that municipal water would undoubtedly come from groundwater sources, so there would be a minor reduction in groundwater available for other uses or natural features while the construction took place.

Common materials present during construction would be considered groundwater contaminants were those materials to be spilled, leaked, or otherwise released and eventually reach groundwater. The potential for groundwater contamination is minor due to the EPMs and permitting requirements; however, the potential would not be eliminated.

2.8.8 Health, Safety, and Intentional Destructive Acts

There is a statistical possibility that accidents resulting in worker injuries and possibly death could occur during implementation of the Project. The hazardous nature of the work, the complexity of the electrical system, and the size and areal extent of the Project all would contribute to a potential for worker injuries or death and would be considered unavoidable adverse impacts. These unavoidable adverse impacts could be as a result of common personnel-involved injuries (e.g., slips, trips, or falls), hazardous materials or waste accidents, aircraft incidents, fire hazards, natural events or disasters, or intentional destructive acts.

2.8.9 Historic and Cultural Resources

DOE intends develop a Programmatic Agreement (PA) that will include assessment and resolution of effects, including avoidance, where practicable, and mitigation. Compliance with the PA and related plans would minimize unavoidable and adverse impacts to historic and cultural resources.

2.8.10 Land Use

Unavoidable adverse impacts to land uses from the Project include the removal of vegetation and conversion of primarily rangeland and cultivated crops and some forested lands and developed open space to a utility use. The Applicant Proposed Route would result in the conversion of up to approximately 2,600 acres of land to utility use for the life of the Project, including 2,394 acres for access roads (assuming 90 percent of them will remain after construction), 120 acres for two converter stations, 86 acres for all pole structures, and 2 acres for fiber regeneration sites.

Under the Applicant Proposed Route, 28 structures are present in the representative ROW: 2 residences, 2 commercial structures, 18 agricultural structures, 2 industrial structures, 2 abandoned structures, and 2 other structures. These structures would have to be removed if the Project features could not avoid them. Yields from cultivated crops, pasture/hay, and timberlands would be temporarily affected in the construction areas, and uses that are incompatible with the operation of the transmission line, such as tall trees for timber, would be removed from the ROW for the life of the Project.

2.8.11 Noise

Temporary noise impacts from construction activities would occur along the Project ROW. It is possible that EPA guidelines could be exceeded at some noise sensitive receptors from operations and maintenance of the AC and HVDC transmission lines.

2.8.12 Recreation

Unavoidable adverse impacts include the potential loss or alteration of recreational land and recreational uses of public or private lands that are located within the transmission line ROW because public access would be restricted at structure locations. Impacts to the setting of public recreational lands would be unavoidable and long-term, in recreational areas crossed by the Project.

2.8.13 Socioeconomics

No unavoidable adverse impacts to socioeconomic resources were identified.

2.8.14 Special Status Wildlife, Fish, Aquatic Invertebrate, and Amphibian Species

2.8.14.1 Special Status Terrestrial Wildlife Species

Construction and operations and maintenance of the Project could result in the mortality of some special status wildlife species if they are present in the affected areas during these Project phases. Mortalities could include potential mortalities associated with the clearing of vegetation as well as avian collisions with Project structures during operations and maintenance. Potential mortalities would be highest if vegetation clearing was conducted during the breeding season. Construction-related disturbances to habitats could also result in degradation and loss of some wildlife habitats (through factors that include but are not limited to noise and visual disturbances, as well as the effects of fragmentation, edge effects, and invasive plant species). ROW maintenance in forested habitats as well as the footprint of Project structures would result in a permanent loss of mature forest habitats.

2.8.14.2 Fish, Aquatic Invertebrate, and Amphibian Species

Construction and operations and maintenance of the Project could result in the mortality and injury of some special status fish, aquatic invertebrate, and amphibian species if they are present in the affected areas during construction or operations and maintenance. Construction mortalities and injuries could result from crushing during waterbody crossings with equipment, sedimentation, potential exposure to hazardous materials, and blasting. Mortalities and injuries during operations and maintenance could result from sedimentation and potential exposure to hazardous materials. Unavoidable impacts to special status fish, aquatic invertebrate, and amphibian species and their habitat include the potential loss or alteration of aquatic habitat in streams that may require culverts or vehicle crossings, potential loss or disturbance to riparian vegetation along streams on private or public lands where the ROW is parallel and adjacent to the stream, and potential short-term sedimentation effects on aquatic resources as a result of vehicular traffic causing disturbances within or adjacent to streams.

2.8.15 Surface Water

The Project would require a moderate level of water use, and some access roads would likely traverse through or over stream channels. Sediment-laden runoff from a construction site could occur and could have adverse effects on a receiving water. The construction general permit for stormwater discharges would minimize the potential for such incidents and would keep potential adverse impacts to these surface waters to a minimum.

2.8.16 Transportation

Construction-related adverse impacts to local traffic would occur on roadways where materials and equipment are hauled to the construction areas. Construction activities associated with the crossing of roadways and railroads and potential encroachment along roadway ROWs would also result in unavoidable temporary impacts to roadways and traffic.

2.8.17 Vegetation Communities and Special Status Plant Species

Unavoidable adverse impacts to vegetation and special status plant species from the Project may include the following elements:

- Removal of vegetation in the footprints of new transmission line support structures, permanent access roads, converter stations, and other associated infrastructure
- Conversion of structural types of vegetation (e.g., forest conversion to grassland or forest to low-stature shrublands)
- Changes to plant species diversity with the general trend likely to be a diminishment of vegetation species diversity in disturbed areas
- Potential lower yields in croplands that are disturbed during construction and operations and maintenance

2.8.18 Visual Resources

Unavoidable impacts include the potential loss or alteration of sensitive views from public or private lands that are located within or adjacent to (within the foreground/middleground) the transmission line ROW or adjacent to converter station siting areas.

2.8.19 Wetlands, Floodplains, and Riparian Areas

Unavoidable adverse impacts to wetlands, floodplains, and riparian areas from construction and operations and maintenance of the Project could include:

- Removal of vegetation in the footprints of new transmission line support structures, access roads, converter stations, and other associated infrastructure, some of which may be wetland vegetation, or vegetation present in floodplains or riparian zones
- Conversion of vegetation structure (e.g., floodplain/riparian forest conversion to grassland/herbaceous or shrub/scrub land cover)
- Changes to species diversity within wetlands, floodplains, and/or riparian areas
- Changes in total cover percentage in wetland, floodplain, and riparian zone vegetation.

2.8.20 Wildlife, Fish, and Aquatic Invertebrates

2.8.20.1 Wildlife

Construction and operations and maintenance of the Project would result in the death of some wildlife species. Mortalities could result from the vegetation clearing activities as well as avian collisions with Project structures during operations. These mortality events would likely be highest if vegetation clearing is conducted during the breeding season. Construction-related disturbances to habitats would also result in degradation and loss of some wildlife habitats (through factors that include but are not limited to noise and visual disturbances, as well as the effects of fragmentation, edge effects, and invasive plant species). ROW maintenance in forested habitats as well as the footprint of Project structures would result in a permanent loss of habitats.

2.8.20.2 Fish and Aquatic Invertebrates

Unavoidable impacts include the potential loss or alteration of aquatic habitat in smaller streams that may require culverts or vehicle crossings, potential loss or disturbance to riparian vegetation along streams on private or public lands where the ROW is adjacent to the stream, and potential short-term sedimentation effects on aquatic resources as a result of vehicular traffic causing disturbances within or adjacent to streams.

2.9 Summary of Irreversible and Irretrievable Commitment of Resources

2.9.1 Definition

An "irreversible commitment of resources" occurs when, once committed to the Project, the resource would continue to be committed throughout the life of the Project but would become available again following decommissioning of the Project and restoration (if necessary). An "irretrievable commitment of resources" occurs when, once used, consumed, destroyed or degraded during construction, operations, maintenance, or decommissioning of the Project, the resource would no longer be unavailable for use by future generations. Such resources could not be restored, replaced, or otherwise retrieved for the life of the Project or thereafter. Examples of irretrievable types of resources include nonrenewable resources, such as minerals and cultural resources, as well as renewable resources that would be unavailable for the use of future generations such as loss of habitat that is not restored following or as part of decommissioning of the Project.

2.9.2 Agricultural Resources

Upon decommissioning of the Project, all land could return to previous uses. There would be no irreversible or irretrievable commitment of agricultural resources

2.9.3 Air Quality and Climate Change

No irreversible and irretrievable commitments of air quality resources are anticipated to result from the Project.

2.9.4 Electrical Environment

No irreversible and irretrievable commitment of resources associated with electrical effects is anticipated to result from the Project.

2.9.5 Environmental Justice

No irreversible and irretrievable commitments of resources associated with environmental justices are anticipated to result from the Project.

2.9.6 Geology, Paleontology, Minerals, and Soils

2.9.6.1 Geology, Paleontology, and Minerals

There would be no irreversible and irretrievable commitments of resources regarding geologic hazards. Because paleontological resources are nonrenewable, any impacts would render the resource disturbance irreversible and the integrity of the resource irretrievable. The short-term preclusion of access to some mineral resources would constitute an irreversible impact for the operational life of the Project.

2.9.6.2 Soils

An irreversible commitment of soil resources during the life span of the Project would occur until all transmission line concrete foundations, converter station facilities, and access roads were removed and successful reclamation was achieved for soils at the ground surface.

2.9.7 Groundwater

The Project would involve a commitment of groundwater resources, but at least to some extent, those resources would be replenished by cyclic seasonal recharge. The commitment of groundwater resources would be irreversible in that it would limit, in the short term, other options for use of that resource. Over time, however, the amounts of groundwater used to support construction would be expected to have a negligible effect on groundwater resources. In sum, the groundwater resource would be renewable or recoverable, so the commitment would not be considered irretrievable.

2.9.8 Health, Safety, and Intentional Destructive Acts

The health of workers and the public are important resources that must be protected. Through the implementation of safety plans, procedures, and required design elements, irreversible commitment of these resources would be kept to a minimum.

2.9.9 Historic and Cultural Resources

Cultural resources are nonrenewable. Adverse direct effects to these resources would constitute an irreversible and irretrievable commitment of resources. DOE will develop a PA that will include assessment and resolution of effects, including avoidance, where practicable, and mitigation. Compliance with the PA and related plans would minimize adverse direct effects to cultural resources. Any remaining adverse direct effects to cultural resources would represent an irreversible and irretrievable commitment of resources.

2.9.10 Land Use

The use of the approximately 2,600 acres for the life of the Project would be irreversible since some land use restrictions would result. Once the Project has been decommissioned, all land could return to previous uses; therefore, there would be no irretrievable commitment of land use resources.

2.9.11 Noise

With the implementation of EPMs and identified BMPs to resolve potential noise impacts to noise sensitive areas, no irreversible or irretrievable commitments of resources related to noise are anticipated.

2.9.12 Recreation

All impacts related to recreational resources would cease with the end of the Project and would not be irreversible or irretrievable.

2.9.13 Socioeconomics

No irreversible or irretrievable commitments of socioeconomic resources were identified.

2.9.14 Special Status Wildlife, Fish, Aquatic Invertebrate, and Amphibian Species

2.9.14.1 Special Status Terrestrial Wildlife Species

The potential permanent loss or alteration of established trees in mature forests in the eastern portion of the Project (in Regions 3, 4, 5, and 7) would last throughout the life of the Project; however, gradual recovery of habitat may occur once the Project is decommissioned. As the exact state of this recovery is not known (e.g., substantial changes related to climate, land-use, and/or weeds or pathogens may occur during the assumed 80-year lifespan of the Project), and mature forests are subject to long-term climatic regimes and it is reasonable to assume that some portions of the habitat for special status wildlife species in these forests would be irreversibly and irretrievably impacted.

2.9.14.2 Special Status Fish, Aquatic Invertebrate, and Amphibian Species

The potential permanent loss or alteration of aquatic habitat in smaller streams that may require road crossings would last throughout the life of the Project; however, gradual recovery of habitat may occur once the road crossing was removed. As the exact state of this recovery is not known (e.g., substantial changes related to climate, land-use, and/or watershed hydrology may occur during the assumed 80-year lifespan of the project), and aquatic habitat is subject to long-term climatic regimes and changes in land-use and watershed hydrology, it is reasonable to assume that some portions of the aquatic habitat for special status fish, aquatic invertebrate, and amphibian species in these smaller streams would be irreversibly and irretrievably impacted.

2.9.15 Surface Water

The commitment of surface water resources would be irreversible in that it would limit, in the short term, future options for use of that resource. Over time, however, the amounts of water used to support construction would be expected to have a negligible effect on surface water resources. In other words, the surface water resource would be renewable or recoverable, so the commitment would not be considered irretrievable.

2.9.16 Transportation

As a result of the increased traffic associated with construction of the Project, a portion of the local roadway network capacity would be lost during the construction period. This loss would be irretrievable but short term. The use of non-renewable resources and resources that cannot be recycled would occur as a result of access roadway construction. The use of these resources would be irreversible.

2.9.17 Vegetation Communities and Special Status Plant Species

Both short- and long-term disturbance to vegetation would be reconciled through appropriate application of the Project's Restoration Plan. Once the Project has been decommissioned, there is potential for all of the approximately 2,600 acres of vegetation to be recovered. Therefore, it is predicted that there would be no irreversible or irretrievable commitment of vegetation resources.

2.9.18 Visual Resources

Irretrievable impacts to visual resources are anticipated where large trees are removed in the ROW, since trees would not be replanted or would be replanted and would result in age disparities, the effects of which would be noticeable to the casual observer.

Views of the transmission structures and converter stations for the life of the Project would be irreversible due to the introduction of structures and vegetative clearing. Once the Project has been decommissioned, all structures could be removed, access roads reclaimed, and vegetation restored; therefore, there would be no irreversible or irretrievable commitment of visual resources.

2.9.19 Wetlands, Floodplains, and Riparian Areas

The potential permanent loss or alteration of wetlands, floodplains, and riparian areas would last throughout the life of the Project; however, gradual recovery of these resources is expected after decommissioning. It is reasonable to assume that some wetlands, floodplains, and riparian areas may be irreversibly and irretrievably impacted.

2.9.20 Wildlife, Fish, and Aquatic Invertebrates

2.9.20.1 Wildlife

The potential permanent loss or alteration of wildlife habitat associated with established trees in mature forests in the eastern Project area (in Regions 3, 4, 5, and 7) would last throughout the life of the Project; however, gradual recovery of habitat may occur once the Project is decommissioned. As the exact state of this recovery is not known (e.g., substantial changes related to climate, land-use, and/or weeds or pathogens may occur during the 80-year lifespan of the project), and mature forests are subject to long-term climatic regimes, it is reasonable to assume that some portions of the wildlife habitat in these forests would be irreversibly and irretrievably impacted.

2.9.20.2 Fish and Aquatic Invertebrates

The potential permanent loss or alteration of aquatic habitat in smaller streams that may require road crossings would last throughout the life of the Project, or at least through the duration of use of the access roads; however, gradual recovery of habitat may occur once the road crossing was removed and the stream restored to original conditions. As the exact state of this recovery is not known (e.g., substantial changes related to climate, land-use, and/or watershed hydrology may occur during the 80-year lifespan of the Project), and aquatic habitat is subject to long-term climatic regimes and changes in land-use and watershed hydrology, it is reasonable to assume that some portions of the aquatic habitat for fish and aquatic invertebrate species in these smaller streams would be irreversibly and irretrievably impacted.

2.10 Summary of Relationship between Local Short-term Uses and Long-term Productivity

2.10.1 Definition

Pursuant to NEPA regulations (40 CFR 1502.16), an EIS must consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. In this EIS, short-term impacts are those impacts expected to occur during construction. Long-term impacts are those impacts expected to occur for some time during operations and maintenance. Permanent impacts are those that would be expected to continue even after decommissioning of the Project. The potential impacts to the environment from all phases of the Project could be minimized through the implementation of the EPMs and BMPs identified in Appendix F and Section 2.7, respectively. The following sections provide a brief summary of the relationship between local short-term uses and long-term productivity for each environmental resource area as provided in Chapter 3.

2.10.2 Agricultural Resources

The conversion of primarily agricultural land to a utility use to construct and operate the Project would result in short-term use impacts. These direct effects would include the loss of crops pasture/hay and grazing land for livestock in the representative ROW as well as loss of agricultural structures. Other short-term and localized impacts include the disruption of access to local agricultural land uses during construction. The productivity of the soil in temporary construction areas may also be reduced due to compaction and soil erosion.

2.10.3 Air Quality and Climate Change

Emissions from construction of the Project are not predicted to impact sensitive receptors and also would not impact long-term productivity. While over the short-term emissions from construction would be higher in localized areas—because the Project provides for development of non-fossil fuel energy sources over the long term—air quality would be improved in comparison to not building the Project.

2.10.4 Electrical Environment

No short-term uses or resource removal exist that would affect long-term productivity associated with electrical effects from the Project.

2.10.5 Environmental Justice

Because the EIS did not identify any disproportionately high and adverse impacts to low-income or minority populations, there would be no long-term impact to these populations.

2.10.6 Geology, Paleontology, Minerals, and Soils

2.10.6.1 Geology, Paleontology, and Minerals

No relationships exist between local short-term uses and long-term productivity for geological hazards. Short-term impacts associated with the exposure of any scientifically important fossils from Project activities would not adversely impact the long-term potential for discovery of potential fossil resources. Any short-term effects are not expected to cause long-term impairment to the productivity of mineral resources.

2.10.6.2 Soils

Overall site productivity is primarily a matter of revegetation/reclamation success and availability for agricultural or other uses. Impacts to short-term uses of soil resources would result from construction and operations and maintenance of the Project, while impacts to long-term productivity would depend on the success of the reclamation activities. Short-term impacts are associated with land areas directly affected by construction and operations and maintenance of the Project. Short-term impacts include the construction and use of access roads during the construction phase of the Project and the use of access roads for operations and maintenance. Other short-term impacts to soil resources could occur at the footprint areas of construction work areas, converter station sites, transmission line structures, fiber optic sites, and construction tensioning and pulling areas. These areas could all be returned to other productive uses following decommissioning. A decrease in the long-term productivity of soils would result if soils were not reclaimed to their existing quality condition including such characteristics as aeration, permeability, texture, salinity and alkalinity, microbial populations, fertility, and other physical and chemical characteristics that are accepted as beneficial to overall plant growth and establishment.

2.10.7 Groundwater

Groundwater required to support the Project would represent a new, short-term use of the resource, but would have negligible effect on its long-term productivity.

2.10.8 Health, Safety, and Intentional Destructive Acts

While there would be a short-term temporary increase in potential health and safety impacts associated with construction, long-term impacts in the region would not increase and would not affect the productivity of the region.

2.10.9 Historic and Cultural Resources

The impacts associated with short-term use of the environment for cultural resources would likely be minor as DOE intends to develop a PA that will include assessment and resolution of effects, including avoidance, where practicable, and mitigation.

2.10.10 Land Use

Local short-term use effects from the Project would result from the removal of vegetation and conversion of primarily agricultural and undeveloped land to a utility use. Other short-term and local impacts include the disruption to access to local land uses that may occur, such as agriculture, oil and gas development, and residences and businesses during construction.

2.10.11 Noise

Construction noise would temporarily impact nearby noise sensitive areas; noise levels associated with operations and maintenance of the Project would not impact long-term productivity. Changes in sound level associated with the Project would not be expected to negatively impact current land use and activities.

2.10.12 Recreation

Some direct short-term impacts to resources such as noise or visual disturbance, or restricted access to the recreation area during construction, would likely diminish the quality of a recreational visit. Long-term productivity of recreational areas could potentially decrease in recreational areas that were crossed by the Project.

2.10.13 Socioeconomics

Potential short-term impacts to socioeconomic resources are not expected to outweigh the long-term benefits of the Project. In the long term, the Project would be expected to increase economic productivity through the delivery of renewable energy generated in the Oklahoma and Texas Panhandle regions to load-serving entities in the mid-south and southeast regions of the United States.

2.10.14 Special Status Wildlife, Fish, Aquatic Invertebrate, and Amphibian Species

2.10.14.1 Special Status Terrestrial Wildlife Species

The Project could result in a short-term disturbance to special status wildlife; however, these impacts should not affect the long-term productivity of populations of special status wildlife.

2.10.14.2 Special Status Fish, Aquatic Invertebrate, and Amphibian Species

The Project may result in a short-term disturbance to special status fish, aquatic invertebrate, and amphibian resources; however, these impacts would not likely affect the long-term productivity of populations of special status fish, aquatic invertebrate, and amphibian species.

2.10.15 Surface Water

Surface water required to support the Project would represent a new, short-term use of the resource, but would have negligible effect on its long-term productivity. Any alterations to streambeds required by access road construction would have short term impacts on the altered segment of stream, but over time the impacts would be expected to fade as natural flora and fauna re-established and the impacted stream segments would be small.

2.10.16 Transportation

Construction of the Project would increase the short-term uses of the local roadway network during construction but would have no impact on long-term productivity because roadways would be returned to their original condition and travel conditions would neither improve nor deteriorate during the operational life of the Project.

2.10.17 Vegetation Communities and Special Status Plant Species

The impact of short-term uses on long-term productivity to vegetation resources would be limited to those areas where (1) structural foundations are left in place until decommissioning, or (2) instances where vegetation structure is altered from forested to herbaceous structural types. In this second specific case, the functions of wildlife habitat maintenance, biodiversity, and recreational opportunities could be diminished.

2.10.18 Visual Resources

Short-term vegetation management may impair long-term visual resources where trees or areas of thick vegetation are removed and take years to grow back.

2.10.19 Wetlands, Floodplains, and Riparian Areas

The Project would result in a short-term disturbance to wetlands, floodplains, and riparian areas; however, these impacts should not affect the long-term productivity of these resources.

2.10.20 Wildlife, Fish, and Aquatic Invertebrates

2.10.20.1 Wildlife

The Project may result in a short-term disturbance to wildlife resources; however, these impacts should not affect the long-term productivity of populations of wildlife resources.

2.10.20.2 Fish and Aquatic Invertebrates

The Project would result in a short-term disturbance to aquatic resources; however, these impacts should not affect the long-term productivity of populations of fish and other aquatic species. The short-term impact of introducing non-native invasive species would be negligible; however, over time, long-term productivity would be affected and species could be eliminated from their native habitat.

2.11 Summary of Impacts from Connected Actions

The following sections provide a characterization of the potential connected actions associated with the Project. Descriptions of these connected actions are provided in Section 2.5.

2.11.1 Wind Energy Generation

As described in Section 2.5.1, wind power facilities that would interconnect with the Project are anticipated to be located in parts of the Oklahoma Panhandle and Texas Panhandle within an approximate 40-mile radius of the western converter station. The Applicant anticipates future wind farm development to be between 4,000 and 4,550MW. Neither the Applicant nor DOE knows the exact location of wind power facilities that would be connected to the Project. The Applicant has identified 12 wind development zones (WDZs) based on available wind resources and existing land uses. The range of potential impacts across these WDZs is presented in Table 2.11-1.

Table 2.11-1:
Summary of Impacts from Wind Energy Generation

RESOURCE	POTENTIAL IMPACTS
Agricultural Resources	Construction Approximately 2% of land within a wind energy facility would be disturbed, typically primarily cropland and grasslands. As indicated in Section 3.2.6.8.1, assuming between 20 and 30% of the WDZs would be built-out, between 4,328 and 6,492 acres of primarily agricultural land would be temporarily affected during construction. Wind farm developers are typically able to micro-site turbines and other facility components to avoid displacing or damaging agricultural structures such as irrigation equipment, barns, and silos. Operations and Maintenance Approximately 1% or less of the land for a wind energy facility would be affected or disturbed (converted to utility use for life of the project). For the 12 WDZs, assuming 20 to 30% build-out, between 2,164 and 3,246 acres of primarily agricultural land would be affected for the life of the wind energy facilities. Agricultural uses may usually resume around the facility once construction has been completed.
Air Quality and Climate Change	Construction Minor temporary impacts from construction emissions and are not expected to contribute to substantially increased air pollutant concentrations. Operations and Maintenance Reduction in emissions of pollutants and greenhouse gases from the displacement of current fossil fuel power sources for electricity generation.
Electrical Environment	Construction/Operations and Maintenance None expected.
Environmental Justice	Construction/Operations and Maintenance None expected.
Geology, Paleontology, Soils, and Minerals	Construction Potential impacts to karst and to paleontological resources if shallow bedrock disturbed. Complete avoidance of karst is not possible, and the risk to wind farm components from subsidence would still exist. Impacts on mineral resources extraction during construction are anticipated to be minor. Specific locations of wind generation facilities are not known at this time and therefore specific impacts to designated farmland, soil limitation parameters, or

Table 2.11-1:
Summary of Impacts from Wind Energy Generation

RESOURCE	POTENTIAL IMPACTS
	contaminated soil cannot be determined. Based on the general characteristics of the WDZs, some affected soils may be susceptible to compaction or have moderate to high wind erosion potential. The remaining soil limitation characteristics are not prominent in the WDZs. Operations and Maintenance Due to the prevalence of karst in the area, the risk for subsidence does exist. Impacts from subsidence in karst areas can be avoided and minimized during engineering design. Impacts to mineral resource accessibility would not be expected if protective measures described for the construction phase were put in place, and the locations of the facilities would be designed to avoid mineral resources to the extent possible. Impacts to designated farmland, and soils within infrastructure footprints, including turbine footprint areas, collector lines, substations, met towers, operations and maintenance buildings, and access roads for the maintenance and operations of these facilities.
Groundwater	Construction Common impacts include (1) minor potential for contamination from spills or leaks of fuels and lubricants, (2) small and short-term changes in infiltration rates in areas of land disturbance that would not be expected to result in any noticeable changes in the area's natural groundwater recharge rates; (3) minor impacts to water availability from groundwater demands for soil compaction during road, substation, and wind turbine foundation construction and for dust suppression, and (4) potential damage to wells and associated piping systems in construction areas. Operations and Maintenance Groundwater use would be minor; (limited to personal needs of the few workers associated with maintenance of facilities and equipment) no notable sources of contaminants would be in use other than the typical fuels and lubricants found in vehicles and equipment, no soil disturbance would occur, no impacts expected.
Health, Safety, and Intentional Destructive Acts	Construction Lost-time accident and fatality risks to workers typical of large construction projects. Aircraft operations, including helicopter use, could pose collision risks. Operations and Maintenance Minor potential for rotor blade failure and ice buildup and throw from blades during freezing weather conditions. Impacts typically remaining within the wind generation facility site or transmission line ROW. Potential for shadow flicker and blade glint and glare to cause annoyance to workers and public within range of wind energy generation structures.
Historical and Cultural Resources	Construction Ground disturbance has the potential to disturb belowground historical and cultural (archaeological) resources if present. The level of potential adverse impacts to cultural resources associated with wind energy generation would depend on the level of archaeological surveys conducted and the associated cultural resources BMPs and mitigation plans implemented by wind energy developers. Operations and Maintenance No additional impacts expected.
Land Use	Construction Disturbance of approximately 2% of land within an individual wind energy facility, typically primarily cropland and grasslands. Assuming between 20 and 30% of the WDZs would be built out, between 4,328 and 6,492 acres would be temporarily disturbed (2% of the 20% for the low end, 2% of the 30% for the high end.) Operations and Maintenance Approximately 1% of land within a wind energy facility is converted to utility use for life of the project. For the 12 WDZs, assuming 20 to 30% build-out, between 2,164 and 3,246 acres would be disturbed (until decommissioning). Temporary construction acres would revert to their previous use. Only turbines, access roads, generation tie-lines (if necessary), substations, and operations and maintenance buildings would remain. Agricultural uses and oil/gas development may usually resume around the facility.

Table 2.11-1:
Summary of Impacts from Wind Energy Generation

RESOURCE	POTENTIAL IMPACTS
Noise	Construction Noise sensitive areas near wind energy facilities could experience temporary elevated sound levels from motorized construction equipment used for general construction. Operations and Maintenance Noise from operation of wind energy generation facilities would result from the operation of wind turbines, and maintenance of the wind energy developments. Because there are no site-specific plans for the wind energy development areas, it is not possible to analyze noise impacts for each potential wind energy generation development area. As wind development projects are established in the WDZs, each would be required to proceed through state, local, and other permitting efforts as applicable.
Recreation	Construction Noise, dust, and human activity, as well as vegetation clearing and turbine erection would cause short-term reduced access to, or enjoyment of, recreational areas. No recreational areas are present in WDZ-C, E, F, G, H, I, J, and K, so no impacts are expected in those WDZs. It is assumed that wind energy developers would likely site wind farms to avoid direct impacts to parks and municipalities. Operations and Maintenance Long-term impacts to recreation would typically be limited to changes in the visual characteristics of a recreational area.
Socioeconomics	Construction Construction would result in a range of estimated total (direct, indirect, and induced) jobs of between 8,762 and 9,910 in Region 1. Construction would also result in a range of estimated total (direct, indirect, and induced) earnings of between $435 million and $494 million. Temporary housing impacts could occur if wind generation construction is concurrent with construction of the Project in Region 1 because housing is more limited in this region. Estimated state sales and use tax revenues would range from $158 million to $161 million in Oklahoma and from $217 million to $223 million in Texas. For the three Oklahoma counties, estimated county sales and use tax revenues per facility would range from $0.9 million to $1.9 million for a 50MW facility and from $17.9 million to $35.7 million for a 1,000MW facility.
	Operations and Maintenance Operations and maintenance would result in a range of estimated total (direct, indirect, and induced) jobs of between 665 and 798. Operations and maintenance would also result in a range of estimated total (direct, indirect, and induced) earnings of between $32.9 million and $41.2 million. These annual impacts would occur each year for the operating life of the potential wind facilities. Positive tax revenue impacts would be expected from annual ad valorem or property taxes. For potentially affected counties in Oklahoma, the tax revenues for a single wind facility would range from $1.9 million (for a 50MW facility in Beaver County) to $36 million (for a 1,000MW facility in Texas County). For potentially affected Texas counties, the property tax revenues for a single wind facility would range from $4.3 million (for a 50MW facility in Hansford County) to $85.6 million (for a 1,000MW facility in Sherman County).
Special Status Wildlife and Fish, Aquatic Invertebrate, and Amphibian Species	Construction Potential impacts during wind farm development could include short-term disturbances to species (i.e., displacement in the vicinity of construction activity) during construction, loss of habitat from land disturbance, and potential mortality from vehicle collisions. Potentially suitable habitat for piping plover is limited; however, there is a potential for piping plover to occur during migration. LEPC and whooping crane may feed within the croplands and grasslands; however, the whooping crane occurrence is likely to be limited to migratory and stopover occurrences. The LEPC habitat within some zones is categorized as CHAT category 1 (i.e., focal area) suggesting that large areas of undeveloped, contiguous grassland/herbaceous land cover occur. The LEPC could be potentially impacted during construction of wind farms by clearing of grassland habitats for access roads, wind turbines, and electrical stations. Specifically, the potential for construction impacts to the LEPC and its habitat is greater in WDZ-D, -I, -J, -K, and -L. These WDZs occur in eastern Texas County and western Beaver County in Oklahoma and western Ochiltree County in Texas. Potential mortality and injury, disturbance, and aquatic habitat loss and modification impacts to the Arkansas darter and Arkansas River shiner could occur in WDZ-J and WDZ-K.

Table 2.11-1:
Summary of Impacts from Wind Energy Generation

RESOURCE	POTENTIAL IMPACTS
	Operations and Maintenance Migrant bald and golden eagles and whooping cranes could be at risk for mortality collisions with the turbines. Behavioral avoidance by LEPC of otherwise suitable habitat surrounding wind turbine towers could be possible. Specific impacts would be dependent on the eventual location of the wind energy facilities. Potential impacts to the Arkansas darter and Arkansas River shiner would be similar to those from construction.
Surface Water	Construction Common impacts include (1) potential for runoff and receiving water contamination from spills or leaks of fuels and lubricants, (2) small and short-term changes in runoff rates in areas of land disturbance, and (3) possible disturbance of drainage features, including intermittent or perennial streams, from construction of access roads. Operations and Maintenance Water use would be minor; no impacts expected. Compared to pre-wind farm conditions, long-term operations and maintenance of wind farms in any of the WDZs would only result in minor changes to stormwater runoff and drainage.
Transportation	Construction: Impacts to roads would be minor, short term and temporary, most roads have the potential for one-level decreases to level of service. Level of service would not decrease below LOS-C even in the unlikely scenario where 38 wind farms and the AC collection system are under construction within 1 year, which further supports the conclusion that impacts during construction would be minor and temporary. Although railroads, airports, airstrips, and navigational aids are located within the WDZs, impacts to these features from construction are not expected. Operations and Maintenance Low level of increased rural traffic from wind farm workers and their families. FAA lighting requirements would apply to the wind turbines. In addition, the heights of the turbines would require careful selection of specific turbine sites to avoid potential conflicts with airports and military airspace. In some cases, FAA notification requirements might be triggered.
Vegetation Communities	Construction Approximately 2% of land within any wind energy facility is assumed to be disturbed during construction, equating to approximately 6,492 acres of temporary disturbance. All of the potential wind generation areas are dominated by cropland and grassland land cover types. Temporary impacts during construction may result from increased dust entrainment that can settle on surrounding vegetation causing a reduction in photosynthetic capability of plants. It is also likely that there would be mowing or potential removal of vegetation in ROWs for generation tie-lines, access roads, and electrical collection lines that are placed underground. Long-term to permanent impacts may result to vegetation where it is removed to facilitate construction of substation facilities. Operations and Maintenance Approximately 1% of land within any given wind energy facility is anticipated to be impacted by maintenance and operations. This would equate to approximately 3,246 acres. Once construction has been completed, agricultural operations would be able to continue in most of the wind farm. Agricultural activities such as cultivating crops are generally permitted up to the wind turbine pads, so only a very minimal area of existing agricultural land would be permanently removed from production. Permanent access roads may change the configuration of fields for crops.
Visual Resources	Construction Short-term visual intrusion of construction vehicles, equipment, materials, and work force in staging areas, and final turbine location. Operations and Maintenance The tall, vertical wind turbines would be in strong contrast with the primarily horizontal lines of the surrounding landscape; therefore, higher impacts are anticipated where the wind turbines are located in the foreground and near middle ground in relation to sensitive viewers. In addition, the required FAA lighting would be visible for long distances and would likely attract attention when flashing. Most of the highly sensitive resources, such as the national grassland and recreation areas, however, would be located in the background distance zone, so impacts would not be as strong as turbines would not be a dominant feature at that distance.

Table 2.11-1:
Summary of Impacts from Wind Energy Generation

RESOURCE	POTENTIAL IMPACTS
Wetlands, Floodplains, and Riparian Areas	Construction The potential short-term impacts from construction activities for wind energy generation could include mechanical damage/crushing of wetland and riparian vegetation, compaction of soils, sedimentation and turbidity from construction activities adjacent to these resources, alteration of hydrology from access road construction, dewatering activities, and contamination from accidental spills of hazardous substances such as fuels and lubricants. The potential long-term impacts to wetlands, floodplains, and riparian resources could include removal of vegetation during excavations for structure foundations, electrical collection lines, or during permanent access road construction, conversion of forested wetlands and riparian areas to shrubby or herbaceous cover types within the ROW, changes to hydrology from permanent access roads construction, and the introduction of invasive species from construction equipment. Operations and Maintenance There would be a potential for impacts from contamination from accidental spills of hazardous substances such as fuels and lubricants, however, the potential would be less than during construction.
Wildlife and Fish	Construction Short-term impacts to wildlife resources during construction may include disturbance due to increased noise, dust, and traffic. Additionally, there is the potential for short-term indirect impacts to wildlife habitats as a result of the clearing of vegetation and soil disruption during construction. There is the potential for long-term, direct habitat loss related to construction of a wind energy development. Potential localized aquatic habitat damage, sensory disturbance, and mortality/injury to fish and aquatic invertebrate species could occur at stream and water body crossings. Operations and Maintenance Operations and maintenance of wind energy developments are known to have direct impacts on some wildlife species, specifically avian and bat species, due to collisions with wind turbine blades, collisions and electrocutions associated with generation tie-lines, and barotrauma of bat species. Permanent habitat loss would occur due to the footprint of the project. Potential impacts to fish and aquatic invertebrate species similar to those during construction could occur during maintenance activities at stream and river crossings.

2.11.2 Optima Substation

The future Optima Substation is anticipated to be constructed on 160 acres of currently undeveloped land near an operating wind energy facility. The land cover of the site is primarily grassland/herbaceous. Any agricultural practices, such as grazing, that currently occur on the site would be converted to a utility use. The site would be partially contained within the Oklahoma AC Interconnection Siting Area. Therefore, impacts of this connected action would be similar, but of a smaller scale, to the impacts presented for the Oklahoma Converter Station and Interconnection Siting Area. Impacts would occur primarily during construction of the substation because there would be few, if any environmental impacts associated with operations and maintenance of the substation.

2.11.3 TVA Upgrades

The required TVA upgrades could have impacts similar to the Project, but on a smaller scale, being restricted to an approximately 37-mile-long new 500kV AC transmission line in western Tennessee and upgrades to existing facilities. The potential impacts would be limited primarily to the construction phase of the required upgrades. The upgrades to existing facilities would be unlikely to result in any significant, adverse impacts since there would not likely be any additional land disturbance required beyond the existing footprint of those facilities. The specific impacts of the new transmission line would be subject to environmental review once specific locations are identified. TVA anticipates tiering from this EIS when completing its review of potential environmental impacts as required by NEPA.

2.12 Summary of Impacts from the No Action Alternative

Under the No Action Alternative, DOE would not participate with the Applicant in the Applicant Proposed Project or DOE Alternatives. DOE assumes for analytical purposes that the Project would not move forward and none of the potential environmental effects associated with the Project would occur. Therefore, the Project would not be constructed and no additional impacts would occur to any of the environmental resources analyzed.

2.13 Summary of Cumulative Impacts

The cumulative impacts analysis identified past, present, and reasonably future actions that could occur within the same time and place as the Project. This section identifies those cumulative impacts for both construction and operations and maintenance. Chapter 4, Cumulative Impacts, describes the identification of past, present, and reasonably foreseeable future actions in detail and provides an evaluation of potential cumulative impacts.

Impacts from Construction

Construction activities in the seven diverse regions of the Project could result in impacts to agricultural resources, changes to land uses, temporary land disturbance, increased traffic, increased air emissions, increased noise levels, intrusions into the visual landscape, and potential impacts to wildlife, fish, aquatic invertebrate, and amphibian species and vegetation, including special status species. In most cases, the impacted areas would begin to return to their original state within months after construction activities have been completed. Cumulatively, other construction activities occurring in the same time and vicinity would have similar impacts on the specific ROIs within each region. Other past, present, and reasonably foreseeable actions identified for the seven regions that could occur within the same time and place of the Project include electrical transmission lines, roadway and bridge enhancements, new road construction, oil or natural gas pipelines, wind farm developments, and two relatively large development projects in Region 7 (Great River Super Site and Green Meadows Development; see Table 4.2-1a in Chapter 4). Multiple activities occurring at the same time and vicinity would have greater impacts than just one action. If construction activities overlapped in the same area, then the construction-related impacts could be greater than for just the Project. However, with the exception of the converter stations, construction of the Project would not affect any one area for long (i.e., no more than a few weeks or months), so the short temporal overlap would limit cumulative impacts. The majority of the actions identified are transmission lines and road construction. Most of the road construction would occur on existing roadways, not disturbing new lands, and therefore would have only minor contributions to cumulative impacts from the Project. Overall, construction of the Project, when considered with past, present, and reasonably foreseeable actions, would result in the following cumulative impacts: short-term, temporary disturbance of active agricultural lands and operations; possible restrictions on existing land uses; temporary soil and vegetation disturbance; increased risk of localized water quality impacts (spills or sedimentation); increased traffic; increased air emissions and noise levels; potential shortages in temporary housing (in Region 1); visual disruptions from construction equipment and land disturbance; and potential impacts to wildlife, fish, aquatic invertebrate, and amphibian species and vegetation, including special status species. Fish special status species are the Arkansas darter, Arkansas River shiner, Ozark cavefish, Yellowcheek darter, and pallid sturgeon. The aquatic invertebrate special status species are spectaclecase, pink mucket, Neosho mucket, speckled pocketbook, scaleshell mussel, fat pocketbook, rabbitsfoot, snuffbox, and Curtis' pearlymussel. The special status amphibian is the Ozark hellbender.

Impacts from Operations and Maintenance

After completion of construction, the majority of the Project-related impacts would be minimized. Those that would continue or increase would include electrical environment (electric fields, magnetic fields, audible noise, and radio and television interference) and visual resources. The Project individually would not be considered a strong source of magnetic fields. Other existing and proposed transmission lines that would be crossed by the Project would be an additional source of magnetic fields at the location of the crossing. People are exposed to numerous sources of magnetic fields on a daily basis from sources like power lines, but also from electric devices in home and office environments. The research available on the health impacts of magnetic field exposure are not definitive, and no conclusions regarding the health impacts can be drawn based on what is presently known about the health impacts of magnetic fields.

Long-term visual impacts from the Project include the intrusion of the converter station and associated structures and transmission structures, access roads, and cleared ROW that may introduce contrast into the surrounding landscape setting. The cumulative impacts would be of a similar nature in areas where additional transmission line actions have been identified (Regions 1, 2, and 3). Additionally, sensitive viewers in Regions 1, 2, and 6 that are characterized primarily by flat croplands and grasslands with scattered vegetation are anticipated to have greater visibility of the Project due to long viewing distances associated with an open landscape with panoramic views. A new planned section of Highway 71 would cross Link 6 of the Region 4 Applicant Proposed Route and near the Alma Key Observation Point. The visual impacts of the new section of Highway 71 would be cumulative over the long-term with those of the Project.

2.14 Agency Preferred Alternative

CEQ regulations at 40 CFR 1502.14(e) require an agency to identify its preferred alternative, if one exists, in the Draft EIS. At this point in the NEPA process, DOE does not have a preferred alternative. DOE has not identified a preference for whether to participate with Clean Line in some manner as prescribed by Section 1222 of the EPAct. As part of its deliberations, DOE will consider all of the alternatives analyzed in the Draft EIS and take into consideration the comparison of potential impacts for each resource area coupled with input received during the public comment period on the Draft EIS. DOE will identify its preference for whether to participate with Clean Line and its preferred alternatives for each of the project elements (including route alternatives) in the Final EIS.

As identified in Section 2.4.3.2.4, DOE analyzed HVDC Alternative Route 4-B, which would intersect the Ozark National Forest in Crawford County, Arkansas. The representative ROW for HVDC Alternative Route 4-B crosses approximately 387 acres of the Ozark National Forest (230 of which are federally owned), while other alternative routes in Region 4 do not. (A small portion, 2.5 acres, of the representative ROW for the Applicant Proposed Route overlaps the Ozark National Forest, however, this could potentially be avoided during final siting of the Project within the analyzed 1,000-foot-wide corridor for the Applicant Proposed Route.) After detailed analysis and discussion with the USFS, DOE has determined that HVDC Alternative Route 4-B is not a preferred alternative.

DOE and Clean Line considered constraints and routing criteria when developing a route alternative to cross National Forest land (DOE 2013). DOE consulted with USFS and determined that HVDC Alternative Route 4-B struck a balance between minimizing potential environmental impacts to private and public lands, while still allowing the construction of the Project. The primary reasons that HVDC Alternative Route 4-B is non-preferred include the following:

- The route alternative would adversely affect sensitive resources by creating discontinuities (linear breaks) in National Forest land (Section 3.10.6).
- The route alternative would cross lands designated as High Scenic Integrity Objectives as identified in the USFS' Forest Plan (Section 3.18.6).
- Required ROW maintenance along the route alternative would adversely affect timber production (see Section 3.10.6).
- The route alternative would, in places, undermine the use for which the National Forest land was originally acquired (i.e., conservation of natural resources) (Section 3.10.6).
- The route alternative would, in places, traverse steep, rugged terrain that could present an increased safety hazard during construction and future maintenance of an HVDC transmission line (Section 3.8.5.3).
- The route alternative is close to the Ozark Plateau region, which contains cave hibernacula for special status bat species. The increase in forested land in this area increases the potential for impacts to the special status bat species (e.g., disturbances to or loss of roost trees) compared to routes that do not cross the Ozark National Forest (3.14.1.7).
- The route alternative would cross into the Ozark National Forest Important Bird Area (identified by National Audubon Society), potentially indirectly impacting wildlife species (Section 3.20.1.7.3).
- The interspersed land cover and land ownership along the route alternative suggests that a variety of land uses may occur along the ROW, and as a result, a variety of wildlife species common to both deciduous forests and pasture/hay land covers may occur in this area (thereby potentially exposing more wildlife species to project related impacts compared to the Applicant Proposed Route) (Section 3.20.1.7.3).
- To the extent that the route alternative might have the benefit of avoiding private land, that benefit is limited because the route alternative would also cross a large number of parcels of privately owned land within the National Forest boundary (Section 3.10.6).[5]

[5] Privately owned land, or inholdings, can occur inside the boundary of a National Forest. Inholdings result from private ownership of lands prior to the designation of the National Forest, which then end up grandfathered within the legally designated boundary.