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## FINAL ENVIRONMENTAL ASSESSMENT

# **VOLUNTEER-EAST KNOX BULK TRANSMISSION PROJECT**

**Knox County, Tennessee**

**PREPARED BY:**  
TENNESSEE VALLEY AUTHORITY

DECEMBER 2012

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## ACRONYMS, ABBREVIATIONS, AND GLOSSARY OF TERMS USED

<b>acre</b>	A unit measure of land area equal to 43,560 square feet
<b>Advisory Council</b>	Advisory Council on Historic Preservation
<b>APE</b>	Area of potential effect
<b>BMPs</b>	Best management practices or accepted construction practices designed to reduce environmental effects
<b>B.P.</b>	Before present
<b>CFR</b>	Code of Federal Regulations
<b>conductors</b>	Cables that carry electrical current
<b>danger tree</b>	A tree located outside the right-of-way that could pose a threat of grounding a line if allowed to fall near a transmission line or a structure
<b>dB</b>	Decibels
<b>dBA</b>	A-weighted decibel
<b>DCKC</b>	Development Corporation of Knox County
<b>distribution line</b>	A series of electrical conductors used to transfer electric power locally between substations or from substations to power consumers; distribution lines carry less electric power than the transmission lines and substations that feed them
<b>DNL</b>	Day/Night levels
<b>EA</b>	Environmental Assessment
<b>easement</b>	A legal agreement that gives TVA the right to use property for a purpose such as a right-of-way for constructing and operating a transmission line
<b>endangered species</b>	A species in danger of extinction throughout all or a significant part of its range
<b>EMF</b>	Electric and magnetic field
<b>EO</b>	Executive Order
<b>ESA</b>	Endangered Species Act
<b>FPPA</b>	Farmland Protection Policy Act
<b>feller-buncher</b>	A piece of heavy equipment that grasps a tree while cutting it, which can then lift the tree and place it in a suitable location for disposal; this equipment is used to prevent trees from falling into sensitive areas, such as a wetland
<b>FICON</b>	Federal Interagency Committee on Noise
<b>GIS</b>	Geographic Information System
<b>groundwater</b>	Water located beneath the ground surface in the soil pore spaces or in the pores and crevices of rock formations
<b>guy</b>	A cable connecting a structure to an anchor that helps support the structure
<b>HUD</b>	Department of Housing and Urban Development
<b>I</b>	Interstate
<b>ibid</b>	Abbreviation for the Latin term <i>ibidem</i> , meaning “in the same place”; refers to the immediately preceding work cited
<b>KUB</b>	Knoxville Utilities Board
<b>kV</b>	Symbol for kilovolt (1 kV equals 1,000 volts)
<b>load</b>	That portion of the entire power in a network consumed within a given area; also synonymous with “demand” in a given area

## Volunteer-East Knox Bulk Transmission Project

<b>loop</b>	A transmission line loop is accomplished by building two circuits into a switching station from two tap points in an existing line and removing the line between the two tap points; this loop would connect into two new circuit breakers
<b>n.d.</b>	Indicates “no date” or unknown date of Web access
<b>NEPA</b>	National Environmental Policy Act
<b>NERC</b>	North American Electric Reliability Corporation
<b>NESC</b>	National Electric Safety Code
<b>NHPA</b>	National Historic Preservation Act
<b>NIEHS</b>	National Institute of Environmental Health Sciences
<b>NPS</b>	National Park Service
<b>NRCS</b>	Natural Resource Conservation Service
<b>NRHP</b>	National Register of Historic Places
<b>NRI</b>	Nationwide Rivers Inventory
<b>OPGW</b>	Fiber optic ground wire
<b>OSHA</b>	Occupational Safety and Health Administration
<b>outage</b>	An interruption of the electric power supply to a user
<b>riparian</b>	Related to or located on the banks of a river or stream
<b>RM</b>	River mile
<b>ROC</b>	Regional Operations Center
<b>ROW</b>	Right-of-way, a corridor containing a transmission line
<b>runoff</b>	That portion of total precipitation that eventually enters a stream or river
<b>SHPO</b>	State Historic Preservation Officer
<b>SMZ</b>	Streamside management zone
<b>SNA</b>	State Natural Area
<b>SOC</b>	Systems Operations Center
<b>structure</b>	A pole or tower that supports a transmission line
<b>substation</b>	A facility connected to a transmission line used to reduce voltage so that electric power may be delivered to a local power distributor or user
<b>surface water</b>	Water collecting on the ground or in a stream, river, lake, or wetland; it is naturally lost through evaporation and seepage into the groundwater
<b>switch</b>	A device used to complete or break an electrical connection
<b>tap line</b>	An electric power line that connects an existing transmission line to a substation
<b>tap point</b>	A connection point between a tap line and an existing transmission line
<b>TDEC</b>	Tennessee Department of Environment and Conservation
<b>TDOT</b>	Tennessee Department of Transportation
<b>TEPPC</b>	Tennessee Exotic Plant Pest Council
<b>TGRs</b>	Tree growth regulators
<b>threatened species</b>	A species likely to become endangered within the foreseeable future
<b>TOM</b>	Transmission, Operations, and Maintenance
<b>transmission line</b>	A series of electrical conductors (“wires”) and their supporting structures used to transmit electric power from one location to another
<b>TVA</b>	Tennessee Valley Authority

<b>TVARAM</b>	TVA Rapid Assessment Method, a version of the Ohio Rapid Assessment Method for categorizing wetlands, designed specifically for the TVA region
<b>underbuild</b>	A lower voltage conductor attached to the same transmission line structure as a higher voltage conductor, typically beneath the higher voltage conductor
<b>undertaking</b>	Any project, activity, or program that has the potential to have an effect on a historic property and that is under the direct or indirect jurisdiction of a federal agency, or is licensed or assisted by a federal agency
<b>US</b>	United States Highway
<b>USACE</b>	United States Army Corps of Engineers
<b>USDA</b>	United States Department of Agriculture
<b>USEPA</b>	United States Environmental Protection Agency
<b>USFS</b>	United States Forest Service
<b>USFWS</b>	United States Fish and Wildlife Service
<b>USGS</b>	United States Geological Survey
<b>WHO</b>	World Health Organization
<b>wetland</b>	A marsh, swamp, or other area of land where the soil near the surface is saturated or covered with water, especially one that forms a habitat for wildlife
<b>WNS</b>	White-nose syndrome
<b>WWC</b>	Wet-weather conveyance

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## CHAPTER 1

### 1.0 PURPOSE OF AND NEED FOR ACTION

#### 1.1 Proposed Action - Improve Power Supply

The Tennessee Valley Authority (TVA) proposes to improve the existing power supply system in Knox, Sevier, and Jefferson counties and surrounding areas by constructing and operating new 161-kilovolt (kV) transmission lines and a new switching station in east Knox County, Tennessee (Figure 1-1). In addition, Knoxville Utilities Board (KUB), a distributor of TVA power, has requested a new 161-kV delivery point. TVA proposes to purchase a 34.85-acre site and prepare approximately 28 acres for construction of a new joint substation, which would include a TVA 161-kV switching station and a KUB 161-kV substation. TVA would construct and operate its new switching station and sell a portion of this site to KUB for their construction of a new 161-kV substation (Figure 1-1). The proposed transmission lines and switching station would be completed by May 2015 or as soon as possible after that date.

Electric power would be supplied to the switching station from TVA's existing Volunteer 500-kV Substation, located in northeast Knox County, by constructing and operating approximately 13.4 miles of new 161-kV double-circuit transmission line (Figure 1-1). TVA would also construct a 1-mile loop line from TVA's existing Dumplin Valley-Nixon Road 161-kV Transmission Line to the switching station. TVA's switching station would connect to KUB's new substation. For simplicity's sake, TVA's switching station and KUB's new substation (both located on the same site) will collectively be referred to as the East Knox 161-kV Substation for the remainder of this document.

The proposed 13.4-mile Volunteer-East Knox 161-kV Transmission Line would be built on a 100-foot-wide right-of-way (ROW). Some portions of the proposed line would be constructed on new ROW and some on existing ROW. About 2.7 miles of this line would be constructed parallel to an existing TVA ROW, requiring 87.5 feet of additional ROW in most places. The existing 100-foot-wide vacant Waterville-Arlington Transmission Line ROW would be utilized for approximately 4.5 miles of this transmission line. The remaining 6.2 miles of the proposed Volunteer-East Knox 161-kV Transmission Line, as well as the 1-mile Dumplin Valley-Nixon Road Loop Line, would be constructed on new ROW. The proposed transmission lines would occupy approximately 115 acres of new ROW and 55 acres of existing ROW.

Additionally, to facilitate the operation of the new transmission lines and the switching station, TVA would complete the following:

- Install fiber optic ground wire (OPGW) along the new transmission line;
- Install a new structure on the double-circuit Volunteer-Knox #2 and Volunteer-North Knoxville #2 161-kV transmission lines;
- Provide a 69-kV transmission line underbuild, if necessary, for KUB at the entrance to the East Knox 161-kV Substation;
- Install a new 161-kV breaker, replace relay equipment, and add new telecommunications connections at the Volunteer 500-kV Substation; and
- Modify the TVA system's map board at the System Operations Center (SOC) and Regional Operations Center (ROC) in Chattanooga to include the names and numbers of the new transmission lines and switching station.

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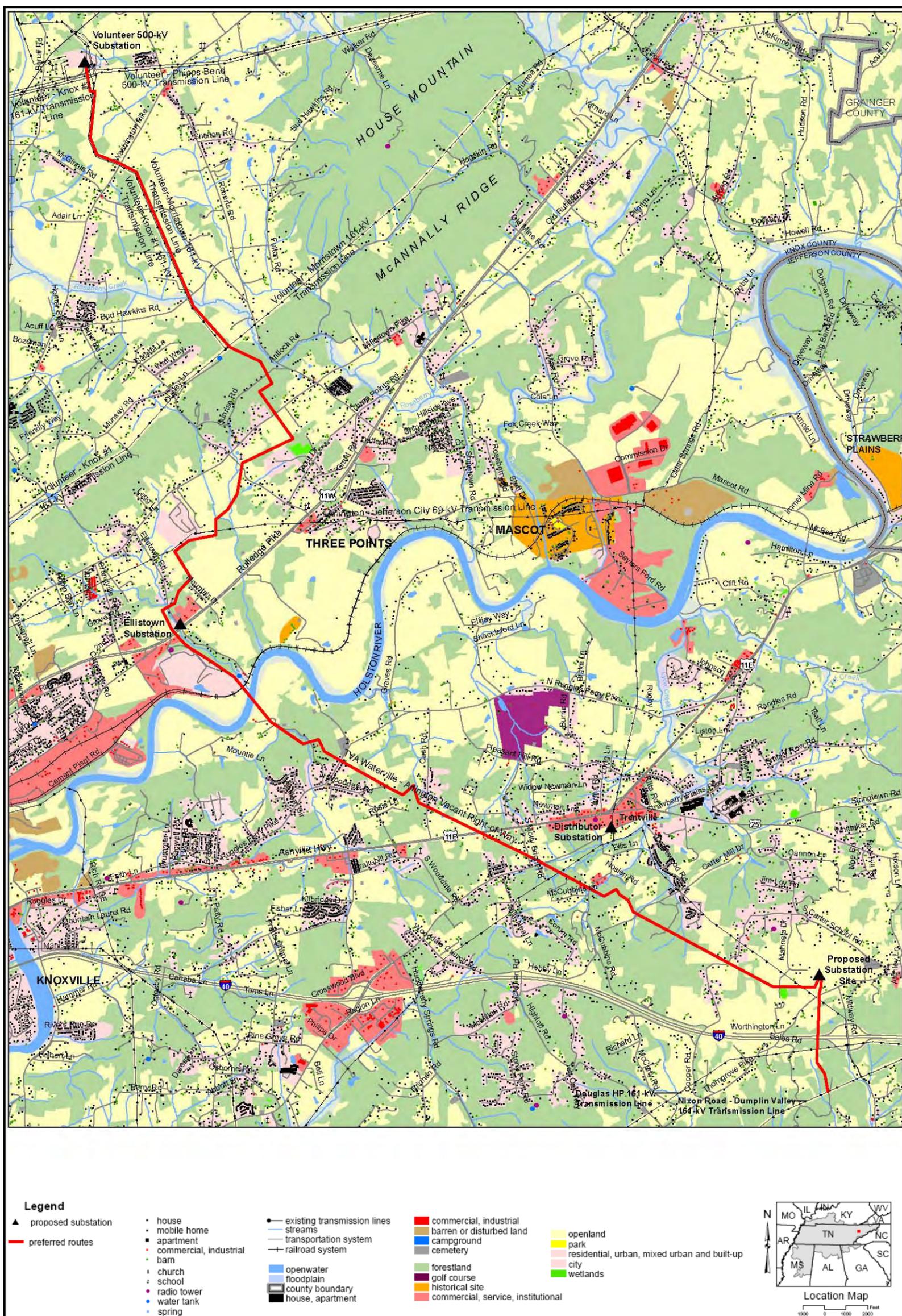


Figure 1-1. The Preferred Volunteer-East Knox 161-kV Transmission Line, Dumplin Valley-Nixon Road 161-kV Loop Line, and East Knox 161-kV Substation Site in Knox County, Tennessee



## 1.2 Need for Proposed Action

TVA plans its transmission system according to industry-wide standards provided by the North American Electric Reliability Corporation (NERC). The standards state that the TVA transmission system must be able to survive single-failure events while continuing to serve customer loads with adequate voltage and no overloaded facilities, and while maintaining adequate line clearances as required by the National Electric Safety Code (NESC).

TVA serves the power needs of Knox, Sevier, and Jefferson counties and the surrounding areas of eastern Tennessee (hereafter referred to as “the project area”) through an infrastructure network that includes 161-kV and 500-kV transmission lines, 161-kV and 500-kV substations, and several generating facilities. While the Douglas and Cherokee Hydroelectric Plants are critical power sources, power generation from these plants during drought conditions can be unreliable. TVA studies indicated that during these drought periods, the loss of a single transmission source would result in heavier line loadings on the TVA transmission facilities in the area making them highly susceptible to voltage and capacity problems. Accordingly, to continue to meet the power demand in the project area, TVA proposes to supply the area through another source, the Volunteer 500-kV Substation.

For example, within the next several years, under conditions resulting in the loss of generation from the hydroelectric plants, the Volunteer-Knox #1 161-kV Transmission Line would overload if the Volunteer-Knox #2 161-kV Transmission Line were lost from service. Further, TVA conducts operational, “real-time” contingency studies for all facilities within the transmission system. These studies have shown, in recent years, that the Volunteer-Knox #1 161-kV Transmission Line could overload. As a result, TVA’s transmission system operators have implemented short-term mitigation measures that temporarily reduce loading on this line. Similarly, the Volunteer-Knox #2 Transmission Line would be near capacity with the loss of the Volunteer-Knox #1 Transmission Line. The loss of other transmission lines in the area would also cause the transmission system voltage within the project area to drop below TVA’s acceptable limits.

Additionally, because the jointly owned KUB-TVA Knox 161-kV Substation has exceeded its firm capacity in recent years, KUB plans to construct a new substation to reduce loading on their equipment and prevent voltage problems at several KUB substations. To serve this planned substation, KUB has requested that TVA provide a new delivery point.

During its substation planning, KUB expressed a desire to TVA to locate their new substation near an existing TVA power supply source, in order to minimize the length of new transmission line required to provide a delivery point. Because KUB’s desired area of location would also accommodate TVA’s proposal to construct a new 161-kV switching station to address the TVA bulk power system issues, KUB and TVA jointly proposed to construct their facilities on a single site.

To ensure that Knox, Sevier, and Jefferson counties and the surrounding areas, including KUB’s service area, have a continuous, reliable source of electric power, TVA needs to provide additional electric service to the area. The construction of new transmission lines and a new switching station would meet this need by providing redundancy within the electric transmission system. These improvements to the TVA bulk power system would provide additional flexibility in delivering electric power to both distributor-owned substations and TVA substations. As a result, it would overcome the voltage and capacity problems, improve the reliability of the TVA and KUB’s power supply, and thereby allowing TVA to meet the reliability criteria established by the NERC.

Additionally, the proposed project would provide a delivery point as requested by KUB. This would allow TVA to ensure the area is provided with a strong, affordable source of power for continued economic health and residential and commercial growth in the area.

### 1.3 The Decision

The primary decision before TVA is whether to provide additional electric service to Knox, Sevier, and Jefferson counties, including KUB's service area, by constructing new 161-kV transmission lines and a switching station to ensure the supply of continuous reliable power to these areas. If the proposed transmission lines and switching station are to be built, other secondary decisions are involved. These include the following considerations:

- Timing of the proposed improvements;
- Most suitable location for the proposed switching station;
- Most suitable route for the proposed transmission lines; and
- Determination of any necessary mitigation and/or monitoring necessary to meet TVA standards and to minimize the potential for damage to environmental resources.

A detailed description of the alternatives is provided in Section 2.1.

### 1.4 Other Pertinent Environmental Reviews or Documentation

In 2011, TVA completed the *Integrated Resource Plan: TVA's Environmental & Energy Future* (TVA 2011a) to determine how it will meet the electric power demands of its customers over the next 20 years while fulfilling TVA's mission of providing low-cost, reliable power, environmental stewardship, and economic development. TVA released the accompanying *Environmental Impact Statement for TVA's Integrated Resource Plan: TVA's Environmental & Energy Future* in March 2011 (TVA 2011b).

### 1.5 Scoping Process and Public Involvement

TVA contacted the following federal and state officials, as well as federally recognized Native American tribes, concerning the proposed project. TVA also conducted a review by a network of designated environmental specialists.

- Absentee Shawnee Tribe of Oklahoma
- Alabama-Quassarte Tribal Town
- Cherokee Nation
- Chickasaw Nation
- Choctaw Nation of Oklahoma
- Eastern Band of Cherokee Indians
- Eastern Shawnee Tribe of Oklahoma
- Jena Band of Choctaw Indians
- Kialegee Tribal Town
- The Muscogee (Creek) Nation
- Mississippi Band of Choctaw Indians
- National Park Service (NPS)
- Seminole Nation of Oklahoma
- Seminole Tribe of Florida
- Shawnee Tribe
- Tennessee Department of Environment and Conservation (TDEC)
- Tennessee State Historic Preservation Officer (SHPO)
- Thlopthlocco Tribal Town
- United Keetoowah Band of Cherokee Indians in Oklahoma
- United States Fish and Wildlife Service (USFWS)

This proposal was reviewed to ensure conformity with Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Protection of Wetlands), the Farmland Protection Policy Act (FPPA), the National Historic Preservation Act (NHPA), the Endangered Species Act (ESA), Section 404 of the Clean Water Act, and EO 12372 (Intergovernmental Review). Correspondence received from other agencies related to this review and coordination is contained in Appendix A.

TVA developed a public communication plan that included a website with information about the project, a map of the alternative routes, and feedback mechanisms. Public officials were briefed on the project. The 507 property owners who could potentially be affected by any of the route alternatives, along with 10 public officials, were invited to a project open house. TVA used local news outlets and notices placed in the local newspapers to notify other interested members of the public of the open house. TVA held the open house on July 10, 2008, at Carter High School in Strawberry Plains, Tennessee, which was attended by 194 people.

At the open house, TVA presented a network of 36 alternative transmission line routes comprised of 22 different line segments, along with two possible locations for TVA's switching station to the public for comment (see Figure 1-2). These sites would also accommodate the location of KUB's substation.

The alternative transmission line segments are described in Section 2.3.6.2. The primary concern expressed by the public was the impact of the proposed transmission line to residential development and farmland in the area. Landowners also voiced concerns relative to health issues, property value, and impacts of the proposed line on visual quality and natural, historical, and cultural resources. The alternative locations, as presented at the 2008 open house for the East Knox 161-kV Substation, are described in Section 2.3.4. TVA received no written objections to the use of either of these locations.

A 30-day public review and comment period was held following the open house, where TVA accepted public comments on the alternative transmission line routes, substation locations, and other issues. A toll-free phone number and facsimile number were made available to facilitate comments. During the comment period, numerous landowners contacted TVA to express their concerns, most of which were similar to those voiced at the open house.

At the conclusion of the comment period, TVA made adjustments to some of the proposed transmission line route segments in response to the comments received. TVA then announced a preferred Volunteer-East Knox 161-kV Transmission Line route and East Knox 161-kV Substation site to the public in November 2008 (Figure 1-3). Letters were sent to affected property owners and information was provided to the public through TVA's website.

As a result of information obtained, following this announcement, from both public and agency comments as well as field surveys, TVA made further adjustments to the preferred transmission line route (Figure 1-4). In February 2011, letters were again sent to the affected property owners regarding these changes to the preferred route, and information was provided to the public through TVA's website. These adjustments are described in Section 2.4.4. Figures 1-5 and 1-6 are provided as a comparison of all of the various route segment locations that have been considered since the 2008 open house. Subsequently, TVA provided another opportunity for public and agency review when the Draft Environmental Assessment (EA) was made available for comment on July 17, 2012. The comment period closed on August 17, 2012. One comment on the proposed project was received from TDEC (Appendix A).

Since the 2008 open house, TVA has considered additional substation sites that were provided as alternatives by the Development Corporation of Knox County (DCKC), the owner of one of the initial sites considered (Figure 1-7). These sites were addressed in the Draft EA and are described in Section 2.4.2.

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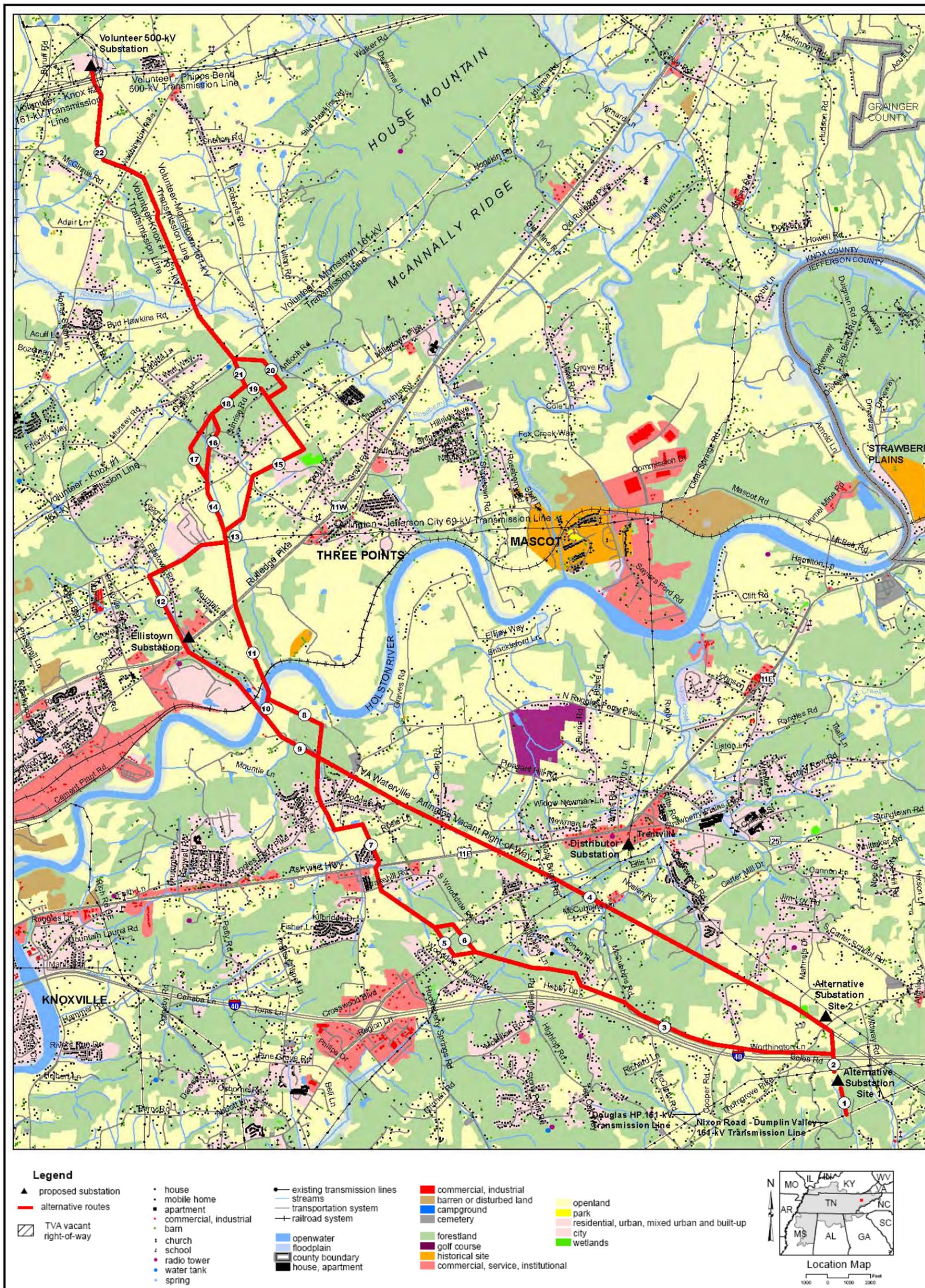


Figure 1-2. 2008 Alternative Route Segments for the Volunteer-East Knox 161-kV Transmission Line and the Dumplin Valley-Nixon Road 161-kV Loop Line and Switching Station Sites in Knox County, Tennessee



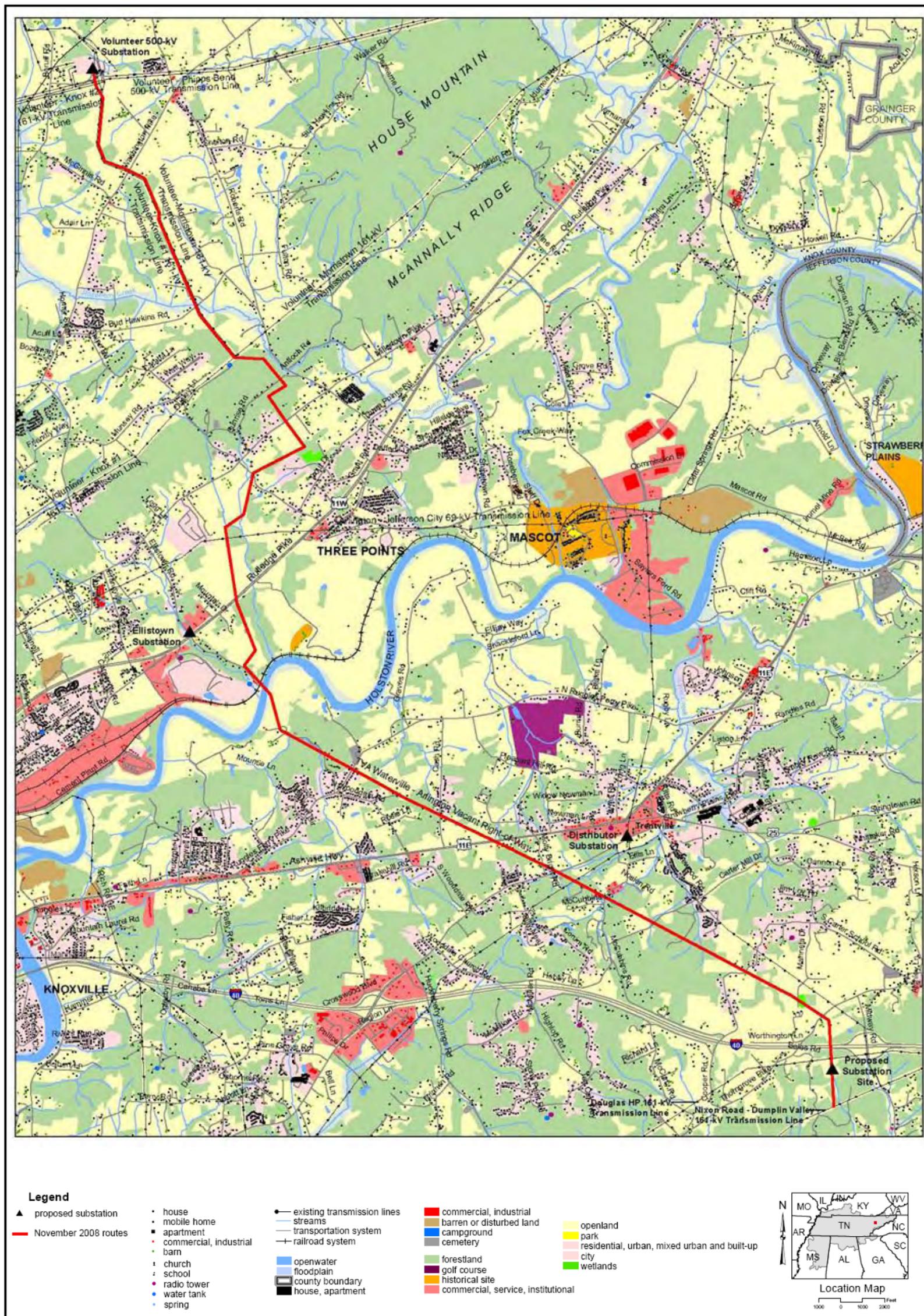


Figure 1-3. 2008 Preferred Volunteer-East Knox 161-kV Transmission Line and Dumplin Valley-Nixon Road 161-kV Loop Line Routes and East Knox 161-kV Substation Site in Knox County, Tennessee



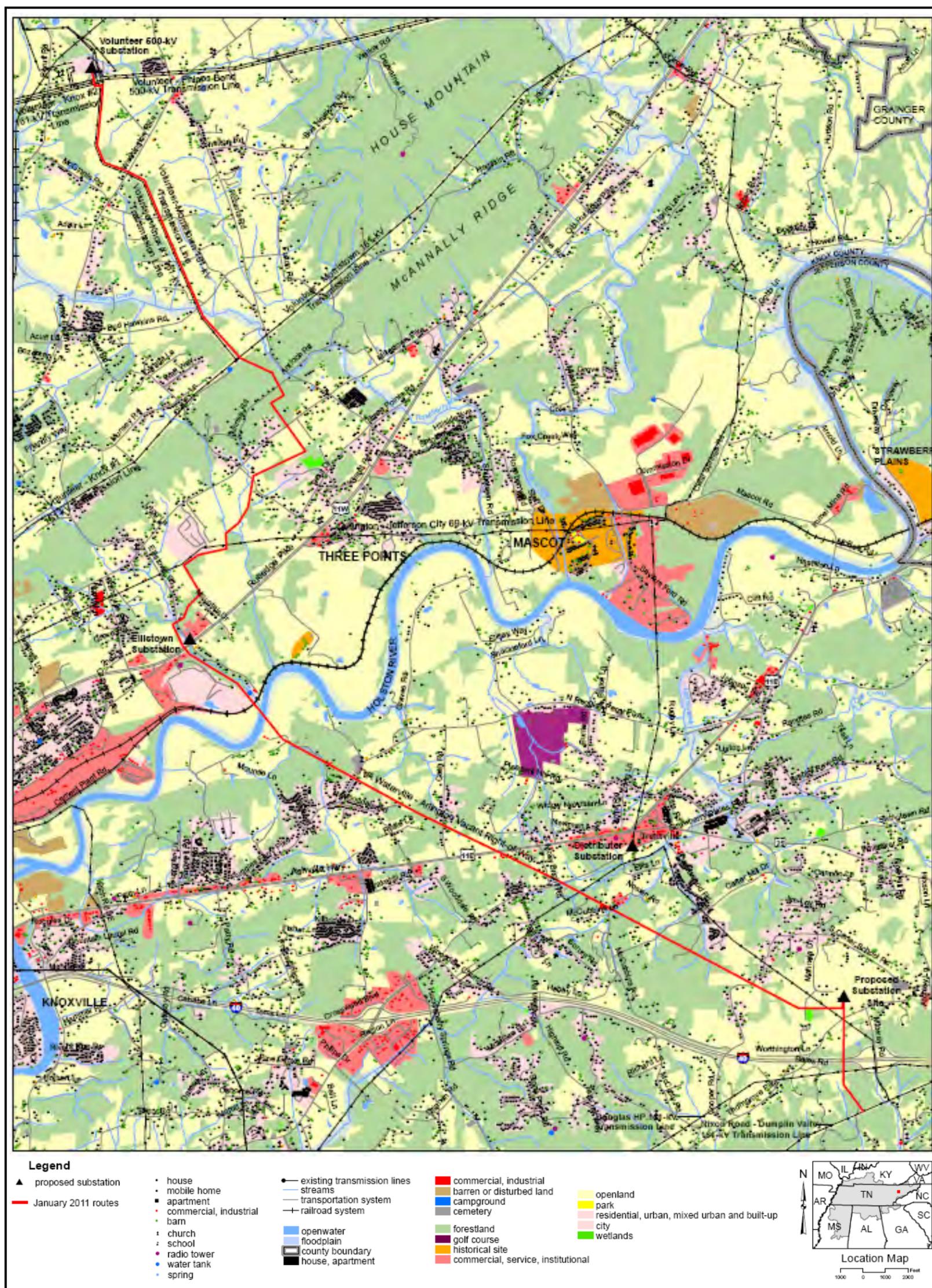


Figure 1-4. 2011 Preferred Volunteer-East Knox 161-kV Transmission Line and Dumplin Valley-Nixon Road 161-kV Loop Line Routes and East Knox 161-kV Substation Site in Knox County, Tennessee



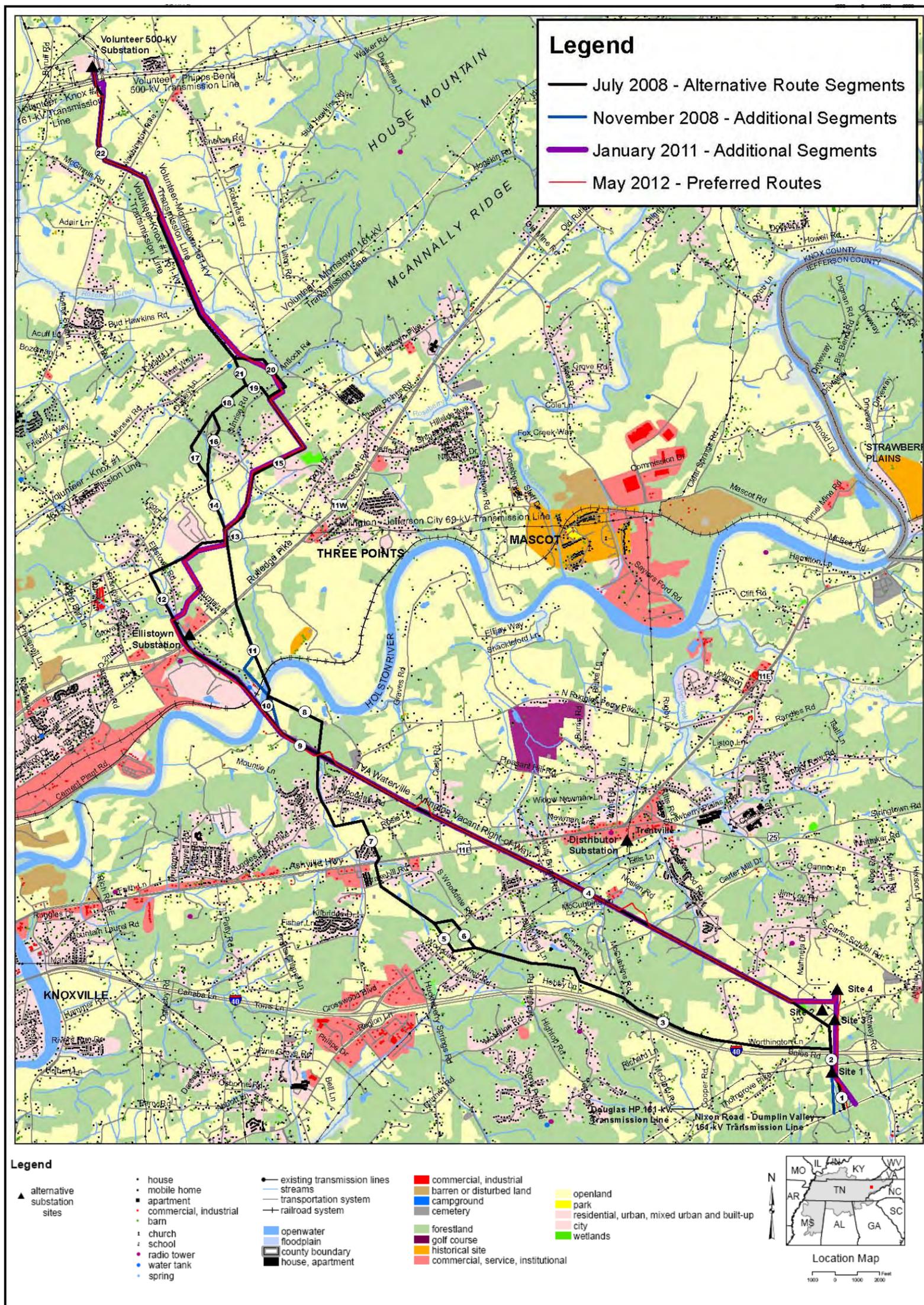


Figure 1-5. All Alternative Transmission Line Route Segments and Substation Sites Considered for the Volunteer-East Knox Bulk Transmission Project in Knox County, Tennessee (Land Use Land Cover Model)



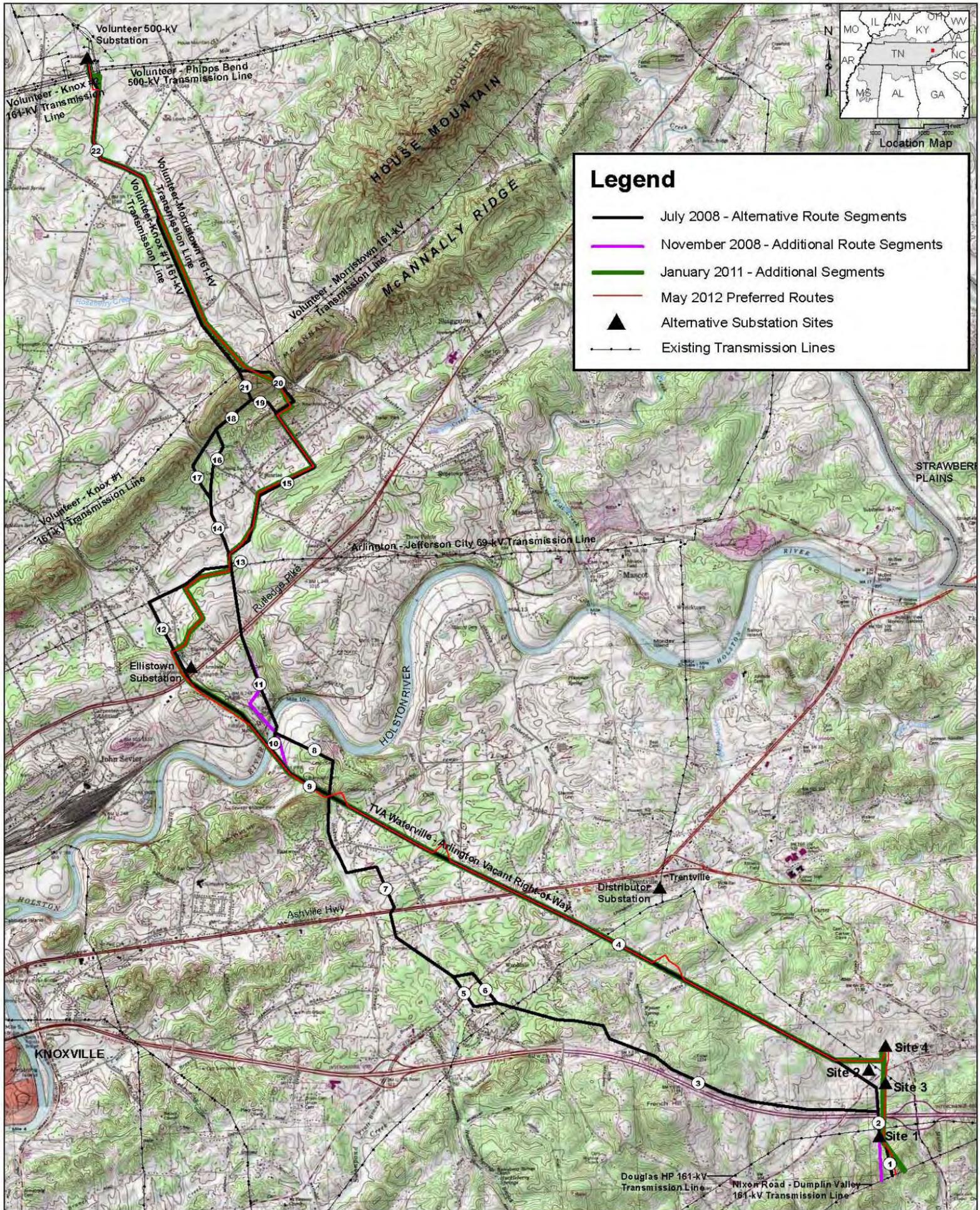
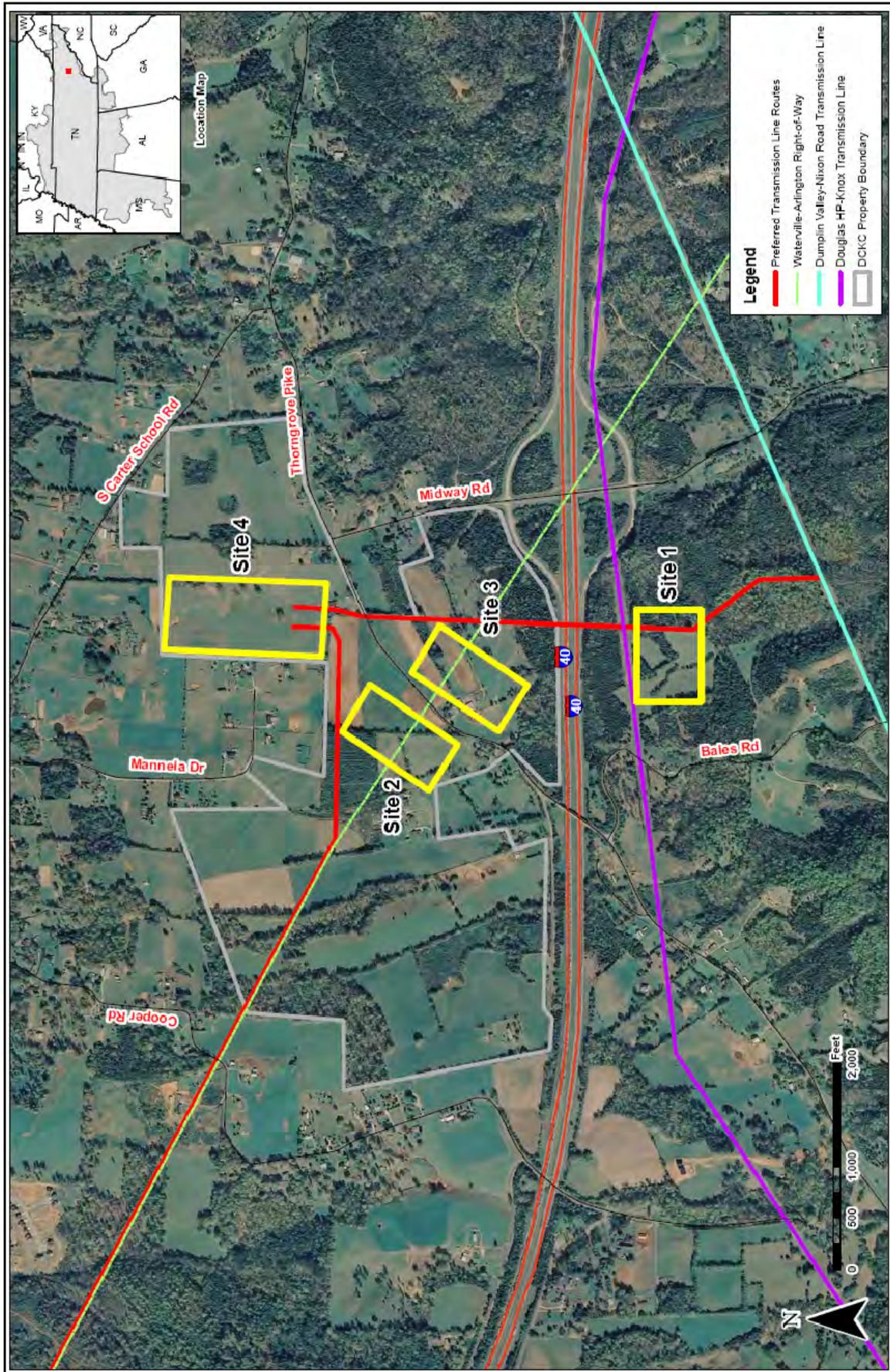


Figure 1-6. All Alternative Transmission Line Route Segments and Substation Sites Considered for the Volunteer-East Knox Bulk Transmission Project in Knox County, Tennessee (Topo Map Model)

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**Figure 1-7. Alternative Site Locations Considered for the Proposed East Knox 161-kV Substation in Knox County, Tennessee**

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## 1.6 Issues to be Addressed

TVA identified resources that could potentially be affected by the construction and operation of the proposed transmission lines and switching station through an early internal scoping process. This list of resource issues was refined based on comments received during the public review process. Potential impacts to the following environmental resources are addressed in this environmental assessment.

- Water quality for both surface water and groundwater
- Aquatic ecology
- Vegetation
- Wildlife
- Endangered and threatened species and their critical habitats
- Floodplains
- Wetlands
- Aesthetic resources
- Archaeological and historic resources
- Recreation, parks, and natural areas
- Land use and prime farmland
- Socioeconomics and environmental justice

Potential effects related to air quality, hazardous and nonhazardous wastes, and health and safety were considered. However, because of the nature of the action, any potential effects to these resources would be minor and insignificant. Thus, potential effects to these resources are not analyzed in detail.

## 1.7 Necessary Federal Permits or Licenses

A permit would be required from the state of Tennessee and Knox County for the discharge of construction site stormwater associated with the construction of the transmission lines and substation. TVA would prepare the required erosion and sedimentation control plans and coordinate them with the appropriate state and local authorities. A permit may also be required for burning trees and other combustible materials removed during transmission line construction. A permit would be obtained from the Tennessee Department of Transportation (TDOT) for crossing state highways during transmission line construction. A permit would be required from Knox County for the installation of a septic system at the switching station. A county or state permit would be obtained to connect the substation access road to Thorngrove Pike. An Underground Injection Control permit would be obtained from the Tennessee Division of Water Supply for the modification of karst features on the proposed East Knox 161-kV Substation site.

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## CHAPTER 2

### 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As described in Chapter 1, TVA and KUB jointly propose to construct the East Knox 161-kV Substation, consisting of a new TVA 161-kV switching station and a new KUB 161-kV substation. TVA would purchase 34.85 acres and prepare approximately 28 acres for the new facilities. TVA would construct a 161-kV switching station on about 17 acres of the site. KUB would then purchase approximately 11 acres of the site for construction of their planned substation. TVA would connect the TVA switching station to TVA's existing Volunteer 500-kV Substation by constructing and operating approximately 13.4 miles of new 161-kV transmission line. TVA would also construct a 1-mile loop line from TVA's existing Dumplin Valley-Nixon Road 161-kV Transmission Line to the new switching station. The new 161-kV switching station would have a connection to KUB's 161-kV substation.

This chapter contains the following six major sections:

1. Description of Alternatives
2. Description of Construction, Operation, and Maintenance of the Proposed Transmission Lines and TVA Switching Station
3. Explanation of the Siting Process
4. Comparison of the Alternative Substation Locations and Transmission Line Routes
5. Comparison of Environmental Impact Analysis for the Alternatives
6. Identification of the Preferred Alternative

This chapter also provides additional background information about the transmission line and switching station construction, operation, and maintenance.

#### 2.1 Alternatives

Two alternatives (No Action Alternative and Action Alternative) are addressed in this EA. Under the No Action Alternative, TVA would not undertake the proposed action. The Action Alternative involves the construction, operation, and maintenance of the proposed transmission lines and switching station, and the sale of property to KUB.

##### 2.1.1 Alternative 1 – Do Not Build Additional Transmission Facilities (No Action Alternative)

Under the No Action Alternative, TVA would not construct the new switching station, the new transmission lines, or other facilities to improve the project area power supply. As a result, the TVA power system in the project area would continue to operate under the current conditions increasing the risk for loss of service and occurrence of violations of the NERC reliability criteria.

Further, under the No Action Alternative, TVA would not purchase property or construct the proposed transmission lines to serve KUB's planned substation. However, KUB would still have to address overloading equipment and voltage problems at several of their substations. If TVA elected not to provide a delivery point to KUB, via their Dumplin Valley-Nixon Road 161-kV Transmission Line, KUB could independently decide to purchase property to build a substation and construct a new transmission line to serve its new

substation. The distributor could use the proposed substation location and Dumplin Valley-Nixon Road 161-kV Transmission Line route identified by TVA, or it could select a different substation location and/or another route.

If KUB were to independently provide transmission service and construct a new transmission line, the potential environmental effects of implementing the No Action Alternative would likely be comparable to those resulting from the adoption of the portion of the Action Alternative that proposes to provide a delivery point to KUB, depending on various factors, such as the route chosen and the construction methods used by KUB.

### **2.1.2 Alternative 2 – Construct, Operate, and Maintain a 161-kV Switching Station, a 161-kV Transmission Line, and a 161-kV Transmission Loop Line (Action Alternative)**

Under the Action Alternative, TVA would improve the existing TVA power supply system in the project area, by constructing and operating about 14.4 miles of new 161-kV transmission line and a new 161-kV switching station (Figure 1-1).

The proposed project would include the purchase of a 34.85-acre site for a joint TVA-KUB East Knox 161-kV Substation. TVA would prepare approximately 28 acres of this site for construction of the new facilities. TVA would then build the new 161-kV switching station on about 17 acres and sell approximately 11 acres of this site to KUB for their construction of a new substation (Figure 1-1). KUB would reimburse TVA for their portion of the property as well as TVA's site preparation for KUB's substation.

To connect TVA's new switching station to the Volunteer 500-kV Substation, TVA would construct approximately 13.4 miles of new 161-kV double-circuit transmission line (Figure 1-1). TVA would also construct a 1-mile loop line from the existing Dumplin Valley-Nixon Road 161-kV Transmission Line to the proposed switching station, which would connect to KUB's substation. Although the proposed transmission lines would utilize a 100-foot-wide ROW, some portions of the proposed Volunteer-East Knox 161-kV Transmission Line would be constructed on new ROW and some on existing ROW. Approximately 2.7 miles would be constructed parallel to an existing TVA ROW that would require an additional ROW width of 87.5 feet in most places. Approximately 4.5 miles would utilize TVA's vacant 100-foot-wide Waterville-Arlington Transmission Line ROW, and the remaining 7.2 miles (including the Dumplin Valley-Nixon Road 161-kV Loop Line), would be constructed on new ROW. Access roads would be required for construction and maintenance of the proposed transmission lines. Prior to construction, TVA would also remove several structures (such as houses or barns) that are currently located on the proposed ROW and substation site.

Additional information detailing the implementation of the Action Alternative, as well as how the most suitable transmission line routes and substation site were determined, is provided in Sections 2.2 through 2.4.

Additionally, under the Action Alternative, TVA would complete the following to facilitate the operation of the new transmission lines and switching station:

- Install OPGW along the new double-circuit transmission line;
- Install a new structure on the double-circuit Volunteer-Knox #2 and Volunteer-North Knoxville #2 161-kV Transmission Lines to raise the existing conductor and allow the proposed Volunteer-East Knox 161-kV Transmission Line to pass underneath with proper electrical clearance;
- Provide a 69-kV transmission line underbuild, if necessary, for KUB at the entrance to the East Knox 161-kV Substation;
- Install a new 161-kV breaker, replace relay equipment, and add new telecommunications connections at the Volunteer 500-kV Substation; and
- Modify the TVA system's map board at the SOC and ROC in Chattanooga to include the names and numbers of the new transmission lines and switching station.

Implementation of this alternative would improve the reliability of the TVA bulk power system by providing additional flexibility in delivering electric power to both distributor-owned substations and TVA substations. The redundancy added within the electric transmission system would allow TVA to overcome the voltage and capacity problems in the project area. Additionally, the proposed project would provide a delivery point as requested by KUB. By improving reliability in KUB's service area, TVA would continue to meet NERC reliability criteria. This would allow TVA to ensure that the area is provided with a strong, affordable source of power for continued economic health and residential and commercial growth in the area.

### **2.1.3 Alternatives Considered But Eliminated From Further Discussion**

During the development of this proposal, other alternatives were considered. However, upon further study it was determined that these other alternatives would not meet project needs. These alternatives, which were considered but not selected for further consideration, are described briefly below.

#### **2.1.3.1 Create a Knox-North Knox 161-kV Transmission Line**

Under this alternative, TVA would reconfigure their existing Volunteer-Knox #2 and Volunteer-North Knoxville #2 161-kV transmission lines to create a Knox-North Knox 161-kV Transmission Line. Parts of these two existing transmission lines are configured as double-circuit tied-together sections. In this case, the transmission lines are on double-circuit structures with the conductors electrically connected to have both circuits function as a single circuit to increase load capacity. These sections would be re-conducted and electrically untied to create a new transmission line from the Knox 161-kV Substation to the North Knox 161-kV Substation. KUB and TVA jointly own both of these substations. Five new capacitor banks would then be installed at TVA's Dumplin Valley 161-kV Substation to provide voltage support for certain contingencies. Finally, TVA would upgrade their existing Douglas-East Sevierville and Douglas-North View 161-kV transmission lines.

Although this alternative would address both the overloads that occur on the Volunteer-Knox #1 and Volunteer-North Knox #1 161-kV transmission lines and the low voltage at the Knox 161-kV Substation, it would limit future options in the area. It would also lower the load-carrying capacity on the Volunteer-Knox #2 and Volunteer-North Knox #2 transmission lines because it would split the double-circuit sections into individual circuits. Since no new transmission lines or switching station would be built, this alternative would not provide a

new power source to the area. Because this alternative would provide only limited long-term benefits and would not address KUB's request for a delivery point, it was consequently eliminated from further consideration.

### **2.1.3.2 Construct a Volunteer-Knox #3 161-kV Transmission Line**

Under this alternative, TVA would construct a new transmission line, approximately 8.4 miles long, between the Volunteer 500-kV Substation and the Knox 161-kV Substation. This transmission line would require approximately 3 miles of new ROW and about 5.4 miles of existing ROW. The 5.4 miles would utilize the double-circuit portion of the Volunteer-Knox #1 161-kV Transmission Line. TVA would rebuild this section of double-circuit with a larger conductor on both of the circuits. Capacitors would be installed at TVA's Dumplin Valley 161-kV Substation to provide voltage support for certain contingencies. Finally, as with the alternative described in Section 2.1.3.1, TVA would upgrade their existing Douglas-East Sevierville and Douglas-North View 161-kV transmission lines.

This alternative would address the overloaded Volunteer-Knoxville 161-kV Transmission Line and the low voltage at the Knox 161-kV Substation, but it would limit future options in the project area. This alternative would provide only limited long-term benefits since it would not allow for any future expansion. Finally, this alternative would not address KUB's request for a delivery point. For these reasons, this alternative was eliminated from further consideration.

### **2.1.3.3 Underground Utility Lines**

A frequent objection to the construction of new transmission lines is their adverse visual effects. Thus, a frequently suggested alternative is the installation of buried transmission lines.

Power lines can be buried. However, most buried lines tend to be low-voltage distribution lines (lines that are 13-kV or less) rather than high-voltage transmission lines, which tend to be 69-kV and above. Although low-voltage distribution lines can be laid into trenches and buried without the need for special conduits, some lines require armor casings for safety reasons. Burying higher voltage lines in the 69-kV, 161-kV, and 500-kV range requires extensive excavation, since these lines must be encased in special conduits or tunnels. Additionally, measures to ensure proper cooling and to provide adequate access are required. Usually, a road along or within the ROW for buried lines must be maintained for routine inspection and maintenance.

Although buried lines are much less susceptible to catastrophic storm damage, especially wind damage, they tend to be very expensive to install and maintain. Depending on the type of cable system used, special equipment or ventilation systems may be required to provide adequate cooling for the underground conductors. Similarly, they must be protected from flooding, which could cause an outage. Repairs of buried lines may require excavation, and the precise location of problem areas can be difficult to determine.

Burying the proposed 161-kV line is not a feasible option for these and other reasons. Expense would be prohibitive. The potential adverse environmental effects of constructing and operating a buried high-voltage line would likely be greater overall than those associated with a traditional aboveground line. For these reasons, this alternative was eliminated from further consideration.

## **2.2 Construction, Operation, and Maintenance of the Proposed Switching Station and Transmission Lines**

### **2.2.1 East Knox 161-kV Substation**

TVA would purchase a 34.85-acre site near the intersection of Midway Road and Thorngrove Pike in Knoxville and prepare approximately 28 acres for construction of a new joint TVA-KUB East Knox 161-kV Substation. TVA would construct a new 161-kV switching station, and KUB would build a new 161-kV substation on the site. TVA's proposed switching station would be occupying approximately 17 acres. After TVA has prepared the entire site for construction, KUB would purchase approximately 11 acres and would reimburse TVA for the preparation work on this portion of the site.

#### **2.2.1.1 Site Preparation**

Preparation of the substation site would require approximately 124,000 cubic yards of cut and fill to level the site for construction. The areas of the site that are too high (sloped) must be "cut" down to a level elevation, and other areas that are too low require "fill" to raise the elevation. All of the earthwork would be onsite (that is, no soil would be brought in from offsite), and would result in approximately 7,900 cubic yards of spoil (excess material - soil or rock - from the cut and fill operation) material. The spoil would be placed onsite in several designated spoil areas located on the north side of the property. Silt fences would be installed, and approximately 21.3 acres of the site would be graded. Total disturbance, including grading and spoil material, would be approximately 25 acres (approximately 3 acres would be left undisturbed). Site drainage structures and a detention pond would be installed. The substation yard would be covered with crushed stone and fenced with 7-foot tall chain link fencing. A new gravel access road, approximately 690 feet long, would be constructed from Thorngrove Pike to the southwest corner of the graded area. No fill would be needed to raise the elevation of the road; however, as necessary, stone would be added to support truck wheel loads. The amount of stone added would not raise the existing ground or road elevation. The unused portion of the 34.85-acre site would be restored, to the extent possible, to its condition prior to construction.

#### **2.2.1.2 TVA's Switching Station**

Three transmission lines would initially connect at the switching station, one for the proposed Volunteer-East Knox 161-kV Transmission Line and two for the proposed Dumplin Valley-Nixon Road Loop Line. Space would be provided for four future transmission line connections, as well as capacitor bank installation. The major TVA equipment in the switching station would consist of 161-kV gas breakers, switches, voltage transformers, surge arresters, station service voltage transformers, bus (rigid overhead aluminum conductor) with supports, a switch house, a potable water well, field lines (for the sewage disposal system), bays, and pull-off structures. The equipment would be interconnected with aluminum pipe and copper strand conductors. The conductors and some equipment would be supported on steel structures.

As described in TVA's Substation Lighting Guidelines (Appendix B), all lights at the switching station would be fully shielded or would have internal low-glare optics, such that no light is emitted from the fixture at angles above the horizontal plane. TVA's Environmental Quality Protection Specifications for Transmission Substation or Communications Construction (Appendix C) would be utilized during construction of the switching station.

TVA would provide a vegetative screening along a portion of the western boundary of the site to reduce the visual effects of their new facility.

## **2.2.2 Transmission Line Construction**

### **2.2.2.1 Right-of-Way Acquisition and Clearing**

A combination of entirely new ROW, expanded (parallel to existing) TVA ROW, and existing vacant TVA ROW would be utilized for the proposed transmission lines.

Both of the proposed transmission lines would be built utilizing a 100-foot-wide ROW. Some of the proposed 13.4-mile long Volunteer-East Knox 161-kV Transmission Line would be constructed on new ROW, while other portions would be built on existing ROW. Approximately 2.7 miles of this proposed route would be constructed parallel to an existing TVA ROW, requiring 87.5 feet of new ROW in most places. Approximately 4.5 miles of this route would utilize TVA's vacant 100-foot-wide Waterville-Arlington Transmission Line ROW. The remaining 6.2 miles of the Volunteer-East Knox 161-kV Transmission Line, as well as the 1-mile Dumplin Valley-Nixon Road Loop Line, would be constructed entirely within a new ROW.

The transmission lines in the vicinity of the East Knox 161-kV Substation would be constructed on new ROW on DCKC property. During planning, it was determined that because of the location of TVA's vacant ROW on DCKC property, TVA would not be able to construct transmission lines without impacting the future use of the DCKC property. Additionally, because of the existing easements, DCKC would not be able to fully develop portions of their property. To facilitate this project, as well as potential future industrial and/or commercial development by DCKC, in December 2010, TVA considered the abandonment of the ROW located on DCKC property and the replacement of new ROW by DCKC (Appendix D). In August 2011, TVA abandoned approximately 5.97 acres of the existing Waterville-Arlington 100-foot-wide ROW and approximately 13.69 acres of the existing Cherokee-Alcoa 150-foot-wide ROW located on DCKC property. In exchange, DCKC agreed to provide TVA with replacement ROW that is located on DCKC property.

TVA would purchase easements from landowners for the new ROW. These easements would give TVA the right to construct, operate, and maintain the transmission lines, as well as remove "danger trees" adjacent to the ROW. Danger trees include any trees that are located beyond the cleared ROW, but that are tall enough to potentially impact a transmission line structure or conductor should the trees fall toward the transmission line. The fee simple ownership of the land within the ROW would remain with the landowner, and many activities and land uses could continue to occur on the property. However, the terms of the easement agreement prohibit certain activities, such as construction of buildings and any other activities within the ROW that could interfere with the transmission line or create a hazardous situation. Additionally, TVA would revise the existing easement rights to current practices (such as prohibiting obstructions or improvements in the ROW and obtaining danger tree rights) on the section of the vacant TVA Waterville-Arlington ROW that would be used for this project. These actions would give TVA consistent easement rights for the entire proposed ROW.

Because of the need to maintain adequate clearance between tall vegetation and transmission line conductors, as well as to provide access for construction equipment, all trees and most shrubs would be removed from the entire width of the ROW. Equipment used during this ROW clearing would include chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller-bunchers. Marketable timber would be salvaged where feasible; otherwise, woody debris and other vegetation would be piled and burned, chipped, or taken off site. In some instances, vegetation may be windrowed along the edge of the

ROW to serve as sediment barriers. Vegetation removal in streamside management zones (SMZs) and wetlands would be restricted to trees tall enough, or with the potential to soon grow tall enough, to interfere with conductors. Clearing in SMZs would be accomplished using hand-held equipment or remote-handling equipment, such as a feller-buncher, in order to limit ground disturbance. TVA ROW Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, Transmission Construction Guidelines Near Streams (Appendices E, F, and G), and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities (Muncy 1999) would provide guidance for clearing and construction activities.

Following clearing and construction, vegetative cover on the ROW would be restored to its condition prior to construction, to the extent practicable, utilizing appropriate seed mixtures as described in Muncy (1999). Erosion controls would remain in place until the plant communities become fully established. Streamside areas would be revegetated as described in Appendices E, F, and G, and in Muncy (1999).

### **2.2.2.2 Access Roads**

Both permanent and temporary access roads would be needed to allow vehicular access to each structure and other points along the ROW. Typically, new permanent or temporary access roads used for transmission lines are located on the ROW wherever possible and are designed to avoid severe slope conditions and to minimize stream crossings. Access roads are typically about 20 feet wide and are surfaced with dirt, mulch, or gravel.

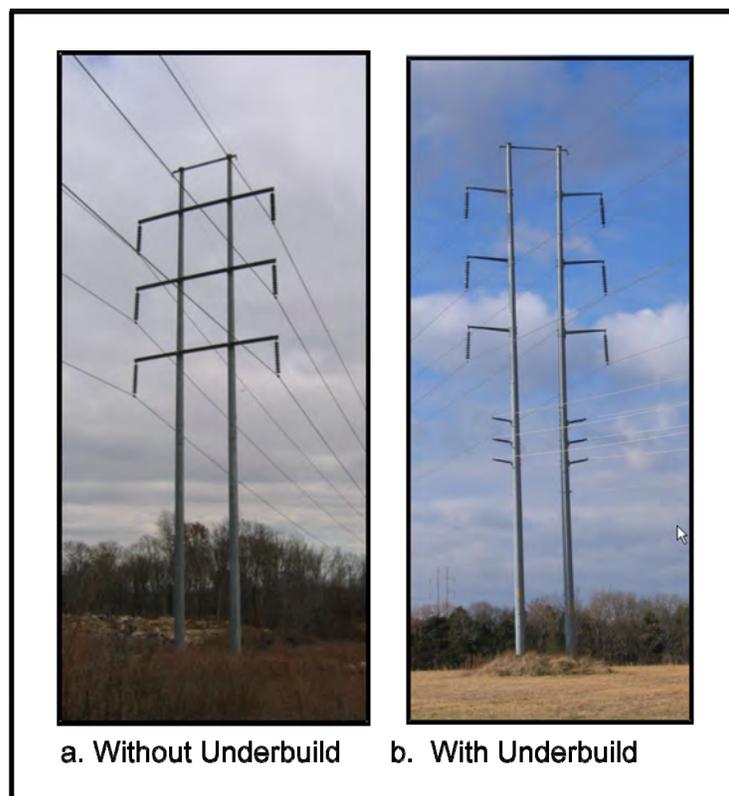
Culverts and other drainage devices, fences, and gates would be installed as necessary. Culverts installed in any permanent streams would be removed following construction. However, in wet-weather conveyances (streams that run only following a rainfall), they would be left or removed, depending on the wishes of the landowner or any permit conditions that might apply. If desired by the property owner, TVA would restore new temporary access roads to previous conditions. Additional applicable ROW clearing and environmental quality protection specifications are listed in Appendices E and F.

### **2.2.2.3 Construction Assembly Areas**

A construction assembly area (laydown area) would be required for worker assembly, vehicle parking, and material storage. This area may be on existing substation property or may be leased from a private landowner for the duration of the construction period. The property is typically leased by TVA about one month before construction begins. Properties such as existing parking lots or areas used previously as car lots are ideal laydown areas because site preparation is minimal. Selection criteria used for locating potential laydown areas include an area typically 5 acres in size; relatively flat; well drained; previously cleared; preferably graveled and fenced; preferably wide access points with appropriate culverts; sufficiently distant from streams, wetlands, or sensitive environmental features; and located adjacent to an existing paved road near the transmission line. TVA initially attempts to use or lease properties that require no site preparation. However, at times, the property may require some minor grading and installation of drainage structures, such as culverts. Likewise, the area may require graveled and fencing. Trailers used for material storage and office space would be parked on the site. Following completion of construction activities, all trailers, unused materials, and construction debris would be removed from the site. Removal of TVA-installed fencing and site restoration would be performed by TVA at the discretion of the landowner.

#### 2.2.2.4 Structures and Conductors

The proposed Volunteer-East Knox and Dumplin Valley-Nixon Road Loop 161-kV Transmission Lines would utilize mostly double steel-pole structures. Structures would either be double-circuit as shown in Figure 2-1 (a) or would also, if necessary, have a KUB underbuild as shown in Figure 2-1 (b). Structure heights would vary according to the terrain and would range between 70 and 140 feet.



**Figure 2-1. Examples of Double-Circuited Double Steel-Pole 161-kV Transmission Structures**

Three conductors (the cables that carry the electrical current) are required to make up a single-circuit in alternating-current transmission lines. For 161-kV transmission lines, each single-cable conductor is attached to polymer insulators suspended from the structure cross arms. A smaller overhead ground wire or wires are attached to the top of the structures. This ground wire may contain fiber optic communication cables. Both of the proposed transmission lines would be constructed with double-circuit structures. TVA would provide, as needed, space for two KUB 69-kV transmission line underbuilds at the entrance of the proposed East Knox 161-kV Substation.

Poles at angles (angle points) in the transmission line may require supporting screw, rock, or log-anchored guys. Some angle structures may be self-supporting poles or steel towers, which would require concrete foundations. Most poles would be directly imbedded in holes augured into the ground to a depth equal to 10 percent of the pole's length plus an additional 2 feet. Normally, the holes would be backfilled with the excavated material, but, in some cases, gravel or a concrete-and-gravel mixture would be used.

Equipment used during the construction phase would include trucks, truck-mounted augers, and drills, as well as tracked cranes and bulldozers. Low ground-pressure-type equipment would be used in specified locations (such as areas with soft ground) to reduce the potential for environmental impacts.

#### **2.2.2.5 Conductor and Ground Wire Installation**

Reels of conductor and ground wire would be delivered to various staging areas along the ROW, and temporary clearance poles would be installed at road crossings to reduce interference with traffic. A small rope would be pulled from structure to structure. It would be connected to the conductor and ground wire and used to pull them down the line through pulleys suspended from the insulators. A bulldozer and specialized tensioning equipment would be used to pull conductors and ground wires to the proper tension. Crews would then clamp the wires to the insulators and remove the pulleys.

### **2.2.3 Operation and Maintenance**

#### **2.2.3.1 Inspection**

Periodic inspections of 161-kV transmission lines are performed by helicopter aerial surveillance after operation begins. Foot patrols or climbing inspections are performed in order to locate damaged conductors, insulators, or structures, and to discover any abnormal conditions that might hamper the normal operation of the line or adversely affect the surrounding area. During these inspections, the condition of vegetation within the ROW, as well as immediately adjoining the ROW, is noted. These observations are then used to plan corrective maintenance and routine vegetation management.

#### **2.2.3.2 Vegetation Management**

Management of vegetation along the ROW is necessary to ensure access to structures and to maintain an adequate distance between transmission line conductors and vegetation. For a 161-kV transmission line, TVA standards, based on NESC requirements, require a minimum vegetation clearance of 24 feet. Vegetation management along the ROW would consist of two different activities: felling of danger trees adjacent to the cleared ROW (as described in Section 2.2.2.1), and vegetation control within the cleared ROW. These activities occur on approximately 3- to 5-year cycles.

Management of vegetation within the cleared ROW would include an integrated vegetation management approach designed to encourage the low-growing plant species and discourage tall-growing plant species. A vegetation-reclearing plan would be developed for each transmission line segment based on the results of the periodic inspections described above. The two principal management techniques are mechanical mowing (using tractor-mounted rotary mowers) and herbicide application. Herbicides are normally applied in areas where heavy growth of woody vegetation is occurring on the ROW and mechanical mowing is not practical. Herbicides would be applied selectively by helicopter or from the ground with backpack sprayers or vehicle-mounted sprayers.

Any herbicides used are applied in accordance with applicable state and federal laws and regulations. Only herbicides registered with the United States Environmental Protection Agency (USEPA) are used. A list of the herbicides currently used by TVA in ROW management is presented in Appendix H. This list may change over time as new herbicides are developed or new information on presently approved herbicides becomes available.

### **2.2.3.3 Structure Replacement**

Other than vegetation management, little maintenance work is generally required. The transmission line structures and other components typically last several decades. In the event that a structure needs to be replaced, the structure would normally be lifted out of the ground by crane-like equipment, and the replacement structure would be inserted into the same hole or an immediately adjacent hole. Access to the structures would be on existing roads where possible. Replacement of structures may require leveling the area surrounding the replaced structures, but additional area disturbance would be minor compared to the initial installation of the structure.

## **2.3 Siting Process**

The process of siting the proposed East Knox 161-kV Substation and TVA transmission lines followed the basic steps used by TVA to determine a transmission line route. These include the following:

- Determine potential existing power sources to supply the transmission line,
- Define the study area,
- Collect data to minimize potential impacts to cultural and natural features,
- Develop potential tap points,
- Develop general route options and potential routes,
- Develop potential switching station sites,
- Gather public input, and
- Incorporate public input into the final identification of the transmission line route and substation site.

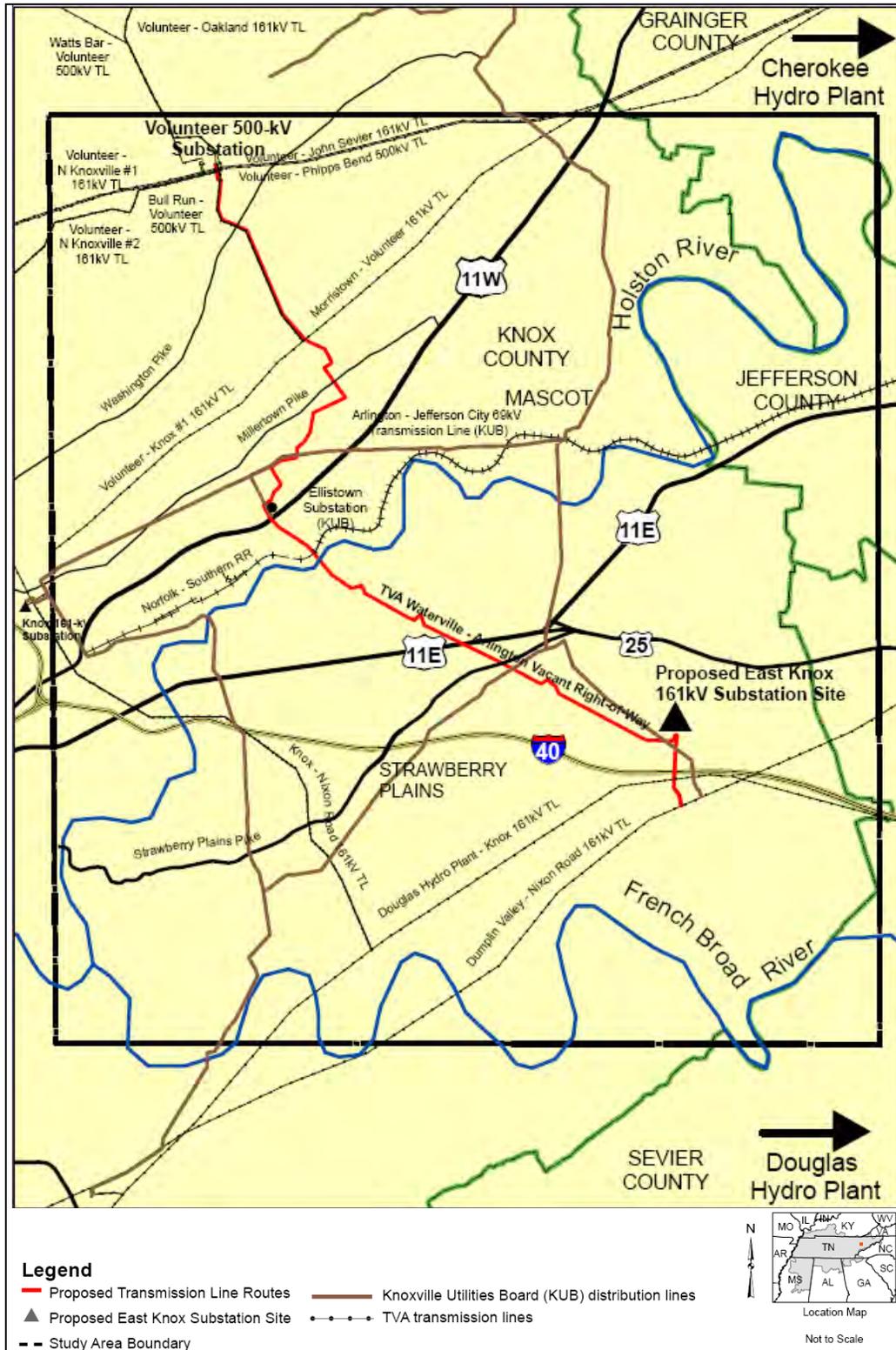
### **2.3.1 Definition of the Study Area**

The first task in defining the study area was to identify the power sources that could supply the proposed switching station.

The study area (Figure 2-2) was chosen to meet two basic objectives: (1) to provide transmission line access between the existing Volunteer 500-kV Substation switchyard and a future TVA switching station site in the east Knoxville area, and (2) to the extent possible, to utilize existing utility transmission line corridors for locating the new transmission lines.

The northern boundary of the study area lies approximately 0.75 mile north of TVA's Volunteer 500-kV Substation, roughly just south of the Knox County/Grainger County line. The eastern boundary is roughly nine miles east of the Volunteer 500-kV Substation and includes portions of Knox, Sevier, and Jefferson counties. All of the proposed transmission line routes were ultimately located within Knox County. The southern boundary of the study area is around twelve miles south of the Volunteer 500-kV Substation and includes part of the French Broad River basin. Finally, the western boundary is located nearly 2.25 miles to the west of the Volunteer 500-kV Substation, just west of the point where the Holston and French Broad Rivers converge to form the Tennessee River.

The 2010 population of Knox, Sevier, and Jefferson counties was 432,237; 89,887; and 51,409 respectively (United States Census Bureau 2011). Following is a brief description of the features of the transmission line routing study area.



**Figure 2-2. Proposed Study Area Considered for Volunteer-East Knox Bulk Transmission Project**

## **2.3.2 Characterization of the Transmission Lines and Switching Station Study Area**

### **2.3.2.1 Natural and Cultural Features**

The entire project area lies in the northeastern corner of Knox County, Tennessee. Grainger County lies to the north, with Jefferson and Sevier Counties to the east of the study area. The entire area is in the Great Appalachian Valley (locally known as the Tennessee Valley) and lies between the Cumberland Plateau to the west and the Great Smokey Mountains to the east. Long, narrow ridges flanked by broad valleys characterize this area.

The predominant geographical features in the area are House Mountain, just to the east of the Volunteer 500-kV Substation, and McAnnally Ridge, just south of the Volunteer 500-kV Substation (Figure 1-6). House Mountain has a peak of approximately 2,100 feet and is the highest peak in Knox County. McAnnally Ridge, an extension of the larger Sharp's Ridge, lies within the study area and would be crossed by the proposed route.

The northern portion of the study area is drained by the Holston River, which cuts across the study area in a meandering, east-to-west pattern. Some of the tributaries in the study area of the Holston River are Flat Creek, Legg Creek, and Lyon Creek. The southern third of the study area is drained by the French Broad River, which lies approximately one mile south of the proposed East Knox 161-kV Substation site. Like the Holston River, the French Broad River runs east to west. Some tributaries of the French Broad near the study area are Burnett Creek, Frazier Branch, Gap Creek, Soap Dam Creek, and Tuckahoe Creek. West of the study area, the Holston and French Broad Rivers converge to form the Tennessee River.

This combination of features results in a unique study area. In the far northern portion of the study area, the land is rolling, with pastures and some developed residential areas. The area is sharply divided by McAnnally Ridge, which rises and descends quickly, making for more pasture and residential areas. The land then gradually descends to the Holston River, located about halfway down into the study area. The land then rises gradually, reaching some rolling hills before entering the proposed East Knox 161-kV Substation site.

Various churches and cemeteries are located within the study area.

### **2.3.2.2 Land Use**

Land uses in the study area include commercial, industrial, residential, and farming. The most concentrated commercial and industrial developments are located along Rutledge Pike (United States Highway [US] 11W), Asheville Highway (US 25W, US 11E) and at the intersection of Interstate 40 (I-40) and Strawberry Plains Pike, the heavier transportation arteries. A truck repair facility, a KUB substation, a woodworking facility, and a large construction debris landfill are located at the intersection of Ellistown Road and Rutledge Pike. In addition, a large Norfolk-Southern railroad switchyard is located just west of this intersection. A metal recycling business is located south of Asheville Highway near the intersection of Cash Road. There are numerous hotels, restaurants, gas stations and other commercial developments at the intersection of I-40 and Strawberry Plains Pike.

The remainder of the study area is a mixture of pasture, woodlands and residential areas. There are also a number of subdivisions currently under development.

### **2.3.2.3 Transportation Features**

The primary transportation features in the study area include several major highways. I-40 is a major east-west interstate highway located near the southern edge of the study area. Other major four-lane highways in the area include Rutledge Pike and Asheville Highway. Major two-lane roads in the study area include Washington Pike, Millerstown Pike, Strawberry Plains Pike, and Emory Road. A Norfolk-Southern railroad track traverses the study area in an east-west direction, with a major railroad switchyard located in the western portion of the study.

### **2.3.3 Data Collection**

TVA first collected geographic data, such as topography, land use, transportation, environmental features, cultural resources, near-term future development, and land conservation information for the study area. Information sources used in the transmission line study included design drawings for area transmission lines, data collected into a geographic information system (GIS), including United States Geological Survey (USGS) digital line graphs, and Knox County tax maps. Various proprietary data maintained by TVA in a corporate geo-referenced database, including Heritage file data on sensitive plants and animals, as well as on archaeological and historical resources, were also used.

Additionally, during February 2008, TVA took new aerial color orthophotography of the study area. These images were geo-referenced to produce an accurate image of the Earth by removing the distortions caused by camera tilt and topographic relief displacements, and then digitized for use in the GIS. This aerial photography was then interpreted to obtain land use and land cover data, such as forests, agriculture, wetlands, houses, barns, commercial and industrial buildings, churches, and cemeteries.

Data were then analyzed both manually and with GIS. The use of GIS allows substantial flexibility in examining various types of spatially superimposed information. This system allowed the multitude of study area factors to be examined simultaneously for developing and evaluating numerous options and scenarios to select the route or routes that would best meet project needs, which included avoiding or reducing potential environmental impacts.

Manual calculations from aerial photographs, tax maps, and other sources included the number of road crossings, stream crossings, and property parcels. Finally, the aerial photography, GIS-based map, and other maps and drawings were supplemented by reconnaissance throughout the study area by TVA staff, including a siting engineer and an environmental engineer.

### **2.3.4 Establishment and Application of Siting Criteria**

TVA uses a set of evaluation criteria that represent opportunities and constraints for development of substation sites and transmission line routes. These criteria include factors such as existing land use, ownership patterns, environmental features, cultural resources, and visual quality. Cost is also an important factor, with engineering considerations and ROW acquisition costs being the most important elements. Application of these constraints is flexible, and TVA can, and does, deviate from them. Identifying feasible transmission line routes involves weighing and balancing these criteria and making adjustments to them as specific conditions dictate.

#### **2.3.4.1 Substation Site Criteria**

The substation siting criteria used in evaluating the potential locations included engineering and construction feasibility, environmental effects, land use compatibility, and feasibility of transmission line connections as discussed below.

- **Engineering and Construction Criteria** take into account the suitability of the size of the site for grading, fencing, and security needs, along with evidence that the site is not in a 100-year floodplain, which requires filling to a final grade above flood level. These criteria also require that locations be near public roads to minimize construction of a lengthy access road, have the ability to develop a safe driveway connection with good sight distance in each direction, and permit the ease of delivery of extremely large electrical equipment. Good site drainage, soils suitable for grading and foundation construction, minimal tree clearing needs, and availability of off-site electrical service and communications sources are also considered.
- **Environmental Criteria** include the presence of wetlands or rare species and/or their habitat, including locations outside the project boundary of the site that would be crossed by future transmission line corridors. Other factors include the presence of historic structures or sites on or adjacent to the site, presence or proximity of the site to prime farmland, and aquatic features crossing or adjacent to the site.
- **Land Use Compatibility Criteria** consist of the number of individual property tracts that comprise the site, the current land use practice of the tract(s), the number of houses on or near the site, and the level of visual impact to surrounding area homes and the traveling public.
- **Transmission Line Connections Criteria** involve transmission line siting criteria including engineering and construction feasibility, environmental effects, and land use compatibility. This involves avoidance of features and areas that are generally incompatible with transmission lines, while identifying other areas with more compatible land uses, thereby resulting in less impact.

#### **2.3.4.2 Transmission Line Routing Criteria**

Each of the transmission line route options was evaluated according to criteria related to engineering, environmental, land use, and cultural concerns. Specific criteria are described below. For each feature identified as occurring along a proposed route option, specific considerations related to these features were identified and scored. In the evaluation, a higher score means a bigger constraint or obstacle for locating a transmission line. For example, a greater number of streams crossed, a longer transmission line route length, or a greater number of historic resources affected would produce a higher (and thus worse) score.

- **Engineering and Constructability Criteria** include considerations such as terrain (steeper slopes can present major challenges for design and construction), total length of the transmission route, width of new ROW, number of primary and secondary road crossings, the presence of pipeline and transmission line crossings, and total line cost.

- **Environmental Criteria** include the presence of slopes greater than 30 percent (steeper slopes have more potential for erosion and potentially greater water quality impacts), consideration of visual aesthetics, the number of forested acres within the proposed ROW, the number of open water crossings, presence of sensitive (that is, those supporting endangered or threatened species) stream crossings, the number of perennial and intermittent stream crossings, presence of wetlands or rare species habitat, the number of natural area crossings, and proximity to wildlife management areas.
- **Land Use Criteria** include the number of fragmented property parcels and proximity to schools, houses, commercial or industrial buildings, and barns.
- **Cultural Criteria** include the presence of archaeological and historic sites, churches, and cemeteries.

A tally of the number of occurrences for each of the individual criteria were calculated for each potential alternative route. Next, a standard deviation analysis of alternative routes was performed for each individual feature based on each route's value as it related to the other alternative routes. Weights reflecting the severity of potential effects were then developed for each individual criterion. These criterion-specific weights were multiplied by the individual alternative rankings to create a table of weighted rankings. The weighted rankings for each alternative were then added to develop overall scores of each alternative route by engineering, environmental, land use, cultural, and overall total. For each of these categories, a ranking of each alternative route was calculated based on the relationship between the various route's scores.

These rankings made it possible to recognize which routes would have the lowest and the highest impacts on engineering, environmental, land use, and cultural resources based on the data available at this stage in the siting process. Finally, the scores from each category were combined into an overall score. The alternative route options were then rank-ordered by their overall scores.

### 2.3.5 Development of Potential Substation Sites

In consideration of the needs of both TVA and KUB, the locality of the Midway Road/I-40 interchange was identified for a potential jointly owned substation site, because it offered several advantages. These included the following.

- This area lies in close proximity to both TVA's Dumplin Valley–Nixon Road 161-kV Transmission Line and vacant Waterville-Arlington Transmission Line ROW. These existing features would, to the greatest extent possible, minimize the amount of new ROW that would be required for new transmission line connections.
- This area is within close proximity to one of KUB's 69-kV transmission lines, allowing KUB to minimize the length of new transmission line connections to the new substation.
- This area's relatively sparse residential development provides the potential for KUB to add distribution line routes, if necessary, in response to future development.

For these reasons, two potential sites were initially selected for further review. Site 1 is located on the south side of I-40, and Site 2 is located on the north side of I-40 (see Figures 1-2 and 1-7). Following the open house, two additional sites were also considered (Figure 1-7). Both of these additional sites are also located on the north side of I-40.

### **2.3.6 Development of General Route Options and Potential Transmission Line Routes**

As described in Section 2.3.3, the collected data were analyzed to develop possible transmission line route segments that would best meet the project needs while avoiding or reducing conflict with constraints (including sensitive environmental resources). Additional potential segments were identified by using known opportunities (such as existing utility corridors and existing ROW).

The straight-line distance from the TVA source (Volunteer 500-kV Substation) to the Midway Road/I-40 area identified for the proposed East Knox 161-kV Substation site is about 10 miles. Dense residential, industrial, and commercial development in the area limited the number of practicable alternative corridors that could be identified and studied for the project.

Twenty-two route segments, as shown in Figure 1-2, were developed using TVA's Volunteer 500-kV Substation and the potential East Knox 161-kV Substation sites as "end points" for potential transmission line routes. The GIS-based land use/land cover model and other data layers, such as property boundaries, digital elevation model results (which were used to identify steepness and terrain characteristics), and known transportation corridors were then evaluated and incorporated to identify opportunities for development of the various segments.

The route segments identified consisted of these four categories:

- Segments parallel to existing TVA transmission lines;
- Segments located on new ROW;
- Segments that utilize existing, vacant TVA ROW corridors; and
- Segments developed by "exchanging" existing, vacant ROW on DCKC property for new ROW on DCKC property.

#### **2.3.6.1 Potential Route Options From the Volunteer 500-kV Substation**

Since the proposed East Knox 161-kV Substation sites are located southeast of the Volunteer 500-kV Substation, and existing TVA transmission lines are present that head south from the Volunteer 500-kV Substation, an opportunity was provided for portions of the proposed transmission line to parallel the existing ROW, thus reducing the amount of new ROW that would be required. In comparison, potential routes heading to the north, east, or west of the existing Volunteer 500-kV Substation would increase the overall length of new transmission line ROW that would be required to connect to any of the proposed East Knox 161-kV Substation sites.

Additionally, new transmission line routes to the west of the Volunteer 500-kV Substation would traverse heavier residential areas near Washington Pike and, potential segments routed to the east would necessitate routing the transmission line around or over House Mountain, a Designated State Natural Area (SNA). The area around House Mountain is forested, presenting construction and design challenges and likely necessitating additional tree clearing for the new ROW. Steep terrain with slopes that are greater than 30 percent

would increase construction difficulty, safety concerns, and the potential for erosion on the ROW. For these reasons, route segments would not be developed to traverse the mountain, but would instead be routed around the mountain's outline.

Finally, because of the opportunity to utilize TVA's existing, vacant Waterville-Arlington ROW located in the project area, any routes that headed west, north, or east from the Volunteer 500-kV Substation would be counterproductive to TVA efforts to minimize the use of new ROW to the maximum extent possible.

### **2.3.6.2 Development of Potential Route Segments**

The challenges and opportunity presented in Section 2.3.6.1 resulted in the development of a route segment heading south from the Volunteer 500-kV Substation and parallel to the existing TVA Morristown-Volunteer and Volunteer-Knox #1 161-kV transmission lines (Segment 22 on Figure 1-2). Continuing towards the southeast for approximately 2.75 miles, Segment 22 ends as the existing transmission lines diverge with the Volunteer-Knox #1 161-kV Transmission Line continuing southwest and the Morristown-Volunteer 161-kV Transmission Line to the northeast. This divergence forced the route segments developed from this point to continue south along new ROW.

The route segments developed between the end of Segment 22 and the vacant TVA Waterville-Arlington ROW were derived from a careful study of the area using the existing maps, photographs, GIS, field reconnaissance, and other information. The first objective of this section of the proposed project was to develop an entry and exit over McAnnally Ridge, a significant obstacle in the study area (Figure 1-6). However, due to the steep, sharp-ridged terrain along the ridge, it was important for all route segments to traverse up and down the slopes, while also avoiding, to the extent possible, existing development. At the highest point of the ridge, it is possible to continue along the ridge for a distance and then drop back down on the south side of the ridge. These observations resulted in Segments 21, 20, 19, 18, 17, 16 and a portion of 15 (Figure 1-2).

Past McAnnally Ridge, the route segments utilized open pasture, property lines and other features. Avoiding existing structures was necessary, but due to existing and planned development, proximity to existing structures varies. The route segments in this section include a portion of Segment 15, as well as Segments 14, 13, 12 and 11 (Figure 1-2). These proposed segments are located north of the Holston River with the exception of Segments 11 and 12, both of which end just south of the river.

Segments 14 and 15 cross Millertown Pike before terminating into Segment 13. From the end of Segment 13, Segment 12 initially heads west parallel to KUB's existing Arlington-Jefferson City 69-kV Transmission Line. After crossing Ellistown Road, Segment 12 proceeds in a southeast direction toward the vacant, TVA Waterville-Arlington ROW. Segment 12 then proceeds along the Waterville-Arlington ROW, crossing the Holston River before terminating into Segment 9. Segment 11 heads south from the end of Segment 13, crossing Rutledge Pike and then turning slightly southeast before crossing the Holston River and terminating into Segments 8 and 10 east of the TVA Waterville-Arlington ROW.

Segment 10 is a short segment along the Holston River that connects Segment 11 to the Waterville-Arlington ROW. Segment 8 parallels the Waterville-Arlington ROW approximately 1300 feet to the north before turning south and terminating into the Waterville-Arlington ROW (Figure 1-2).

South of the Holston River, the proposed route segments either continue on vacant, TVA Waterville–Arlington ROW (Segments 9 and 4), or are on new ROW (Segments 7, 6, 5, 3) located north of I-40 (Figure 1-2). Route Segments 7, 6, 5, and 3 all roughly parallel the Waterville–Arlington ROW several thousand feet to the south (Figure 1-2). All of these segments run in a southeast direction, ultimately terminating at the proposed East Knox 161-kV Substation. Segment 7 crosses Asheville Highway near Brakebill Road and passes through heavy residential and commercial development. Segments 5 and 6 both cross Strawberry Plains Pike and are routed to avoid existing housing and development. Finally, Segment 3 roughly follows I-40 along McCubbins Road and Worthington Lane before terminating into proposed Segment 2 near the proposed substation sites.

Segments 1 and 2, both located near the Midway Road interchange of I-40, would provide the final connections to the proposed East Knox 161-kV Substation. Segment 1 would be a “loop” line that would connect the Dumplin Valley–Nixon Road 161-kV Transmission Line into TVA’s proposed switching station. Segment 2 would connect the loop line into the proposed switching station, and could also be utilized for the proposed Volunteer–East Knox 161-kV Transmission Line if Segment 3 were selected.

**2.3.6.3 Potential Transmission Line Corridors**

Thirty-six alternate transmission line routes, consisting of a combination of 22 constituent segments (see Figure 1-2 and Table 2-1), were then developed. The analysis of the transmission line routes was not affected by the later additions of alternative substation Sites 3 and 4. These sites are located in close proximity to the original Site 2 and the connecting segments for all three locations would utilize DCKC property.

**Table 2-1. Alternative Route Corridors with Constituent Segments**

Alternative Route	Constituent Segments
1	2,4,8,11,13,15,20,22
2	2,4,8,11,13,15,19,21,22
3	2,4,8,11,13,14,16,18,21,22
4	2,4,8,11,13,14,17,18,21,22
5	2,4,9,12,13,15,20,22
6	2,4,9,12,13,15,19,21,22
7	2,4,9,12,13,14,16,18,21,22
8	2,4,9,12,13,14,17,18,21,22
9	2,3,6,7,9,12,13,15,20,22
10	2,3,5,7,9,12,13,15,20,22
11	2,3,6,7,9,12,13,15,19,21,22
12	2,3,5,7,9,12,13,15,19,21,22
13	2,3,6,7,9,12,13,14,16,18,21,22
14	2,3,5,7,9,12,13,14,16,18,21,22
15	2,3,6,7,9,12,13,14,17,18,21,22
16	2,3,5,7,9,12,13,14,17,18,21,22
17	2,4,9,10,11,13,14,17,18,21,22
18	2,4,9,10,11,13,14,16,18,21,22
19	2,4,9,10,11,13,15,19,21,22
20	2,4,9,10,11,13,15,20,22
21	2,3,5,7,9,10,11,13,14,17,18,21,22
22	2,3,5,7,9,10,11,13,14,16,18,21,22

Alternative Route	Constituent Segments
23	2,3,5,7,9,10,11,13,15,19,21,22
24	2,3,5,7,9,10,11,13,15,20,22
25	2,3,6,7,9,10,11,13,14,17,18,21,22
26	2,3,6,7,9,10,11,13,14,16,18,21,22
27	2,3,6,7,9,10,11,13,15,19,21,22
28	2,3,6,7,9,10,11,13,15,20,22
29	2,3,6,7,8,11,13,14,17,18,21,22
30	2,3,6,7,8,11,13,14,16,18,21,22
31	2,3,6,7,8,11,13,15,19,21,22
32	2,3,6,7,8,11,13,15,20,22
33	2,3,6,7,8,11,13,14,17,18,21,22
34	2,3,5,7,8,11,13,14,16,18,21,22
35	2,3,5,7,8,11,13,15,19,21,22
36	2,3,5,7,8,11,13,15,20,22

### 2.3.7 Route Identification and Evaluation

Each of the 36 alternative routes offered different opportunities and constraints. Opportunities included utilization of transmission line routes either parallel to existing TVA ROW or along existing, vacant ROW; open undeveloped land; areas less suitable for development (commercial or residential); and property line geometry allowing the use of longer route segments with a shared easement between owners. Major constraints included land features (including House Mountain, McAnnally Ridge, Holston River, and various creeks); highly developed residential areas around Washington Pike and Strawberry Plains Pike and commercial areas around Rutledge Pike, Asheville Highway, and the Strawberry Plains Pike/I-40 interchange; existing development along the vacant, TVA Waterville–Arlington ROW; sensitive environmental areas; and land use conflicts.

The scores ranking the alternative routes ranged from 170 for Alternative Routes 1 and 20 (routes ranked best) to 226 for Alternative Route 14 (the route ranked worst) (Table 2-2).

**Table 2-2. Alternative Route Corridor Scores**

Route Rankings	Total Score Based on Criteria Analysis	Alternative Route
1	170	1
1	170	20
3	172	4
4	174	3
5	176	2
6	178	17
7	180	32
8	181	18
8	181	19
8	181	28
11	182	29
12	184	30
13	186	31
13	186	36
15	187	24
16	188	33

Route Rankings	Total Score Based on Criteria Analysis	Alternative Route
17	189	25
18	190	34
19	191	27
20	192	26
20	192	35
22	195	21
23	196	5
24	198	22
25	200	23
26	202	8
27	206	6
27	206	7
29	207	9
30	212	15
31	213	10
32	217	11
32	217	13
34	221	16
35	223	12
36	226	14

## 2.4 Comparison of Alternative Substation Sites and Transmission Line Routes

### 2.4.1 Alternative Substation Sites

As explained in Sections 2.2.1.2, the selected substation site would not only need to support the transmission line termination for the proposed Volunteer–East Knox 161-kV Transmission Line, but would also support a proposed transmission line loop connection to the Dumplin Valley–Nixon Road 161-kV Transmission Line. Additionally, the site would be co-located with a KUB substation and would need to provide for the capability of expansion for new transmission lines, if necessary, to respond to future development. For these reasons, it was imperative to select a site with specific characteristics that could support all of these requirements.

Initially, Sites 1 and 2 were evaluated using criteria that included the amount of available acreage, terrain and accessibility to the site, feasibility of transmission line connections, environmental effects, visibility, land use compatibility, and engineering and construction feasibility. The comparative analysis of the two sites using the criteria described in Section 2.3.4.1 is described below.

**Engineering and Construction:** The steep sloping areas found on Site 2 would require an abundance of fill material, while the bowl-shaped terrain found on Site 1 would require much less. Accessibility to both sites was analyzed utilizing aerial photography and site visits. Both Site 1 and 2 would require the construction of a new access road. Site 1 is not located adjacent to a road and would require a longer access road to connect to the nearby Bales Road. Therefore, an additional (off-parcel) easement purchase would be required for this access road. Site 2 is located directly adjacent to Thorngrove Pike, requiring a much shorter access road that could be located on the substation parcel. A preliminary constructability review (prior to site soil borings) included soil and rock makeup, grading and

drainage of the sites. This review indicated that each site would be suitable for construction.

**Environmental:** TVA conducted field surveys on each site. No environmental issues were identified concerning wetlands, rare species or their habitat, aquatic features, or cultural resources that would preclude the construction of a new substation at either Site 1 or Site 2.

**Land Use Compatibility:** Site 1 is located on privately owned property and met the land use criteria for locating a substation. After the 2008 public open house, the property owner for Site 1 indicated to TVA that there were no immediate plans for the property and that the site was available for sale for TVA's use. DCKC, the property owner of Site 2, indicated at the time that the site was already part of a planned industrial park. A substation located at Site 1 would be less visible than Site 2, because Site 1 is hidden behind a ridge and is not visible from I-40 or Midway Road. Site 2 is visible from Thorngrove Pike and Midway Road and potentially from I-40. Therefore, Site 1 received a better land use score.

**Transmission Line Connections:** These considerations included the need for connections to accommodate the proposed Volunteer–East Knox 161-kV Transmission Line and a transmission loop line from the existing Dumplin Valley–Nixon Road 161-kV Transmission Line. Additionally, the site would need to accommodate potential future connections to other transmission lines in the area, including, but not limited to, the Knox–Douglas HP 161-kV Transmission Line. Regardless of the selection of Site 1 or 2, both sites would require a transmission line crossing of I-40 to accommodate one of the two proposed connections, due to the geography of the area. More new ROW would be needed to connect to Site 2 than for Site 1. This resulted in Site 1 scoring slightly better overall in this category.

Based on terrain, visibility, land use, and transmission line routing considerations, Site 1 scored better than Site 2.

#### **2.4.2 Preferred Substation Site Location Change**

TVA announced the preferred routes for the proposed transmission lines utilizing Site 1 as the preferred substation in November 2008. In March 2009, TVA developed the project scope and schedule and conducted a soil boring study of the preferred substation site. Results of this study, received in June 2009, found that Site 1 contained less than desirable soil characteristics, a high potential for sinkholes, and much higher costs for site preparation and construction than were originally anticipated. The soil boring results from this site eliminated it from consideration and caused an unexpected delay in the project as other potential sites were then identified and evaluated.

TVA and KUB reapproached DCKC in July 2009 regarding the purchase of Site 2 for the substation. Although DCKC did not wish to sell Site 2, they provided several alternate sites within the then planned Midway Business Park. As a result, two new locations, Sites 3 and 4 (Figure 1-7), were identified as potentially meeting the substation criteria. Site 3 is located south of Thorngrove Pike and Site 4 is on the north side.

Exploratory soil borings to evaluate the suitability of each of these sites was performed in August 2009 and additionally on Site 3 in April 2010. It was determined that the cost to prepare Site 3 for the substation facilities would be substantially more than Site 4. Site 4 could be graded using soil material on site, balancing cut and fill, while Site 3 would require fill material to be imported from offsite, excavation of rock pinnacles, treatment of exposed rock surfaces to prevent development of sink holes, removal of alluvial soils, and additional

treatment of foundations to accommodate weaker soils. The higher costs associated with these actions do not include any additional earthwork that might be required in the area where soil, not suitable for supporting substation structures, would be exposed.

DCKC preferred to retain ownership of the northern portion of the parcel which fronts on Thorngrove Pike and locate the substation as far south on the parcel as possible. However, because of the area that would be required for multiple transmission lines on the north and south sides of the substation, and due to a stormwater detention pond that would need to be located on the south side of this site, it is likely the construction of a substation on Site 3 would leave no land for future development. As a result, it could be necessary to purchase the entire 60-acre tract to accommodate the substation and transmission line connections on Site 3. By comparison, a substation could be placed on Site 4 by purchasing about 28 acres, with the TVA lines around the substation site being on easements. Therefore, land costs for Site 3 could be substantially higher than those for Site 4.

Three existing buildings (houses and barns) are located on Site 4 and would need to be removed. Six existing buildings are located on Site 3, all of which would most likely be demolished to facilitate the substation construction. Thus, the cost of demolition is expected to be much higher for Site 3.

In conclusion, Site 4 was determined to be the more favorable site based on site characteristics and overall costs (see Figure 1-1 and Figure 1-7).

Initial discussions with DCKC for Site 4 involved the purchase of approximately 28 acres to accommodate both the proposed TVA 161-kV switching station and KUB 161-kV substation. However, because approximately 7 acres of the original DCKC parcel would become “landlocked” (no outlet to surrounding access roads) and thereby unusable to DCKC if the original parcel was sold separately, DCKC would require TVA and KUB to purchase the additional parcel as a condition of the sale, totaling 34.85 acres. The TVA and KUB substation facilities, however, would only utilize about 28 acres.

Additional adjustments to the route were made on DCKC property at their request. As described in Section 2.2.2.1, TVA abandoned existing ROW and obtained new ROW from DCKC to support planned development of DCKC property (Appendix D).

### **2.4.3 Alternative Volunteer-East Knox 161-kV Transmission Line Routes**

From TVA’s Volunteer 500-kV Substation, and utilizing 22 possible alternative transmission line segments as shown in Figure 1-2, TVA established and considered 36 alternative routes that ranged between 12.4 and 14.4 miles in length. This section provides analysis of the route segments and their relation to alternative routes.

All of the proposed routes connecting TVA’s Volunteer 500-kV Substation to the proposed East Knox 161-kV Substation are primarily oriented in a northwest to southeast configuration. Housing density and commercial development, coupled with the natural features in the area, restricted the potential corridors and route segments from the Volunteer 500-kV Substation to a southerly direction (see Section 2.3.6.1). Additionally, the most feasible corridor out of the Volunteer 500-kV Substation would parallel existing TVA transmission lines in the area. These conditions resulted in the establishment of Segment 22, a segment utilized by each of the potential transmission line routes.

Approximately 2.75 miles south of the Volunteer 500-kV Substation, the existing TVA transmission lines that Segment 22 follows diverge and begin running northwest to southeast. This forced the routes developed in this area to continue south, along new ROW. As mentioned in Section 2.3.6.2, TVA first had to establish a route across McAnnally Ridge. This resulted in the development of Segments 21, 20, 19, 18, 17, 16, 15 and 14. Routes traversing McAnnally Ridge that utilized Segments 15 and 20 scored more favorably because, when combined, these routes had less of an impact to developed housing in the area. Based on utilizing these segments, nine of the 36 potential routes (Table 2-1) were considered as more viable options (Alternative Routes 1, 5, 9, 10, 20, 24, 28, 32, and 36).

Each of these routes then converged and utilized Segment 13, a short segment that ends at the KUB Arlington-Jefferson City 69-kV Transmission Line ROW. At this point, the routes diverge, either continuing southeast crossing mostly unoccupied land (Segment 11) or following existing ROW before continuing southeast through a more developed area (Segment 12). Alternative Routes 1, 20, 24, 28, 32, and 36 utilized Segment 11 while Alternative Routes 5, 9, and 10 used Segment 12.

Initial scoring for routes that used Segment 11 ranked better than those for Segment 12, and TVA announced, in November 2008, a preferred route that utilized a slightly modified version of this segment presented at the open house (Figure 1-3). However, strong public opposition was voiced following both the July 2008 open house and the announcement of a preferred route regarding the crossing of the Strong Stock Farm by this segment. Additional information provided to TVA regarding this location, and results from field surveys, found that the preferred route would potentially cause visual impacts to the Strong Stock Farm. As a result, the route segments between Segment 13 and the Holston River were modified (Figures 1-1, 1-4, 1-5, and 1-6). A detailed explanation of these segment modifications can be found in Section 2.4.4.2.

These segment changes resulted in a crossing of the Holston River that eliminated the need for the use of Segments 8 or 10 to connect to the Waterville–Arlington ROW, leaving Segment 9 as the only possible option. Alternative Routes 5, 9, and 10 used Segment 9, while Alternative Routes 1, 20, 24, 28, 32, and 36 crossed the river slightly north and used Segments 8 or 10.

From the end of Segment 9, the route could either utilize TVA's existing, vacant Waterville–Arlington ROW, or use route segments that roughly parallel the Waterville–Arlington ROW to the south along the I-40 corridor. As mentioned in Section 2.3.6.2, options for using new ROW along Segments 3, 5, 6, and 7 were greatly limited by the dense commercial and residential development around Strawberry Plains Pike, Asheville Highway, and I-40 along McCubbins Road and Worthington Lane. Route alternatives utilizing these segments would affect nearly as many parcels as Segment 4, result in approximately 0.6 mile of additional transmission line, and present more design challenges due to the greater amount of angle structures required. The initial analysis scores shown in Table 2-2 supported the use of the existing Waterville–Arlington ROW (Segment 4), which was used in 80 percent of the top ten scores, including the top 6 routes. Consequently, the existing Waterville–Arlington ROW was used to take the route from just south of the Holston River to the proposed substation site.

Segment 4 continues southeasterly towards the proposed substation sites. The potential transmission line route segments in the vicinity of the Substation Site 2 are located on

DCKC property. Alternative Sites 3 and 4, as proposed by DCKC for the location of the East Knox 161-kV Substation, were considered following the project open house. As a result, additional route segments were developed in the vicinity of the substation sites. As described in Section 2.2.2.1, these segments would occupy new ROW located on the DCKC property. The location of the connecting segments was developed in cooperation with DCKC and would allow TVA to obtain both ROW for the proposed project and locations for possible future transmission line development in the area. Additionally, DCKC would be able to fully develop their property with minimal impacts from transmission line ROWs. These segments connecting to the new alternative sites are not provided as numbered segments, but are shown as part of the final proposed transmission lines (Figure 1-1).

#### **2.4.4 Explanation of Changes Along Proposed Volunteer-East Knox 161-kV Transmission Line Route**

The initial analysis indicated that either Route 1 or 20, received the lowest, or best, overall score. Although Alternative Route 20 scored slightly better from an engineering and land use perspective, the environmental issues that would be associated with this route made Alternative Route 1 a more preferable option. Additionally, Alternative Route 1 provided TVA with opportunities to minimize the purchase of new ROW, to the greatest extent practicable, by either paralleling existing ROW or by utilizing sections of existing ROW for the proposed new transmission line. Furthermore, the route segments along Alternative Route 1 that would require new ROW minimized impacts to existing housing and other developed uses. Therefore, Alternative Route 1 was selected as the preferred route announced to affected landowners by letter and to the public via TVA's project information website in November 2008.

Following this announcement, several route modifications were found necessary from the original alignment (see Figures 1-5 and 1-6) to further reduce overall project and community impacts. These modifications were made as a result of public and agency comments, feedback from technical and environmental experts, field surveys, and other available data sources.

##### **2.4.4.1 *Minor Route Adjustments Between Volunteer 500-kV Substation and Arlington-Jefferson City 69-kV Transmission Line***

The proposed transmission line segments within this area begin with Segment 13, running north from the crossing of the Arlington-Jefferson City 69-kV Transmission Line, and end with Segment 22, terminating into the Volunteer 500-kV Substation (Figure 1-2). Segment 22 would parallel existing transmission lines. Due to design constraints, TVA determined that it was not feasible along this segment for multiple crossings (west to east and vice versa) to occur under the existing Volunteer-Knox #1 and Morristown-Volunteer 161-kV transmission lines. Therefore, minor adjustments to the preferred Volunteer-East Knox 161-kV Transmission Line route were needed immediately outside the existing Volunteer 500-kV Substation, moving the proposed transmission line from the west side to the east side of the existing transmission lines (Figure 1-5). The proposed transmission line would then parallel the east side of the existing transmission lines.

TVA made other minor route adjustments along portions of the preferred route parallel to the existing Morristown-Volunteer and Volunteer-Knox #1 161-kV transmission lines, as well as some sections that utilized new ROW. These adjustments, made during siting and survey activities, were made primarily as the result of property owner requests or as the result of field conditions.

#### **2.4.4.2 Preferred Route Changes Between Segment 13 and TVA's Existing, Vacant Waterville–Arlington ROW**

In March 2009, TVA's preferred route, Alternative Route 1, was modified in the area surrounding Segment 11 (Figure 1-5). TVA announced, via their project information website, that a modified version of Segment 12 would be considered as TVA's preferred segment along this section of the proposed route. The route changes were made to alleviate concerns expressed by numerous property owners during and after the open house regarding potential environmental impacts Segment 11 would have on the Strong Stock Farm. In response to the public opposition to this segment, TVA conducted a cultural resource survey of this area and found that Segment 11, as originally proposed, would pose a potential effect to a property deemed eligible for the National Register of Historic Places (NRHP). As described in Chapters 3 and 4, TVA has performed surveys regarding the Strong Stock Farm. In a letter dated June 8, 2012, TVA is seeking concurrence from the Tennessee SHPO for its findings.

The initial analysis showed that the route as proposed at the open house that scored best using Segment 12 was Alternative Route 5. This route ranked as number 23 out of 36 possible routes. The remaining 11 Alternative Routes (6-16) that also use the original Segment 12 received the least favorable scores in the initial analysis. These low scores were due to this segment's close proximity to numerous homes in the vicinity of Ellistown Pike. However, Alternative Route 5 only differs from the original preferred Alternative Route 1 in that it uses segments 9 and 12 rather than segments 8 and 11. The route changes described below resulted in a substantially modified Segment 12, which greatly reduced these effects such that the revised Alternative Route 5 compares favorably with the originally proposed Alternative Route 1.

In cooperation with the property owner, route adjustments were implemented in the area around the Strong Stock Farm to minimize the potential effects of the proposed transmission line (Figures 1-1 and 1-5). First, to avoid crossing the Strong Stock Farm, a small portion of Segment 12, near the intersection of Segments 11, 12 and 13, was used along the northern border of the property line. The proposed route then turns southeast, following along property lines before turning west to cross over Ellistown Road, just north of the intersection of Ellistown Road and Rutledge Pike.

The route utilizes the proposed Segment 12 to cross Rutledge Pike and the Holston River. Additional information resulted in changes to this section of the segment. An existing KUB distribution line (along Ellistown Road) would have to be "underbuilt" on the proposed TVA transmission line. This would require an extended electrical service outage to homes and to a wastewater treatment facility in this area. Additionally, transmission line construction along this section would be difficult because of both the severe sloping terrain south of Rutledge Pike and the close proximity of the proposed ROW to Legg Creek that could result in environmental impacts. Further, many landowners in the vicinity of Ellistown Road were strongly opposed to the segment as originally proposed due to the close proximity to numerous homes. For these reasons, TVA adjusted the proposed route further west to an open field north of Rutledge Pike, and then onto an existing construction debris landfill south of Rutledge Pike. The landowner of both of these properties agreed to the changes contingent on no immediate interruptions or long-term impacts to the landfill operations. To finalize this route change, TVA submitted the proposed revision to the TDEC and received approval. TDEC approval was necessary since the proposed transmission line would affect an existing landfill and would slightly impact an existing buffer zone around the landfill. Following the approval, the route was modified to utilize unused property on the landfill, and

TVA confirmed that the proposed route would have no short-term or long-term effects on the landfill operations. The preferred route then continued onto the existing, vacant Waterville–Arlington ROW just north of the Holston River crossing.

The route adjustments in this area resulted in modifications to several other segments. The use of a modified Segment 12 eliminated both the possibility of crossing the Holston River northeast of the Waterville–Arlington ROW and the need to use Segments 8 or 10 to connect to the Waterville–Arlington ROW. Instead, a portion of the proposed Segment 12 would be used to reach the Waterville–Arlington ROW just after crossing Ellistown Road.

#### **2.4.4.3 Preferred Route Changes Between the Existing, Vacant Waterville–Arlington ROW and the Preferred East Knox 161-kV Substation Site**

Adjustments to preferred route Segments 9 and 4 were necessary to minimize impacts to existing homes and other structures along the vacant Waterville–Arlington ROW (Figures 1-1 and 1-5). Immediately south of the Holston River crossing, adjustments were made to Segment 9 in order to exclude existing modular homes and a KUB distribution line within the ROW. Further south, a large existing site-built home was located on the ROW. The route was modified using new ROW to exclude this home from the proposed route. One existing modular home would have to be relocated since no adjustments could be made in the area due to existing housing, other structures, and a small creek. Further south, route adjustments were made to avoid an existing barn. However, a number of existing sheds and other small structures would need to be removed from other areas along the proposed ROW.

Additional adjustments to the route were made on DCKC property at their request (Figure 1-7). As mentioned in Sections 2.2.2.1 and 2.4.3, TVA abandoned existing ROW and obtained new ROW from DCKC to support planned development of DCKC property (Appendix D).

#### **2.4.5 Dumplin Valley-Nixon Road Loop Line**

TVA would also loop the existing Dumplin Valley–Nixon Road 161-kV Transmission Line into TVA’s proposed 161-kV Switching Station. This approximately 1-mile loop line is necessary to provide more reliability to the Dumplin Valley–Nixon Road 161-kV Transmission Line. Beginning at Structure 216 on the Dumplin Valley-Nixon Road 161-kV Transmission Line, the route heads north crossing privately owned property, I-40 just west of the Midway Road interchange, and DCKC property before terminating into the proposed 161-kV switching station. This line would utilize entirely new 100-foot-wide ROW.

No comments were received following the open house regarding this transmission line. However, by request of one private landowner during the siting stage, TVA shifted the proposed transmission line slightly to the east on the individual’s parcel to reduce the visual impact to the property.

Because of the proximity to the Dumplin Valley-Nixon Road 161-kV Transmission Line to the proposed substation sites, the loop line was considered as part of the substation analysis. The geography of the area allowed for only two possible tap points to connect the proposed loop line to the Dumplin Valley-Nixon Road 161-kV Transmission Line. These are both located in the same general area. Furthermore, the close proximity of the Dumplin Valley-Nixon Road 161-kV Transmission Line to the original selected substation site (Site 1) would require a minimal amount of new ROW to facilitate a transmission line connection, while any transmission line connection to Sites 2, 3, or 4 would utilize a significant amount

of DCKC property, which was planned for commercial development. Consequently, the overall land use, environmental, and engineering impacts of this transmission line loop would be minimal regardless of the substation site location.

#### **2.4.6 Identification of Preferred Transmission Line Routes and East Knox 161-kV Substation Site**

TVA's preferred East Knox 161-kV Substation site is Alternative Site 4 (Figure 1-1 and 1-7). This 34.85-acre site is located north of Thorngrove Pike, of which approximately 28 acres would be used for the proposed East Knox 161-kV Substation. Further, based on additional analysis and route adjustments, TVA's preferred transmission line route for the Action Alternative is Alternative Route Option 5, consisting of Alternative Segments 1 (for the Dumplin Valley-Nixon Road 161-kV Loop Line), 2, 4, 9, 12 (modified), 13, 15, 20 and 22 (see Figure 1-1).

After the preferred transmission line route was identified, affected property owners were mailed information showing the location of the preferred route on their property. Additional comments received from property owners were reviewed and, where practical, changes were made to the preferred route selections prior to and during engineering and environmental field surveys. The route segments were adjusted based on public and property owner input, as well as environmental data, to lessen overall impacts. Examples of changes include following parcel boundaries to lessen the impact on future uses of the property and reducing the proximity to sensitive areas, rare species, and cultural/historical features.

#### **2.4.7 Modifications at Existing TVA Facilities**

One additional 161-kV breaker would be added at the Volunteer 500-kV Substation to facilitate the operation of the proposed Volunteer-East Knox 161-kV Transmission Line. Site grading would be required to install the foundation for this equipment. Adjustments to the substation entrance road and gate may also be required. Any remaining spoil would be handled according to TVA's Environmental Protection Procedures. Communication and control equipment (switches and relays) would also be installed at the Volunteer 500-kV Substation. This work would consist of changes or additions of cable connections and would occur inside the substation facility. TVA's Environmental Quality Protection Specifications for Transmission Substation or Communications Construction (Appendix C) would be utilized during construction activities.

TVA would also replace some electromechanical relays in the Volunteer 500-kV Substation. These relays would be removed and handled through approved TVA procedures - whether recycled, disposed of, or retained for re-use - according to TVA's Environmental Protection Procedures.

Information on the new transmission lines and substation would be added to the ROC and SOC in Chattanooga.

## 2.5 Comparison of Environmental Impact Analysis for the Alternatives

Table 2-3 compares the environmental impacts of the two proposed alternatives (No Action versus Action) derived from the information and analysis provided in Chapter 3, Affected Environment and Chapter 4, Environmental Consequences.

**Table 2-3. Environmental Impact Comparison of the Proposed Alternative Actions**

RESOURCE AREA	ALTERNATIVE 1: NO ACTION ALTERNATIVE	ALTERNATIVE 2: PREFERRED ACTION ALTERNATIVE
Number of ROW Miles	0	14.4
Groundwater	None	No significant effects to groundwater quality are anticipated.
Surface Water	None	Potential impacts to surface waters are expected to be minor. No cumulative impacts are anticipated.
Aquatic Ecology	None	A total of 54 watercourses (12 perennial and 5 intermittent streams, 34 wet-weather conveyances [WWC], and 3 ponds) could be affected. Impacts to aquatic ecology with implementation of best management practices (BMPs) and protective measures are expected to be insignificant.
Vegetation	None	About 90 acres of forest would be converted to early successional habitat. The cumulative project-related effects to forest resources would be negligible in the context of the total forested land occurring in the region. No significant changes would occur to the terrestrial ecology of the region.
Wildlife	None	Potential impacts to wildlife would result from the long-term conversion of forest to early successional habitats and from the creation of forest-edge habitat. However, most species that would be affected by these changes are common locally and regionally, and the effects on wildlife would be minor.
Endangered and Threatened Species	None	No impacts to state-listed aquatic animals, terrestrial animals, or plants are anticipated. No federally listed plants are known to occur in areas of the proposed ROW or substation site. No adverse effects to federally listed terrestrial or aquatic animal species are anticipated. USFWS has concurred regarding no adverse affect on Indiana bat. No impacts are anticipated to the Lower French Broad and Lower Holston Nonessential Experimental Population.
Floodplains	None	Portions of the proposed transmission lines and access roads would be in floodplains, but would not adversely affect flooding or floodplain values.
Wetlands	None	The proposed transmission lines would span four wetlands comprising a total 0.6 acre and convert 0.27 acre from forested to nonforested wetlands. Wetland areas along the ROW would be maintained by standard BMPs. Overall wetland impacts are considered insignificant.
Aesthetic Resources	None	The proposed transmission lines and substation would be seen by local residents and motorists along local roads. These actions would contribute to a cumulative reduction of visual integrity in the rural landscape. Visual impacts are anticipated to be minor and insignificant as a result of this alternative. Noises and odors associated with construction activities would be temporary, and impacts would be insignificant.
Archaeological and Historic Resources	None	The proposed transmission line would have a visual effect on one Century Farm and one NRHP-eligible property. However, the SHPO has concurred that there would be no adverse effects on any historic properties.
Recreation, Parks, and Natural Areas	None	The proposed transmission line would parallel an existing transmission line and cross the Holston River Nationwide Rivers Inventory (NRI) stream at river mile (RM) 8. No impacts are anticipated. No impacts to House Mountain Designated SNA or Tuckahoe Creek State Scenic River are anticipated.

RESOURCE AREA	ALTERNATIVE 1: NO ACTION ALTERNATIVE	ALTERNATIVE 2: PREFERRED ACTION ALTERNATIVE
Land Use	None	About 90 acres of forested land would be cleared. No noticeable changes in land use or restrictions on uses of adjacent properties would occur. About 18 acres of the proposed substation site are classified as Prime Farmland. However, no significant effects would occur to Prime Farmland based on the Natural Resource Conservation Service (NRCS) Farmland Conversion Impact Rating.
Socioeconomics and Environmental Justice	TVA cannot ensure service reliability or reduce risk of disruptions. Long term, this could have adverse economic effects to region through loss of electric service. Impacts would negatively affect all populations in the region.	Continued stability of service would provide positive impacts to the area by helping maintain economic stability and growth in the area. Any negative social, economic, or environmental justice impacts that might occur under the action alternative would be small, tending to diminish over time, and would be much smaller than negative impacts under the No Action Alternative.

## 2.6 The Preferred Alternative

The Action Alternative (Construct, Operate, and Maintain a 161-kV Switching Station, a 161-kV Transmission Line, and a 161-kV Transmission Loop Line) is TVA's Preferred Alternative for this proposed project. TVA would build a 161-kV transmission line from TVA's Volunteer 500-kV Substation to a new East Knox 161-kV Substation. TVA's preferred Volunteer-East Knox 161-kV Transmission Line route for the Action Alternative is Alternative Route Option 5. This route is composed of Alternative Route Segments 2, 4, 9, 12 (modified), 13, 15, 20 and 22, and would terminate into substation Site 4, TVA's preferred site (Figure 1-1). This transmission line route would be approximately 13.4 miles in length. TVA would also sell a portion of the substation site to KUB for their planned East Knox 161-kV Substation and construct a 1-mile 161-kV transmission loop line from TVA's existing Dumplin Valley-Nixon Road 161-kV Transmission Line to the new East Knox 161-kV Substation.

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## CHAPTER 3

### 3.0 AFFECTED ENVIRONMENT

The existing condition of environmental resources that could be affected by the proposed actions is described in this chapter. The descriptions below of the potentially affected environment are based on field surveys conducted between 2008 and 2012, on published and unpublished reports, and on personal communications with resource experts. This information establishes the baseline conditions against which TVA decision makers and the public can compare the potential effects of implementing the alternatives under consideration.

The scope of the environmental review includes portions of Knox County, Tennessee. The proposed 14.4 miles of transmission line would require a cleared 100-foot-wide ROW. The two transmission lines would occupy approximately 115 acres of new ROW and 55 acres of existing ROW. The proposed East Knox 161-kV Substation would require the purchase of a 34.85-acre site, of which approximately 28 acres would be prepared for construction. Thus, the “project area” as used below refers primarily to that area within the route of the proposed ROWs and substation site, unless otherwise stated. The analysis of potential effects to endangered and threatened species and their habitats included records of occurrence within a 3-mile radius for terrestrial animals, a 5-mile radius for plants, and a 10-mile radius for aquatic animals. The analysis area for aquatic resources included the watershed of the project area. The area of potential effect (APE) for architectural resources would cover all areas within a 0.5-mile distance from the proposed transmission line route, as well as any areas where the project would alter existing topography or vegetation in view of a historic resource.

Potential effects related to air quality, hazardous and nonhazardous wastes, and health and safety were considered. Potential effects on these resources were found to be minimal or absent because of the nature of the action. The current conditions of other resources that could be affected by the proposed project construction, operation, and maintenance of the proposed project are described in this chapter.

#### 3.1 Groundwater and Geology

The proposed project is located in the Valley and Ridge Physiographic Province and is underlain by Cambrian-aged rocks of the Conasauga Group. The Valley and Ridge aquifer consists of folded and faulted carbonate, sandstone, and shale (Lloyd and Lyke 1995).

Groundwater in the Valley and Ridge aquifers is primarily stored in and moves through fractures, bedding planes, and solution openings in the rocks. These aquifers are typically present in valleys and rarely present on the ridges. Most of the carbonate-rock aquifers are directly connected to sources of recharge, such as rivers or lakes, and solution activity has enlarged the original openings in the carbonate rocks (*ibid*).

Groundwater movement in the Valley and Ridge Province is localized, restricted by the repeating lithology created by thrust faulting. Older rocks, primarily the Conasauga Group and the Rome Formation, have been displaced upward over the top of younger rocks (the Chickamauga and the Knox Groups) along thrust fault planes, thus forming a repeating sequence of permeable and less permeable hydrogeologic units. The repeating sequence, coupled with the stream network, divides the area into a series of adjacent, isolated,

shallow groundwater flow systems. The water moves from the ridges where the water levels are high, toward lower water levels adjacent to major streams that flow parallel to the long axis of the valleys. Most of the groundwater is discharged directly to local springs or streams (ibid). In unconfined or poorly confined conditions, karst aquifers have very high flow and contaminant transport rates under rapid recharge conditions such as storm events.

The chemical quality of water in the freshwater parts of the Valley and Ridge aquifers is similar for shallow wells and springs. The water is a hard, calcium magnesium bicarbonate type, and typically has a dissolved-solids concentration of 170 milligrams per liter or less. In places where the residuum that overlies the carbonate rocks is thin, the Valley and Ridge aquifers are susceptible to contamination by human activities (USGS and TDEC 1995).

Public drinking water for Knox County is supplied by both surface water and groundwater sources (USEPA 2011). A majority of the population is supplied by the public water system; however, there are a few domestic groundwater wells within the project area and four domestic wells within one mile of the proposed substation (TDEC 2012).

### **3.2 Surface Water**

Precipitation in the project area averages about 51 inches per year. The wettest month is March, which averages 5.5 inches of precipitation, and the driest month is October, with 2.8 inches of precipitation on average. The average annual air temperature is 58 degrees Fahrenheit (°F) and ranges from a monthly average of 38°F in January to 77°F in July. Streamflow varies with rainfall and averages about 22 inches of runoff per year, or approximately 1.7 cubic feet per second per square mile of drainage area.

The project area drains to the French Broad River via Manifold Branch and Midway Creek of Tuckahoe Creek; and to the Holston River and its tributaries Lyon Creek, Sinking Creek, Legg Creek, Strong Creek, Roseberry Creek, and Flat Creek (via Little Flat Creek). The French Broad River and the Holston River are classified by TDEC for domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, and irrigation. Lyon Creek and Flat Creek are classified for industrial water supply, fish and aquatic life, recreation, livestock watering, and irrigation. The remaining streams are classified for fish and aquatic life, recreation, livestock watering, and irrigation. Roseberry Creek is on the state 303 (d) list as impaired (not fully supporting its designated uses) due to *Escherichia coli* from pasture grazing and septic tanks. Little Flat Creek is listed due to *Escherichia coli* from animal feeding operations. Flat Creek is listed due to *Escherichia coli* from pasture grazing and collection system failure.

### **3.3 Aquatic Ecology**

The proposed transmission lines and substation site are located within the Ridge and Valley ecoregion within drainages of the Holston and French Broad River watersheds. Overall, 55 watercourses including 13 perennial, 5 intermittent, 34 WWCs, and 3 ponds occur along the proposed transmission line routes, access roads, and substation site. The location of each of these was recorded using a global positioning system.

Because transmission line construction and maintenance activities may affect riparian conditions and in-stream habitat, TVA evaluated the condition of both of these at each stream crossing along the proposed routes, access roads, and substation site. Riparian condition was evaluated during September 2011 or January, February, and August 2012 field surveys using a TVA habitat assessment form, or a TDEC Hydrologic Determination

Field Data Sheet was completed for each watercourse. The Hydrologic Determination Field Data Sheet is based on the various interdisciplinary sciences that underlie stream development, channel maintenance, and the relationship between hydrologic regime and stream ecology. In the absence of a primary indicator, or other definitive evidence, secondary indicators are scored to determine the jurisdictional status of the water feature. Under normal conditions, the watercourse is a WWC if the secondary indicator score is less than 19. A listing of stream crossings in the project area, excluding WWCs, as well as observed stream substrate conditions, is provided in Appendix I. Additional information regarding watercourses in the vicinity of the project area can be found in Section 3.2.

Three classes were used to indicate the current condition of streamside vegetation across the length of the proposed transmission lines as defined below and accounted for in Table 3-1.

- Forested – Riparian area is fully vegetated with trees, shrubs, and herbaceous plants. Vegetative disruption from mowing or grazing is minimal or not evident. Riparian width extends more than 60 feet on either side of the stream.
- Partially forested – Although the riparian area is not forested, sparse trees and/or scrub-shrub vegetation are present within a wider band of riparian vegetation (20 to 60 feet). Disturbance of the riparian zone is apparent.
- Nonforested – No trees or only a few trees are present within the riparian zone. Significant clearing has occurred, usually associated with pasture or cropland.

**Table 3-1. Riparian Condition of Streams Located Within the Proposed Volunteer-East Knox 161-kV Transmission Line Right-of-Way**

Riparian Condition	Number of Perennial Streams	Number of Intermittent Streams	Total
Forested	8	4	12
Partially forested	3	0	3
Nonforested	2	1	3
<b>Total</b>	<b>13</b>	<b>5</b>	<b>18</b>

TVA then assigns appropriate SMZs and BMPs based on these evaluations and other considerations (such as State 303(d) listing and presence of endangered or threatened aquatic species). Appropriate application of these BMPs minimizes the potential for impacts to water quality and in-stream habitat for aquatic organisms.

### 3.4 Vegetation

ROWs and associated access roads along the proposed transmission lines are characterized by two main types of vegetation: forest (55 percent) and herbaceous (45 percent). Vegetation on the proposed East Knox 161-kV Substation site is composed of predominantly herbaceous vegetation. All plant communities observed in the project area are common and well-represented throughout the region.

All forest in the project area is deciduous in composition. Deciduous forest is characterized by trees with overlapping crowns, where deciduous species account for more than 75 percent of canopy cover. Most forest stands within the proposed ROWs and access roads are severely fragmented and heavily disturbed. Many of these stands are nearly linear and

follow fencerows and property boundaries, but the proposed ROW does bisect a few areas where forest patch size exceeds 50 acres. Average size of overstory trees in the proposed project area varies, but most of trees are less than 18 inches diameter at breast height. Early successional forest stands are comprised of species typical of that habitat, including black locust, eastern red cedar, sugarberry, tree-of-heaven, and Virginia pine. Many of these areas had been cleared in the recent past or were actively being grazed. The relatively small amount of mature forest in the project area occurs on upland ridges and is dominated by black oak, chestnut oak, southern red oak, shortleaf pine, white ash, and yellow poplar. Though these mature forests are relatively undisturbed, the herbaceous layer is generally species poor because of the dry conditions inherent to those sites. No forested areas in the proposed project area had structural characteristics indicative of old growth forest (Leverett 1996).

Herbaceous vegetation is characterized by greater than 75 percent cover of forbs and grasses and less than 25 percent cover of other types of vegetation. The proposed ROWs cross a few cultivated agricultural fields, but most herbaceous vegetation is comprised of pasture or developed areas. Common species observed in both the pastures and developed areas include beaked panic grass, blackberry, buttercup, greasy grass, ironweed, Japanese honeysuckle, sericea lespedeza, tall fescue, white clover, white wingstem, wild garlic, and yellow wingstem.

EO 13112 (Invasive Species) serves to prevent the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that those species potentially cause. In this context, invasive species are non-native species that invade natural areas, displace native species, and degrade ecological communities or ecosystem processes (Miller 2010). No federal-noxious weeds were observed, but several species identified by the Tennessee Exotic Plant Pest Council (TEPPC) as a severe threat were observed in the project area (refer to Table 3-2; TEPPC 2009).

During field surveys, invasive plants, shown in Table 3-2, were observed in both forest and herbaceous vegetation areas. However, herbaceous areas generally contained both greater numbers and cover of invasive plant species. Disturbances for mowing, agriculture, grazing, and ROW maintenance prevent tree species from becoming established, but can also encourage establishment of invasive species.

**Table 3-2. Invasive Plant Species Observed in the Proposed Right-of-Ways**

Common Name	Scientific Name
Tree-of-heaven	<i>Ailanthus altissima</i>
Tall Fescue	<i>Festuca arundinacea</i>
Sericea Lespedeza	<i>Lespedeza sericea</i>
Chinese Privet	<i>Ligustrum sinense</i>
Japanese Honeysuckle	<i>Lonicera japonica</i>
Johnson Grass	<i>Sorghum halepense</i>

### 3.5 Wildlife

Wildlife habitat assessments along the proposed transmission line corridors and substation locations were conducted during August through September 2011, and January and February 2012. As described in Section 3.4, terrestrial habitat observed along the proposed transmission line routes and substation site is characterized by two main types—herbaceous vegetation and forest. Some aquatic features (emergent wetlands, herbaceous and forested riparian areas along perennial and intermittent streams, ponds, and WWCs) also occur within the project area. These habitats are described in Sections 3.3, 3.4, and 3.8.

Herbaceous wildlife habitat included livestock pasture, residential lawns, fields, and roadside edges. Pastures and other areas composed primarily of herbaceous vegetation provide habitat for early successional bird species such as indigo bunting, dickcissel, eastern kingbird, mourning dove, and American robin. American crow, eastern bluebird, savannah sparrow, and American goldfinch were observed during field surveys. Common mammals in herbaceous habitats include striped skunk, eastern cottontail rabbit, white-tailed deer, Virginia opossum, and rodents such as the white-footed mouse. Additionally, hispid cotton rat and coyote were observed during field surveys. Reptiles often found in early successional habitats include black racer, rat snake, eastern garter snake, and milksnake. Wetlands and streams occurring within areas dominated by herbaceous vegetation provide habitats for amphibians such as American toad, green frog, northern cricket frog, eastern narrowmouth toad, southeastern chorus frog, and central newt. Upland chorus frogs were heard during field surveys.

Forested wildlife habitat included deciduous forest areas that provide habitat for wild turkey, downy woodpecker, pileated woodpecker, white-breasted nuthatch, and American crow, as well as numerous Neotropical migrant birds (summer residents) such as wood thrush, blue-gray gnatcatcher, red-eyed vireo, and ovenbird. Eastern wood-pewee, red-shouldered hawk, common yellow-throat, great-horned owl, and tufted titmouse were observed during field surveys. White-tailed deer, eastern gray squirrel, and common raccoon are mammals frequently found in deciduous forests and were observed during field visits. Eastern box turtle and five-lined skink were reptiles observed in this habitat. American toad, green frog, and bull frog were amphibians observed along streams and wetlands present in this habitat.

The proposed substation site is located in a field. The area surrounding the proposed site is comprised of herbaceous vegetation (fields, agriculture, maintained lawns). This site provides habitat for common species such as American goldfinch, swamp sparrow, field sparrow, eastern meadowlark, common grackle, and cedar waxwing. Other terrestrial animals that utilize this habitat include garter snake, southeastern five-linked skink, northern fence lizard, eastern cottontail, eastern mole, and red fox.

Three caves have been reported within one mile of the proposed East Knox 161-kV Substation. Use of these caves by bats has not been reported. One additional cave has been documented approximately 2.75 miles northwest of the existing Volunteer 500-kV Substation. No bats have been documented in this cave. No previously undocumented caves were found within the proposed transmission line corridors or at the site of the proposed switching station during field observations. Additionally, no heron colonies, other aggregations of migratory birds, or Designated Critical Habitat for terrestrial animals occur along the proposed transmission line routes or substation site.

### **3.6 Endangered and Threatened Species**

Species listed at the federal level as endangered or threatened are protected under the ESA, which is administered by the USFWS. Section 7 of this Act requires federal agencies to conserve these species and to consult with USFWS in situations where a federal action may affect these species or their habitats. The state of Tennessee also lists species as endangered, threatened, or of other conservation concern.

#### **3.6.1 Aquatic Animals**

Twenty-one federally listed and eight state-listed aquatic species are known to occur in Knox County and/or within a 10-mile radius of the proposed transmission line routes, access roads, and substation site (refer to list of aquatic species in Table 3-3). Eight of these are considered as no longer occurring in the area.

Habitat requirements for these species are described for fish in Etnier and Starnes (1993), mussels in Parmalee and Bogan (1998) and snails in NatureServe (2010). The following provides a brief description of species potentially occurring within the project area.

The blue sucker inhabits deep pools of large, free-flowing rivers with swift currents. Once common throughout its range, populations of blue suckers have drastically declined due to impoundments and increasing siltation of big rivers.

The flame chub is an inhabitant of springs/spring runs. Spawning occurs from late January through May. Populations have declined with the continued alteration of spring habitats.

The highfin carpsucker is the smallest of the carpsuckers and has been adversely affected by environmental changes such as habitat siltation and impoundment. It prefers habitat consisting of areas of gravel substrate in clear medium to large rivers.

The lake sturgeon prefers large lakes and rivers and spawns over rocky substrates.

The snail darter is known from larger creeks/rivers where it frequents sand and gravel shoal areas. It is also found in deeper portions of rivers and reservoirs where current is present.

The tangerine darter inhabits clearer portions of large to moderate-sized headwater tributaries of the Tennessee River. It frequents deeper riffles and runs with boulders, large rubble, and bedrock most of the year, but moves into deeper pools in winter. It is confined to the upper Tennessee River drainage, and reaches maximum abundance in smaller tributaries, such as the Emory, Little, Little Pigeon, Tellico, and Hiwassee Rivers.

The Tennessee dace can be found inhabiting shallow pools in association with undercut banks and debris in small low-gradient woodland tributaries in the upper Tennessee River drainage. Spawning occurs from April through July.

The Birdwing Pearlymussel is known to occur in riffles in small to medium rivers with sand and gravel substrate over moderate to fast current.

The dromedary pearlymussel is known to occur in shoals and riffles.

The fanshell occurs in the Ohio, Cumberland, and Tennessee River systems. All viable populations are restricted to unimpounded stretches of the Clinch River on substrate of coarse sand and gravel in strong flowing waters.

**Table 3-3. Federally and State-Listed Aquatic Species Known From Knox County and/or Within a 10-Mile Radius of the Proposed Project Area**

Common Name	Scientific Name	Status <sup>1</sup>	
		Federal	State (Rank <sup>2</sup> )
<b>Fish</b>			
Blue Sucker	<i>Cycleptus elongatus</i>	-	T (S2)
Flame Chub <sup>3</sup>	<i>Hemitemria flammea</i>	-	NMGT (S3)
Highfin Carpsucker	<i>Carpiodes velifer</i>	-	NMGT (S2S3)
Lake Sturgeon	<i>Acipenser fulvescens</i>	-	E (S1)
Snail Darter	<i>Percina tanasi</i>	THR	T (S2S3)
Tangerine Darter	<i>Percina aurantiaca</i>	-	NMGT (S3)
Tennessee Dace	<i>Phoxinus tennesseensis</i>	-	NMGT (S3)
Yellowfin Madtom <sup>3,4</sup>	<i>Noturus flavipinnis</i>	THR	E (S1)
<b>Mussels</b>			
Birdwing Pearlymussel <sup>5</sup>	<i>Lemiox rimosus</i>	LE	E (S1)
Cumberland Monkeyface <sup>4</sup>	<i>Quadrula intermedia</i>	LE	E (S1)
Dromedary Pearlymussel <sup>5</sup>	<i>Dromus dromas</i>	LE	E (S1)
Fanshell <sup>5</sup>	<i>Cyprogenia stegaria</i>	LE	E (S1)
Fine-rayed Pigtoe <sup>3,4</sup>	<i>Fusconaia cuneolus</i>	LE	E (S1)
Green Blossom Pearlymussel <sup>4</sup>	<i>Epioblasma torulosa gubernaculum</i>	LE	X (SX)
Orange-foot Pimpleback <sup>5</sup>	<i>Plethobases cooperianus</i>	LE	E (S1)
Oyster Mussel <sup>5</sup>	<i>Epioblasma capsioformis</i>	LE	E (S1)
Pink Mucket	<i>Lampsilis abrupta</i>	LE	E (S2)
Rabbitsfoot <sup>5</sup>	<i>Quadrula cylindrica cylindrica</i>	C	TRKD (S3)
Ring Pink <sup>5</sup>	<i>Obovaria retusa</i>	LE	E (S1)
Rough Pigtoe <sup>5</sup>	<i>Pleurobema plenum</i>	LE	E (S1)
Sheepnose	<i>Plethobasus cyphus</i>	PE	TRKD (S2S3)
Shiny Pigtoe Pearlymussel <sup>4</sup>	<i>Fusconaia cor</i>	LE	E (S1)
Tan Riffleshell <sup>5</sup>	<i>Epioblasma florentina walkeri</i>	LE	E (S1)
Tubercled Blossom Pearlymussel	<i>Epioblasma torulosa torulosa</i>	LE	X (SX)
Turgid Blossom Pearlymussel <sup>4</sup>	<i>Epioblasma turgidula</i>	LE	X (SX)
Spectaclecase <sup>3</sup>	<i>Cumberlandia monodanta</i>	PE	E (S1)
<b>Snails</b>			
Anthony's River Snail <sup>4</sup>	<i>Athearnia anthonyi</i>	LE	E (S1)
Ornate Rocksnail <sup>5</sup>	<i>Lithasia geniculata</i>	-	TRKD (S2)
Spiny Riversnail <sup>3,5</sup>	<i>Io fluvialis</i>	-	TRKD (S2)

Source: TVA data, February 2012.

<sup>1</sup> Status Codes: C = Candidate; E = Endangered; X = Extirpated; LE = Listed Endangered; NMGT = Listed in need of Management; PE = Proposed endangered; T = Threatened; TRKD = Tracked by state natural heritage program (no legal status).

<sup>2</sup> State Ranks: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; X = Presumed extirpated.

<sup>3</sup> Species known to occur within Knox County, but greater than 10 miles from the proposed project area.

<sup>4</sup> Extirpated = Historically known from the area, but believed to be extirpated.

<sup>5</sup> Historical = Element occurrence is greater than 25 years old.

The orange-foot pimpleback can be found primarily in big rivers. Individuals have been found at depths of 12 to 18 feet in sand and coarse gravel substrate.

The oyster mussel is found throughout the Tennessee and Cumberland River systems. It prefers shallow riffles in fast current.

The pink mucket is typically a big river species, but occasionally individuals become established in small- to medium-sized tributaries of large rivers. It inhabits rocky bottoms with swift current, usually in less than three feet of water.

The rabbitsfoot typically occurs in shoals and riffle areas near the banks, and most frequently occur at depths of 9 to 12 feet.

The ring pink is typically found in large rivers with gravel bars.

The rough pigtoe can be found in medium to large rivers over substrate composed of firmly packed gravel and sand.

The sheepsnose can be found in the Ohio, Cumberland, and Tennessee River systems and from the upper Mississippi River north to Minnesota. The species prefers substrate of mixed coarse sand and gravel.

The spectaclecase has been documented in various types of substrate, including gravel, sand, and mud, in medium-sized to large rivers.

The tan riffleshell prefers substrate of coarse sand, gravel, and some silt, in current and in less than three feet of water.

The ornate rocksnail has been eliminated from much of its original range by pollution and construction of dams and reservoirs. It prefers a sandy gravel substrate.

The spiny riversnail inhabits shallow waters of shoals that have a rapid to moderate current.

The proposed Volunteer-East Knox 161-kV Transmission Line would also be crossing an area classified as Lower French Broad and Lower Holston Nonessential Experimental Population Status. This area extends from the base of Douglas Dam at French Broad RM 32.3 and ends on the Holston River at the base of Cherokee Dam. The USFWS plans to reintroduce 18 species, federally listed as endangered (15 mussels, one snail, and two fish), and three fish that are federally listed as threatened. These species will be released back into their historic range.

### **3.6.2 Plants**

No federally listed plant species are known to occur in Knox County, Tennessee, or within a five-mile vicinity of the project area. Further, no state-listed plant species are known from within a five-mile vicinity of the project area. No habitat capable of supporting federally or state-listed plant species was observed during field surveys of the proposed project area. No designated critical habitat for plant species occurs in the project area.

### **3.6.3 Terrestrial Animals**

One federally listed and one federally protected terrestrial animal species (bald eagle) are known from Knox County (see Table 3-4). The bald eagle has been documented within three miles of the project area. No state-listed terrestrial animal species have been documented within three miles of the proposed project area and none were observed during the field surveys that were conducted August and September 2011, and January and February 2012. Although not previously known to occur in Knox County, surveys for the federally listed endangered Indiana bat were conducted due to recent guidance from the USFWS.

**Table 3-4. Federally and State-Listed Species of Terrestrial Animals Known From Within Knox County, Tennessee**

Common Name	Scientific Name	Status <sup>1</sup>	
		Federal	State (Rank <sup>2</sup> )
<b>Birds</b>			
Bald eagle	<i>Haliaeetus leucocephalus</i>	DM	NMGT (S3)
<b>Mammals</b>			
Indiana bat <sup>3</sup>	<i>Myotis sodalis</i>	LE	E (S1S2)
Gray bat	<i>Myotis grisescens</i>	LE	T (S2)

Source: TVA Regional Natural Heritage Database, December 2011.

<sup>1</sup>Status Codes: DM = Downlisted, Recovered, and Being Monitored; E = Endangered; LE = Listed endangered; NMGT = Listed in need of Management; T = Threatened.

<sup>2</sup>State Ranks: S1 = Extremely rare and critically imperiled in Tennessee; S2 = Very rare and imperiled in Tennessee; S3 = Rare and uncommon in Tennessee.

<sup>3</sup>Not previously known to occur in Knox County, but were included per recent USFWS guidance.

Bald eagles are federally protected by the Bald and Golden Eagle Protection Act of 1940. Bald eagles nest in forested areas near large bodies of water, such as rivers and reservoirs, where they forage. Two active pairs have been reported from within Knox County. Nests from these pairs have been reported along the French Broad and Holston Rivers. The closest active nest is located approximately one mile northeast of the proposed Volunteer-East Knox 161-kV Transmission Line along the Holston River. No suitable habitat for bald eagles exists along the proposed routes or near the proposed switching station site.

The gray bat was listed as endangered by the USFWS in 1976. The species' primary range is concentrated in the cave regions of Alabama, Arkansas, Kentucky, Missouri and Tennessee, with smaller populations found in adjacent states. Gray bats occupy cold caves or mines in the winter, during the hibernation season, and warmer caves during the summer. Gray bats primarily forage over open water of rivers, streams, lakes, or reservoirs as far as 20 miles away from their caves. Maternity colonies are typically found in caves between 0.5 to 2.5 miles from foraging areas. Although this species has recovered in many areas, human disturbance of unprotected caves continues to be the primary cause of continued decline in some populations of the gray bat. The latest threat to gray bat is white-nose syndrome (WNS). The presence of WNS in gray bats was confirmed by the USFWS in May 2012, in caves located in Hawkins and Montgomery counties, Tennessee. WNS has decimated bat populations across eastern North America, with mortality rates reaching up to 100 percent at some sites. First documented in New York in 2006, the disease has spread into 19 states and four Canadian provinces. Bats with WNS may exhibit unusual behavior during cold winter months, including flying outside during the day, and clustering near the entrances of caves and mines where they hibernate. Bats have been found sick and dying in unprecedented numbers near these hibernacula. Seven species of cave-dwelling bats have now been affected by this fungus (USFWS 2012a).

One cave has been documented within three miles of the proposed route. This cave is located approximately 2.75 miles northwest of the existing Volunteer 500-kV Substation. No bats have been documented within this cave. No undocumented caves were found within the proposed transmission line routes during field investigations.

The nearest recorded occurrence of a gray bat is of an individual roosting in a parking garage in downtown Knoxville, nine miles to the west of the project area. This adult bat was observed roosting during the day in the Summit Hill Parking Garage in October 2008,

and likely was in the process of migrating between summer and winter roost sites. The next closest record of gray bat is of a summer colony in a cave approximately 20 miles to the west of the project area. Potentially suitable foraging habitat for gray bat is available within the project area along the proposed Volunteer-East Knox 161-kV Transmission Line corridor between the Holston River and Rutledge Pike.

The Indiana bat was originally listed as in danger of extinction in 1966, under the Endangered Species Preservation Act, and is currently listed as endangered under the ESA of 1973, as amended. The listing was due to large numbers of Indiana bat deaths caused by human disturbance during hibernation (USFWS 2007).

The Indiana bat is an insectivorous, migratory bat that hibernates in caves and mines during the winter throughout the eastern United States. In the spring, reproductive females migrate to wooded areas where they form maternity colonies. Males and non-reproductive females also migrate and roost in wooded areas, but tend to stay closer to hibernacula and not roost in colonies. Summer roosts of both maternity colonies and other adults are typically behind exfoliating bark of large, primarily dead, trees. Maternity colonies tend to occupy dead trees with large pieces of exfoliating bark that receive direct sunlight for more than half the day. Maternity colonies occur in riparian areas, bottomland and floodplain habitats, wooded wetlands, and upland communities. Indiana bats typically forage in semi-open to closed forested habitats, forest edges, and riparian areas. Indiana bats return to hibernacula in late summer or early fall to mate and then enter into hibernation (USFWS 2007; Kurta and Kennedy 2002; USFWS 2008). The Indiana bat has been affected by WNS elsewhere within its winter range.

Prior to 2012, the Indiana bat had not been documented in Knox County. However, recent draft survey guidance for the Indiana bat released by the USFWS indicated that assessments should be conducted to determine the presence of potentially suitable habitat throughout the species range (USFWS 2012b). The closest records of Indiana bat are approximately 12 miles to the east of the project area in Grainger and Jefferson counties, Tennessee, and are associated with caves used for hibernation by the species.

Habitat suitability assessments for the Indiana bat were conducted in August and September 2011 and in January and February 2012. Assessments were performed in accordance with the 2012 Indiana Bat Survey Guidance for Kentucky, developed by the USFWS Kentucky Field Office and the Kentucky Department for Fish and Wildlife Resources. Field surveys within the proposed project area assessed the presence of dead trees greater than five inches in diameter at breast height and were examined for suitable roost characteristics (e.g., exfoliating bark and solar exposure). Suitable live trees with exfoliating bark also were noted.

Vegetation composition along the proposed transmission line ROW is described in Section 3.4. Most of the deciduous forest stands within the proposed ROW are severely fragmented and heavily disturbed. Many of these stands are nearly linear and follow fencerows and property boundaries. Many of the early successional forested areas had been cleared in the recent past or were actively being grazed. The relatively small amount of mature forest in the project area occurs on upland ridges.

Trees with characteristics potentially suitable for summer use by the Indiana bat were identified in three general locations along the proposed project area (Appendix J). The northernmost location is along McAnnally Ridge, on the north and south side of Sunrise

Road. Although ten snags were identified within the project area on the north side of Sunrise Road, in general these trees are of low quality for suitable summer roosting. Twenty-eight trees with characteristics potentially suitable for summer use by the Indiana bat were identified along McAnnally Ridge on the south side of Sunrise Road. These trees are of moderate to high quality for use as summer roost trees. The second location area is further south between Carter Mill Drive and Cooper Road. Thirty-one trees with roost characteristics were identified. These trees are considered low to moderate in quality. The third area is located outside of and adjacent to the proposed project area that borders I-40 to the north and south. Habitat in this area is of low quality for summer roosting.

In June 2012, acoustic surveys were conducted in these areas to determine if the Indiana bat were present (Appendix J). The calls from one individual Indiana bat was detected at a survey site located on the southside of I-40. This site was in the proximity of an existing transmission line ROW and the proposed Dumplin Valley-Nixon Road Loop Line.

### **3.7 Floodplains**

A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a 1-percent chance of flooding in any given year is normally called the 100-year floodplain. The proposed Volunteer-East Knox Transmission Line route as well as certain access roads would cross several floodplain areas associated with streams mentioned in Section 3.2. TVA's proposed switching station and KUB's proposed substation are located outside of the 100-year floodplain. Likewise, the proposed Dumplin Valley-Nixon Road 161-kV loop line is outside of the floodplain.

### **3.8 Wetlands**

Wetlands are those areas inundated by surface or by groundwater such that vegetation adapted to saturated soil conditions are prevalent. Examples include swamps, marshes, bogs, and wet meadows. Wetland fringe areas are also found along the edges of most watercourses and impounded waters (both natural and man-made). Field surveys were conducted in September 2011 and January, February, and September 2012 to delineate wetland areas within the proposed transmission line ROWs, access roads, and the substation site.

Wetland determinations were performed according to the United States Army Corps of Engineers (USACE) standards, which require documentation of hydrophytic (wet-site) vegetation, hydric soil, and wetland hydrology (Environmental Laboratory 1987; Reed 1997; United States Department of Defense and USEPA 2003). Broader definitions of wetlands, such as that used by the USFWS (Cowardin et al. 1979), the Tennessee definition (Tennessee Code 11-14-401), and the TVA Environmental Review Procedures definition (TVA 1983) were also considered in this review. A TVA-developed modification of the Ohio Rapid Assessment Method (Mack 2001) specific to the TVA region (TVA Rapid Assessment Method or "TVARAM") was used to categorize wetlands by their functions, sensitivity to disturbance, rarity, and ability to be replaced. The categorization was used to evaluate impacts and to determine the appropriate levels of mitigation for wetland impacts.

TVARAM scores are used to classify wetlands into three categories. Category 1 wetlands are considered "limited quality waters." They represent degraded aquatic resources having limited potential for restoration with such low functionality that lower standards for avoidance, minimization, and mitigation can be applied. Category 2 includes wetlands of moderate quality and wetlands that are degraded but have reasonable potential for

restoration. Avoidance and minimization are the preferred mitigation measures for Category 2 wetlands. Category 3 generally includes wetlands of very high quality or of regional/state-wide concern, such as wetlands that provide habitat for threatened or endangered species.

Seven wetlands, totaling 0.6 acre, were identified within the proposed Volunteer-East Knox 161-kV Transmission Line ROW (see Table 3-5). No wetlands were identified within the proposed substation site, the Dumplin Valley–Nixon Road 161-kV Transmission Line ROW, or along the proposed access roads.

**Table 3-5. Wetlands Within the Proposed Volunteer-East Knox 161-kV Transmission Line Right-of-Way**

Wetland Identifier	Type <sup>1</sup>	Wetland Acreage	Estimated Forested Wetland Acreage in Proposed ROW	TVARAM Category (score)
W001	PFO1E	0.02	0.02	2
W002	PEM1E	0.05	--	2
W003	PEM1/PUBH	0.01	--	2
W004	PFO1/PUBH	0.28	0.10	2
W005	PEM/PFO1E	0.04	0.02	2
W006	PFO1E	0.13	0.13	2
W007	PEM1E	0.07	--	1
<b>Total Acres</b>		<b>0.6</b>	<b>0.27</b>	

<sup>1</sup>Classification codes as defined in Cowardin et al. (1979): E = Seasonally flooded/saturated; H=Permanently flooded; PEM1 = Palustrine emergent, persistent vegetation; PFO1 = Palustrine, forested, broadleaf deciduous; PUB = Palustrine, unconsolidated bottom.

W001 is a forested headwater seep totaling approximately 0.13 acre, with 0.02 acre located within the ROW. W001 exhibits hydric soils and intermittent connectivity to an unnamed tributary of Little Flat Creek. W001 is dominated by hydrophytic vegetation that includes Shumard oak and green ash.

W002 is an emergent wetland totaling approximately 0.25 acre, with 0.05 acre located within the ROW. W002 exhibits hydric soil and is located in the floodplain of Roseberry Creek. The wetland lies within a fenced cattle pasture and has been severely impacted by livestock. Dominant hydrophytic vegetation consist of soft path rush.

W003 consists of the shoreline emergent wetland fringe of a man-made pond. This wetland fringe totals 0.01 acre inside the ROW, with the entire pond and extended wetland fringe totaling approximately 0.2 acre. W003 exhibited hydric soils and an ephemeral surface water connection via drainage from the pond to an unnamed tributary of the Holston River. Dominant hydrophytic vegetation consist of soft path rush and cattails.

W004 is an isolated man-made pond containing fringe forested wetland vegetation. The entire pond habitat occurs within the ROW and totals 0.28 acre, with 0.1 acre consisting of hydrophytic trees growing in flooded/saturated conditions. The forested area within the pond did not exhibit hydric soils, nor did a surface water connection to a navigable waterway appear evident. Dominant hydrophytic vegetation consist of green ash with several scattered bald cypress.

W005 and W006 are separated by Strawberry Plains Pike, but are both located within the floodplain of an unnamed tributary to Lyons Creek. W005 on the north side of Strawberry Plains Pike is an emergent/forested wetland complex, with approximately 0.04 acre located within the ROW, of which approximately 0.02 acre is composed of forested wetland. W006, on the south side of Strawberry Plains Pike, is a forested wetland, totaling 0.13 acre within the ROW. Both wetlands exhibit hydric soil and dominant hydrophytic vegetation consist of green ash, cattails, soft path rush, and Chinese privet.

W007 is an isolated sinkhole or old pond. The basin has developed wetland characteristics and is culverted so as to maintain a hydrologic connection via ephemeral drainage to an unnamed tributary of Lyons Creek. Dominant hydrophytic vegetation consist of cocklebur and flatsedge.

### **3.9 Aesthetics**

#### **3.9.1 Visual Resources**

The physical, biological, and man-made features of an area combine to make the visual landscape character both identifiable and unique. Scenic resources are evaluated based on existing landscape character, distances of available views, sensitivity of viewing points, human perceptions of landscape beauty/sense of place (scenic attractiveness), and the degree of visual unity and wholeness of the natural landscape in the course of human alteration (scenic integrity). The varied combinations of natural features and human alterations that shape landscape character also help define their scenic importance. Where and how the landscape is viewed would affect the more subjective perceptions of its aesthetic quality and sense of place.

Views of a landscape are described in terms of what is seen in foreground, middleground, and background distances. In the foreground (an area within 0.5 mile of the observer), details of objects are easily distinguished in the landscape. In the middleground (normally between 0.5 and 4 miles from the observer), objects may be distinguishable, but their details are weak and they tend to merge into larger patterns. Details and colors of objects in the background (the distant part of the landscape) are not normally discernible unless they are especially large and standing alone. The impressions of an area's visual character can have a significant influence on how it is appreciated, protected, and used. The general landscape character of the study area is described in this section, with additional details provided in Section 4.9. The scenic integrity indicates the degree of intactness or wholeness of the landscape character.

As described in Section 2.1.2, TVA proposes to construct two transmission lines. Additionally, TVA would purchase and prepare about 28 acres for the construction of a proposed TVA 161-kV switching station and KUB 161-kV substation. TVA would sell approximately 11 acres to KUB for their 161-kV substation. Each of these TVA actions are evaluated separately for potential visual impacts and clarity of the work to be performed.

#### **East Knox 161-kV Substation**

The proposed East Knox 161-kV Substation would be located on open property off of Thorngrove Pike. Topography in this area is gently rolling and views are from nearby homes in the foreground and middleground and from motorists along local roads. Scenic attractiveness along the route is common. Scenic integrity is low.

**Dumplin Valley-Nixon Road Loop Line**

The transmission line loop would follow a variety of east Tennessee countryside, but would be mainly over rolling ridges. The one-mile transmission line may be seen briefly by a few residents in the foreground and middleground distances. Motorists along I-40 would have brief views of the new line between structures. Scenic attractiveness along the route is common. Scenic integrity is low.

**Volunteer-East Knox 161-kV Transmission Line**

The transmission line route would pass over a variety of terrain. The 13.4-mile transmission line would be seen by local residents and motorists along local roads. These views would be from foreground distances. Portions of the line are routed behind dense vegetation and may be difficult to discern in the landscape from various viewing positions. Scenic attractiveness along the route is common. Scenic integrity is low.

**3.9.2 Noise**

Noise is measured in decibels (dB), a logarithmic unit, so an increase of 3 dB is just noticeable, and an increase of 10 dB is perceived as a doubling of sound level. Because not all noise frequencies are perceptible to the human ear, A-weighted decibels (dBA), which filter out sound in frequencies above and below human hearing, are typically used in noise assessments.

To correlate annoyance and noise exposure, the Federal Interagency Committee on Noise (FICON) conducted population surveys (FICON 1992). The surveys provide estimates of the percentage of typical residential populations that would be highly annoyed from a range of background noise and the average community reaction that would be expected (Table 3-6). The level of possible community reaction shown in these surveys does not necessarily equate to a determination that potential noise impacts would constitute a significant environmental impact in the context of a National Environmental Policy Act (NEPA) review.

**Table 3-6. Estimated Annoyance From Background Noise**

<b>Day/Night Level (dBA)</b>	<b>Percent Highly Annoyed</b>	<b>Average Community Reaction</b>
<b>75 and above</b>	<b>37</b>	<b>Very severe</b>
<b>70</b>	<b>25</b>	<b>Severe</b>
<b>65</b>	<b>15</b>	<b>Significant</b>
<b>60</b>	<b>9</b>	<b>Moderate</b>
<b>55 and below</b>	<b>4</b>	<b>Slight</b>

For comparative purposes, typical background Day/Night levels (DNL) for rural areas range from about 40 dBA in undeveloped areas to 48 dBA in mixed residential/agricultural areas (Cowan 1993). Noise levels are typically higher in high-density residential and urban areas. Background noise levels greater than 65 dBA can interfere with normal conversations, requiring people to speak in a raised voice in order to carry on a normal conversation.

Both the USEPA and the Department of Housing and Urban Development (HUD) have established noise guidelines. USEPA guidelines are based on an equivalent DNL sound level that is a 24-hour average sound level with 10 dB added to hours between 10 p.m. and

7 a.m., since people are more sensitive to nighttime noise. USEPA recommends a guideline of DNL less than 55 dBA to protect the health and well-being of the public with an adequate margin of safety. HUD guidelines use an upper limit DNL of 65 dBA for acceptable residential development and an upper limit DNL of 75 dBA for acceptable commercial development. TVA generally uses the USEPA guideline of 55 dBA DNL at the nearest residence and 65 dBA at the property line in industrial areas to assess the noise impact of a project. In addition, TVA gives consideration to the FICON (1992) recommendation that a 3-dB increase indicates possible impact, requiring further analysis when the existing DNL is 65 dBA or less.

### 3.9.3 Odors

Vehicles and equipment used during the construction of the transmission lines and periodic maintenance of the ROWs would emit exhaust fumes. During the construction period, trees and other combustible materials removed during transmission line construction may be burned. These odors may be noticed by nearby residents, but would occur only for a short duration. Construction and operation of the lines are not expected to produce any other noticeable odors.

## 3.10 Archaeological and Historic Resources

The human occupation of east Tennessee began at the end of the Ice Age with the Paleo-Indian period (13,500 to 11,000 years before present, or “B.P.”). In the southeastern United States, prehistoric archaeological chronology is broken into four broad time periods: (1) Paleo-Indian (13,500 to 11,000 B.P.), (2) Archaic (11,000 to 3000 B.P.), (3) Woodland (3000 to 1100 B.P.), and (4) Mississippian (1100 to 500 B.P.) periods. Prehistoric land use and settlement patterns vary during each period, but short- and long-term habitation sites are generally located on flood plains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in the uplands. European interactions with Native Americans in east Tennessee began in the middle of the 17th century with the rise of the fur trading industry. Due in part to the introduction of infectious diseases to which Native Americans lacked natural immunity, these interactions resulted in a rapid collapse of the native population and the cessation of elaborate ceremonialism and mound building. The project area vicinity is known to contain cultural resources pertaining to all of these prehistoric and historic periods. Although land use in the historic and modern periods has damaged and destroyed archaeological sites, numerous sites with value to the scientific study of the past remain intact.

Cultural resources include prehistoric and historic archaeological sites, districts, buildings, structures, and objects, and locations of important historic events. Cultural resources that are listed on, or considered eligible for listing on, the NRHP maintained by the NPS are called historic properties. Historic properties are identified according to whether they meet the Secretary of the Interior’s criteria for evaluation (which states that significant cultural resources possess integrity of location, design, setting, materials, workmanship, feeling, and association) and: (1) are associated with important historical events; (2) are associated with the lives of significant historic persons; (3) embody distinctive characteristics of a type, period, or method of construction or represent the work of a master, or have high artistic value; or (4) have yielded or may yield information important in history or prehistory (36 Code of Federal Regulations [CFR] Part 60.4).

Federal agencies are required by NHPA and NEPA to consider the possible effects of their undertakings on historic properties. Undertaking means any project, activity, or program

that has the potential to have an effect on a historic property and that is under the direct or indirect jurisdiction of a federal agency, or is licensed or assisted by a federal agency (36 CFR Part 800.16). Considering an undertaking's possible effects on historic properties is accomplished through a four-step review process outlined in 36 CFR Part 800, regulations implementing Section 106 of NHPA. These steps are: (1) initiation (defining the undertaking and the APE, and identifying the parties to be consulted in the process); (2) identification (studies to determine whether cultural resources are present in the APE and whether they qualify as historic properties); (3) assessment of effects to historic properties (determining whether the undertaking would damage the qualities that make the property eligible for the NRHP); and (4) resolution of adverse effects (by avoidance, minimization, or mitigation). Throughout the process, the agency must consult with the appropriate SHPO, Native American tribes that have an interest in the undertaking, and any other party with a vested interest in the undertaking.

A project may have effects on a historic property that are not adverse, if those effects do not diminish the qualities of the property that identify it as eligible for listing on the NRHP. However, if the agency determines (in consultation) that the undertaking's effect on a historic property within the APE would diminish any of the qualities that make the property eligible for the NRHP (based on the criteria for evaluation at 36 CFR Part 60.4), the effect would be considered adverse. Examples of adverse effects would be ground-disturbing activity in an archaeological site or erecting structures within the viewshed of a historic building in such a way as to diminish the building's historic setting.

The APE for archaeological resources was defined as all areas in which ground disturbing activities would take place. The APE includes ROW centered on the centerline of the approximately 13.4-mile long proposed transmission line, the 1.0-mile long Dumplin Valley-Nixon Road 161-kV Loop Line, the 34.85-acre proposed East Knox 161-kV Substation site, and the 14 access roads, each with a width of approximately 20 feet. The ROW is 100 feet wide throughout the project, except along the proposed transmission line ROW that would parallel the existing Volunteer-Knoxville #1 161-kV Transmission Line and Morristown-Volunteer 161-kV Transmission Line, where the APE is 87.5 feet wide. The APE for historic architectural resources includes all areas within a 0.5-mile area surrounding the proposed transmission line ROW routes, as well as any areas where the project would alter existing topography or vegetation in view of a historic resource. The architectural APE runs from the existing Volunteer 500-kV Substation to the proposed East Knox 161-kV Substation and includes a 0.5-mile radius surrounding the proposed East Knox Substation (Figure 1-1).

One historic architectural survey and four Phase I cultural resource surveys (including both archaeological and historic architectural studies) of the APE were conducted, covering various alternative transmission line segments of the proposed transmission lines and the proposed new substation (Barrett and Karpynek 2008; Barrett and Karpynek 2011; Barrett and Karpynek 2012a; Barrett and Karpynek 2012b; and Karpynek 2008).

A Phase I cultural resources survey, which includes archaeological sites, historic sites, and historic structures within the APE, was conducted in April 2008 for a proposed transmission line between the existing TVA Volunteer 500-kV Substation to a proposed Midway Road 161-kV Substation (Barrett and Karpynek 2008). This route consisted of approximately 10 miles of existing, but mostly vacant transmission line ROW easement. Portions of the route currently being considered for the Volunteer-East Knox 161-kV Transmission Line were within this study area, including TVA's vacant Waterville-Arlington Transmission Line ROW and the new transmission line ROW corridor parallel to existing Volunteer-Knoxville

#1 161-kV Transmission Line. The survey identified two archaeological sites, both located on the banks of the South Holston River. One of the sites (40LD302) was determined ineligible for the NRHP, and the other (40LD303), in consultation with the SHPO, was found to be eligible. The historic architectural portion of the Phase I survey identified 24 previously unrecorded historic architectural resources, all of which TVA determined to be ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage. The survey included an examination of the 14 previously recorded historic architectural properties within the architectural APE, which had not been evaluated previously for potential NRHP eligibility. Three of these properties were no longer present, six were outside the visual line-of-sight (and therefore outside the APE), and the remaining five were determined ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations.

In August 2008, a historic architectural study was carried out, for planning purposes, within a 1.0-mile wide study area centered on a series of 22 alternative transmission line segments (Karpynek 2008). The study area included approximately 10 miles of the Waterville-Arlington Transmission Line 100-ft wide ROW, plus a combination of new ROW and segments along the existing Volunteer-Knoxville #1 161-kV Transmission Line. This study identified 20 previously unrecorded architectural properties and examined 33 previously recorded ones. One NRHP-listed property, the Alexander McMillan House, was within the 0.5-mile radius. This property, however, was found to be outside of the line-of-sight of the proposed transmission line. Based on the results of the Karpynek study (2008) TVA found that two NRHP-eligible properties were within the study area, the Rising Sun Church and the Strong Stock Farm. The Rising Sun Church lay within the area of visual effects; however, because the integrity of its setting had been compromised by modern developments, TVA found that the proposed new transmission line would not likely adversely affect that property. However, TVA found that the project, as proposed in August 2008, would likely have caused a visual effect to the Strong Stock Farm. As a result of these findings, as described in Section 2.4.3, TVA modified the proposed route segments in the vicinity of the Strong Stock Farm.

A Phase I cultural resources survey of the 1.0-mile long Dumplin Valley-Nixon Road 161-kV Loop ROW identified no previously recorded archaeological sites within the project's APE and no new archaeological sites (Barrett and Karpynek 2011). Five previously recorded architectural sites were within the architectural APE. One of these (HS-3) had been previously determined ineligible and, based on TVA's evaluation, the remaining four were also determined ineligible. The survey identified three previously unrecorded architectural properties, all of which were determined ineligible for the NRHP due to their lack of architectural distinction and to loss of integrity caused by modern alterations and/or damage.

In 2011 and 2012, a Phase I cultural resources survey on a total of 8.7 miles within the proposed ROW (including the modified route segments in the vicinity of the Strong Stock Farm) was completed (Barrett and Karpynek 2012b). No previously recorded archaeological sites were known from within this portion of the APE, and no new archaeological sites were identified by the survey. A total of 25 historic architectural properties had been previously recorded within the APE. Of these 25 properties, eight have been destroyed since their original recordation and seven are located outside a visual line-of-sight to the proposed transmission line. TVA has determined that one property, the Rising Sun Church (KN-2564), is eligible for the NRHP, based on NRHP criterion C (architectural significance). In addition, TVA determined that the remaining nine properties

are ineligible for the NRHP due to a lack of architectural distinction, or to a loss of integrity caused by modern alterations and/or damage. The survey resulted in the identification of 23 additional (previously unrecorded) architectural properties. TVA has determined that all of these are ineligible. The survey also re-examined the Strong Stock Farm and determined that this property continues to be eligible for the NRHP. The SHPO expressed no disagreement with these eligibility determinations in a letter dated April 27, 2012 (Appendix A)..

In 2012, a Phase I cultural resources survey was completed of the 34.85-acre APE for the proposed new substation, which partially overlaps the area investigated by the Dumplin Valley-Nixon Road 161-kV Loop survey (Barrett and Karpynec 2012a). No previously recorded archaeological sites were identified within this portion of the APE, and no new archaeological sites were identified by the survey. A total of eight historic architectural properties had been previously recorded within the APE. Three of these (HS-1, HS-2, and HS-3) were documented during the Dumplin Valley-Nixon Road 161-kV Loop survey. Consistent with the findings of that study, TVA determined (in consultation) that those properties are ineligible for listing in the NRHP. Five other properties in the APE (KN-2428, KN-2429, KN-2430, KN-2533, and KN-2534) were recorded within the substation APE by the Knoxville Metropolitan Planning Commission in 1985, but the eligibilities of these for listing in the NRHP had not been assessed. The substation survey found those five properties to be located outside the viewshed of the proposed substation. TRC's historic architectural survey of the APE identified no previously unrecorded architectural resources.

Fourteen access roads were considered for use along the proposed transmission lines (AR01 through AR12 along the Volunteer-East Knox 161-kV Transmission Line, and AR01 and AR02 along the Dumplin Valley-Nixon Road 161-kV Loop Line). The majority of the access roads are located on existing dirt, gravel, or paved roads, but some would be new roads. Because portions of AR01, AR02, AR08, and AR09 along the Volunteer-East Knox 161-kV Transmission Line, and AR02 along the Dumplin Valley-Nixon Road 161-kV Loop Line are within the proposed ROWs, these had been previously included within one or more of the cultural resources surveys conducted for the ROWs. No known archaeological sites were identified within any of the proposed access roads, and none of the roads are located within an area of high probability for buried cultural resources.

### **3.11 Recreation, Parks, and Natural Areas**

The proposed transmission line routes pass through a mixture of cleared and forested lands. Terrain varies from gently sloping to rugged. Although these lands are primarily in private ownership, a limited amount of informal outdoor recreation activity, such as nature observation, hunting, or walking for pleasure, may occur in the vicinity of the proposed routes. There are no formal public or private outdoor recreation areas or facilities in the immediate area. Some similar informal recreation use may also occur on or in the immediate vicinity of the substation site. However, the potential for public recreation activity in this area is limited and no developed outdoor recreation areas are located nearby.

A proposed transmission line would cross the Holston River NRI stream at RM 8 near a water-filtration plant. This 53-mile river section offers scenic, recreation, geologic, fishing, wildlife, and prehistory features, and is recognized by the NPS as an NRI stream. It is a scenic stream affording excellent duck hunting and fishing opportunities.

The proposed Volunteer-East Knox 161-kV Transmission Line would also cross an area classified as Lower French Broad and Lower Holston Nonessential Experimental Population

Status. This area extends from the base of Douglas Dam at French Broad RM 32.3 and ends on the Holston River at the base of Cherokee Dam.

House Mountain SNA is located one mile west of the proposed Volunteer-East Knox 161-kV Transmission Line. The highest point in Knox County, at 2,100 feet, is found within this 500-acre area, which is part of the southern end of Clinch Mountain. The scenic views are very popular as the area contains steep slopes, rock outcrops, and heavily wooded areas. Trail systems have been developed in this SNA. This natural area is co-managed by both the state of Tennessee and Knox County Parks and Recreation.

Tuckahoe Creek State Scenic River is located 1.7 miles south of Carter Mill Drive. The Tennessee Scenic Rivers Program came about after the passage of the Tennessee Scenic Rivers Act in 1968. Since the passage of this act, 13 rivers have been designated as state scenic rivers. The program seeks to preserve the natural and scenic conditions of these 13 rivers. Tuckahoe Creek has a developed riverfront, making it a Class III scenic river.

### **3.12 Land Use and Prime Farmland**

Soils protected under FPPA include prime farmland, farmland of statewide or local importance, and unique soils. As defined by the United States Department of Agriculture (USDA), these soils have the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, livestock, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and/or labor. These designated areas do not include land that is already in or committed to urban development (for example, through zoning) or to water storage.

The proposed project would construct transmission lines on new ROW utilizing approximately 115 acres and on 55 acres of existing ROW. As a result of an extensive routing process (see Section 2.3), most of the proposed transmission line routes would cross agricultural or forested areas. This project would also involve the purchase of a 34.85-acre site for the construction of the East Knox 161-kV Substation, which would utilize only 28 acres of this site. As mentioned in Chapter 2, the substation site and surrounding land was purchased by DCKC for the development of the Midway Business Park, which has since been rejected by the Knox County Commission.

Concerns regarding potential effects to land use, particularly restrictions on uses within the proposed ROW, are frequently raised by the public. TVA typically purchases an easement with landowners for the ROW. This easement agreement provides TVA the right to construct and maintain the transmission line on private land while the property owner retains fee simple ownership. As described in Section 2.2.2.1, the easement agreement prohibits the construction of permanent structures, especially habitable structures, within the ROW. However, many activities and land uses could continue to occur on the property.

The USDA Soil Survey for Knox County indicates that the proposed substation site contains three different soil types (Appendix K; USDA 2012). Emory silt loam, 0-5 percent slopes (EmB) and Dewey silt loam, 5-12 percent slopes, eroded (DeC2) soils comprise approximately 63 percent of the proposed site. According to the NRCS Web Soil Survey (USDA 2012), EmB is considered prime farmland, and DeC2 is considered farmland of local importance. The remaining soil on the proposed site is the Dewey silt loam, 12 to 25 percent slopes, eroded (DeD2) which is not considered prime farmland areas or farmland of local importance.

### **3.13 Socioeconomics and Environmental Justice**

Both the proposed and existing transmission lines largely avoid more densely populated portions of the project area. The new transmission lines would generally parallel existing transmission line routes, although new ROW would be required for some segments (see Section 2.2.2.1). The proposed new ROW has been routed to minimize impacts to the properties it would cross, generally following fence and property lines and avoiding more populated areas to the extent feasible. The proposed East Knox 161-kV Substation would also be located in an area with low population density.

The minority population in the immediate vicinity of the transmission lines in Knox County, as of the 2010 Census of Population, is a small share of the total population (about 7 percent), which is well below the county level of 16.1 percent, the state level of 24.4 percent, and the national level of 36.3 percent (United States Census Bureau 2010). Poverty levels are also low in the area, with an average poverty level of 8.3 percent in the affected Census Tracts, which is well below the county, state, and national levels of 13.7 percent, 16.5 percent, and 13.8 percent, respectively. Poverty levels in the individual Census Tracts range from 4.7 percent in Tract 52.01, located in the area northwest of Millertown Pike, to 12.1 percent in tract 54.02, which is south of I-40 where the transmission line would proceed south from I-40 to the Dumplin Valley-Nixon Road 161-kV Loop Line.

## CHAPTER 4

### 4.0 ENVIRONMENTAL CONSEQUENCES

The potential effects of adopting and implementing the No Action Alternative and the Action Alternative on the various resources described in Chapter 3 were analyzed, and findings are documented in this chapter. The potential effects are presented by resource, and the consequences of resources is presented in the same order as that in Chapter 3.

As stated in Section 2.1.1, under the No Action Alternative, TVA would not construct the proposed transmission lines to provide power to KUB's planned substation. However, KUB could opt to construct a new transmission line to serve the East Knox 161-kV Substation. In this event, the potential environmental effects resulting from the implementation of the No Action Alternative would likely be comparable to those from the adoption of the Action Alternative. Potential effects of this new, distributor-built line would depend on various factors, including the particular route chosen, as well as KUB's construction and maintenance methods.

In the event that TVA were to choose not to construct the proposed TVA switching station or the transmission lines to serve the new substation, the transmission system in the project area would continue to operate with a high risk of interruption due to overloaded situations and possible equipment failures. The risk for loss of service and possible NERC reliability criteria violations is projected to increase over time.

Some of the possible outcomes under the No Action Alternative are speculative and beyond TVA's ability to control. Because of the speculative nature of those situations, TVA's analysis of potential effects of adopting the No Action Alternative focuses on determining the effects of TVA not building the proposed switching station or transmission lines to provide power to the planned KUB Substation.

### 4.1 Groundwater and Geology

#### 4.1.1 No Action Alternative

Under the No Action Alternative, there would be no effects to groundwater resources or geological features from TVA's action because the proposed transmission lines and TVA switching station would not be built.

#### 4.1.2 Action Alternative

Potential impacts to groundwater could result from sediments from excavated materials, if they enter or clog sinkholes or springs, and from the transport of contaminants, such as herbicides and fertilizers, into sinkholes and other karst features. Three caves have been reported within one mile of the proposed East Knox Substation site. There is also a sinkhole located on the East Knox Substation property.

BMPs, as described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority*, would be used to avoid impacts on groundwater (Muncy 1999). BMPs would also be used to control sediment infiltration from stormwater runoff. Construction activities would avoid springs and sinkholes as practical.

During revegetation and maintenance activities, herbicides with a groundwater contamination warning would not be used, and the use of fertilizers and herbicides would

be considered with caution before application and would be applied according to the manufacturer's label. TVA's BMPs for herbicide and fertilizer application would be used and would prevent impacts to groundwater. With the application of appropriate BMPs during construction, operation, and maintenance of the proposed transmission lines and switching station site, potential direct and indirect effects to groundwater, under the Action Alternative, would be insignificant. No cumulative impacts are anticipated.

## **4.2 Surface Water**

### **4.2.1 No Action Alternative**

Because the proposed transmission lines, access roads, and switching station would not be built and operated under the No Action Alternative, there would be no effects to local surface waters from TVA's actions. Any changes in local surface water conditions would be independent of TVA's actions.

### **4.2.2 Action Alternative**

Soil disturbances associated with transmission lines, access roads, or other construction activities can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog small streams and threaten aquatic life. Removal of the tree canopy along stream crossings can increase water temperatures, algal growth, dissolved oxygen depletion, and adverse impacts to aquatic biota. Improper use of herbicides to control vegetation could result in runoff to streams and subsequent aquatic impacts.

TVA routinely includes precautions in the design, construction, and maintenance of its transmission line projects to minimize these potential impacts. Permanent stream crossings that cannot be avoided are designed to not impede runoff patterns and the natural movement of aquatic fauna. Temporary stream crossings and other construction and maintenance activities would comply with appropriate state permit requirements and TVA requirements as described in Muncy (1999). Canopies in all SMZs would be left undisturbed unless there were no practical alternative. ROW maintenance would employ manual and low-impact methods wherever possible. In areas requiring chemical treatment, only USEPA-registered herbicides would be used, in accordance with label directions that are designed, in part, to restrict applications near receiving waters and to prevent unacceptable aquatic impacts. With proper implementation of these controls, only minor impacts to local surface waters are expected. Because these impacts are minor, no cumulative impacts are anticipated.

## **4.3 Aquatic Ecology**

### **4.3.1 No Action Alternative**

Under the No Action Alternative, the transmission lines, access roads, and TVA switching station would not be built. Thus, no changes to aquatic resources within the project area would occur. However, changes to aquatic life would likely occur over the long term, due to factors such as population growth and land use changes within the area.

### **4.3.2 Action Alternative**

Aquatic life could be affected by the proposed action. Impacts would occur either directly by the alteration of habitat conditions within the stream or indirectly due to modification of the riparian zone and stormwater runoff resulting from construction and maintenance activities along the transmission line corridors, access roads, and substation site.

Potential impacts due to removal of streamside vegetation within the riparian zone include increased erosion and siltation, loss of in-stream habitat, and increased stream temperatures. Other potential effects resulting from construction and maintenance include alteration of stream banks and stream bottoms by heavy equipment and by herbicide runoff into streams.

Siltation has a detrimental effect on many aquatic animals adapted to riverine environments. Turbidity caused by suspended sediment can negatively impact spawning and feeding success of many fish species (Sutherland et al. 2002).

Watercourses that convey only surface water during storm events (such as WWCs) and that could be affected by the proposed transmission line routes, access roads, or substation site would be protected by standard BMPs as identified in Muncy (1999). These BMPs are designed, in part, to minimize disturbance of riparian areas, and subsequent erosion and sedimentation that can be carried to streams. TVA also provides additional categories of protection to watercourses based on the variety of species and habitats that exist in the ponds or streams, as well as the state and federal requirements to avoid harming certain species (Appendix G). The width of the SMZs is determined by the type of watercourse, primary use of the water resource, topography, or other physical barriers (Muncy 1999).

The three ponds and all of the perennial and intermittent streams would be protected by Standard Stream Protection (Category A), as defined in Muncy (1999). This standard (basic) level of protection for streams and the habitats around them is to minimize the amount and length of disturbance to the water bodies without causing adverse impacts on the construction work.

Because appropriate BMPs and SMZs would be implemented during construction, operation, and maintenance of the proposed transmission lines, access roads, and substation site, any direct or indirect impacts to aquatic life resulting from the proposed action would be minor and insignificant. No cumulative impacts are anticipated.

## **4.4 Vegetation**

### **4.4.1 No Action Alternative**

Adoption of the No Action Alternative would not result in any project-related direct, indirect, or cumulative impacts to the terrestrial ecology of the region because terrestrial communities would not change. However, changes to local plant communities, resulting from natural ecological processes and human-related disturbance, would continue to occur, but the changes would not result from the proposed project. The invasive species found near the project area are common throughout the region, and their extent and abundance would likely remain relatively unchanged because no project-related work would take place.

### **4.4.2 Action Alternative**

Adoption of the Action Alternative would not significantly affect the vegetation of the region. In general, natural habitat in the project area and across Knox County, Tennessee, has been greatly impacted by both residential and agricultural development throughout the last century. The majority of forested areas have previously been cleared and remaining forest is highly fragmented. The construction of the proposed transmission lines would convert approximately 90 acres of forested habitat to managed ROWs composed of early successional habitat. This conversion would be a long-term effect and would be insignificant since most of this forested habitat is severely fragmented and heavily

disturbed. Many of the forest stands are nearly linear and follow fencerows and property boundaries. Average size of overstory trees in the proposed ROWs varies, but most of the trees are less than 18 inches diameter at breast height. Many of these areas have been cleared in the recent past or are actively being grazed. The relatively small amount of mature forest in the project area occurs on upland ridges. No forested areas are present on the proposed substation site. Therefore, changes from the proposed project would not be regionally significant.

Further, as of 2010, there were at least 1,000,000 acres of forested land in Knox County and the adjacent Tennessee counties (United States Forest Service [USFS] 2012). The cumulative project-related effects to forest resources would be negligible when considered in the context of the total forested land occurring in the region. Project-related work would temporarily affect herbaceous plant communities, but these areas would likely recover to their pre-project condition in less than one year. Adoption of the Action Alternative would not significantly affect the vegetative terrestrial ecology of the region.

The entire project area currently has a large component of invasive terrestrial plants. Adoption of the Action Alternative would not significantly affect the extent or abundance of these species at the county, regional, or state level. However, the use of TVA's standard operating procedure of revegetating with noninvasive species (Muncy 1999) would help limit the introduction and spread of invasive species in the project area.

## **4.5 Wildlife**

### **4.5.1 No Action Alternative**

Under the No Action Alternative, the proposed transmission lines would not be built and the proposed ROW would not be cleared. Therefore, the ROW corridors and the locations of the access roads for the proposed transmission lines would likely remain in their current condition, and there would be no direct or indirect effects to local wildlife or wildlife habitats resulting from TVA's action. Changes to local animal communities, resulting from natural ecological processes and human-related disturbance, would continue to occur, but the changes would not result from the proposed project.

### **4.5.2 Action Alternative**

Under the Action Alternative, construction of the proposed transmission line and switching station site would result in a change in the composition of wildlife habitats in the project area. Construction of the ROW for the proposed transmission lines would involve clearing of about 90 acres of forest habitat that would be converted and maintained as early successional habitat. This condition would persist within the ROWs during the life of the transmission line. The approximately 28-acre site would be cleared of vegetation and leveled for the substation site. Regular maintenance would be implemented to reduce encroachment of any vegetation into the switchyard.

The initial clearing along the proposed ROWs would increase fragmentation of the remaining adjacent forests within the proposed project area and would likely, temporarily, displace larger animals, such as deer and turkey, from the project area into surrounding areas. Some smaller less mobile animals occupying the areas to be cleared, such as mice, shrews, frogs, and salamanders, would be impacted by construction activities. Following the construction and revegetation of the previously forested areas, wildlife favoring forest edge and early successional habitat would occupy the proposed ROW, changing the overall

species' composition of the area. The loss of forested habitat in the proposed project area would impact species favoring forested habitats. However, the majority of the forested habitat present in the project area is already fragmented and lacking in characteristics typical of contiguous interior forest. Most species that would be affected by these changes are common locally and regionally, and the effects on wildlife would be minor.

As indicated in Section 4.4, the forested land in the project area is already highly fragmented. As such, the proposed action is not expected to contribute significantly to the already fragmented landscape or local wildlife populations. Additionally, in the context of the total forested land occurring in the region, cumulative project-related effects to species favoring forested habitats would be negligible.

No unique terrestrial habitat or habitat important to terrestrial animal species (such as caves, clusters of vernal pools, old-growth forests, and bluff habitats) were observed within the project area. As well, no colonies of herons or other migratory birds were observed. Environmental impacts to unique or important terrestrial habitat or bird colonies are thus not expected to occur because of the proposed actions. The proposed switching station, substation, and transmission lines are not expected to result in significant direct or indirect impacts to terrestrial wildlife or their habitats.

## **4.6 Endangered and Threatened Species**

The ESA provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the United States or elsewhere. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize federally listed species. The policy of Congress is that federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the Act's purposes.

### **4.6.1 No Action Alternative**

Under the No Action Alternative, TVA would not construct the proposed transmission lines, associated access roads, or substation site. Changes to the area would likely occur over time, as factors such as population trends; land use and development; quality of air, water, and soil; recreational patterns; and cultural, ecological, and educational interests change within the area. The status and conservation of any potentially affected listed species would continue to be determined by the actions of others under the No Action Alternative. Thus, there would be no direct or indirect effects to federally or state-listed endangered and threatened species or their habitats caused by TVA project-related actions.

### **4.6.2 Action Alternative**

#### **4.6.2.1 Aquatic Animals**

The Cumberland monkeyface, green blossom pearl mussel, shiny pigtoe pearl mussel, tubercled blossom pearl mussel, turgid blossom pearl mussel, Anthony's river snail, yellowfin madtom, and fine-rayed pigtoe were known to occur either within a ten-mile radius of the project area or within Knox County, Tennessee. However, these species are believed to be extirpated from the area. Therefore, no impacts to these species would occur from the construction or operation of the proposed transmission lines, access roads, or substation site.

Increases in sediment entering downstream habitats from adjacent watercourses could occur during riparian vegetation clearing; soil disturbances associated with transmission line, access road, and substation construction; or maintenance activities at stream crossings. Should any of the remaining aquatic species listed in Table 3-3 occur in the project area or downstream, these activities could result in direct or indirect impacts from increased siltation.

However, as described in Section 4.2.2 and 4.3.2, watercourses that could be affected by the proposed project would be protected by standard BMPs and additional protection measures as identified in Muncy (1999). These BMPs are designed in part to minimize disturbance of riparian areas, and subsequent erosion and sedimentation that can be carried to streams. Because appropriate BMPs and SMZs would be implemented during construction, operation, and maintenance of the proposed transmission lines, access roads, and substation site, no direct or indirect impacts to federally or state-listed endangered and threatened aquatic species are anticipated to occur.

#### **4.6.2.2 Plants**

No federally or state-listed as endangered or threatened plant species are known to occur within the proposed ROWs, associated access roads, the substation site, or in nearby areas that could be affected by the construction and operation of the proposed project. Project-related work would disturb plants currently growing in the project area, but that disturbance would have no direct, indirect, or cumulative impacts on endangered and threatened plant species or designated critical habitat because none are present.

#### **4.6.2.3 Terrestrial Animals**

The federally protected bald eagle is known from Knox County and has been documented within 3 miles of the project area; however, habitat for this species was not found within the proposed ROWs or the substation site during field surveys. Foraging habitat for the gray bat may occur along the Holston River; however, proposed actions would not impact the quality or use of this habitat.

Per USFWS Indiana bat Survey Guidance, the isolation of two separate files using an Indiana bat call filter at one acoustical site, on the same night, is considered to be a positive indicator that the Indiana bat is present (USFWS 2012). Analysis of the recordings collected during acoustic surveys resulted in a single recording that passed through the Indiana bat call filter. This recording file was collected June 20, 2012, at the survey site south of I-40, located along an existing transmission line ROW that bisects the proposed Dumplin Valley-Nixon Road Loop Line just south of I-40. This single detection, therefore, is not considered a positive indicator.

Per discussion with the USFWS office, however, and in lieu of conducting mist net surveys in the two areas nearest the single detection point, TVA would limit clearing activities within the ROW to occur between November 15 and March 31 (Appendix J). During this time period Indiana bats would have migrated to caves for the winter season and, thus, would not be present in the area. A distance of five miles is the extent to which the Indiana bat has been documented to travel and forage from a roost site during the spring and summer seasons. These two areas, in which low to moderate quality Indiana bat habitat was identified, both fall within five miles of the single acoustic detection. This conservative approach of a time limited tree clearance would ensure that the proposed project would not likely adversely affect Indiana bat during the construction, operation, or maintenance activities associated with this transmission line.

In letters dated April 24, 2012 and October 17, 2012, to the USFWS, TVA determined that construction, operation, and maintenance of the transmission line project is not likely to adversely affect the Indiana bat. The USFWS concurred with these findings in a letter dated November 30, 2012. To avoid impacts to the Indiana bat, TVA proposes the following avoidance measures:

- Any tree clearing activities between Carter Mill Drive and Cooper Road that are associated with construction and maintenance practices of the Volunteer-East Knox 161-kV Transmission Line ROW would occur between November 15 and March 31.
- Any tree clearing activities in areas defined as immediately north and south of I-40 that are associated with construction and maintenance practices of the Dumplin Valley-Nixon Road Loop Line ROW would occur between November 15 and March 31.

No direct, indirect, or cumulative impacts to any other endangered and threatened animal species or designated critical habitat are anticipated as a result of the proposed project.

## **4.7 Floodplains**

As a federal agency, TVA is subject to the requirements of EO 11988 (Floodplain Management). The objective of EO 11988 is "...to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (United States Water Resources Council 1978). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practical alternative.

### **4.7.1 No Action Alternative**

Under the No Action Alternative, there would be no direct or indirect adverse effects to floodplains because there would be no physical changes to the current conditions found within local floodplains due to TVA's action. Changes in land use resulting from residential, commercial, or industrial development could affect floodplain functions over the long term. However, these changes would be independent of TVA's action.

### **4.7.2 Action Alternative**

The proposed Volunteer-East Knox 161-kV Transmission Line route crosses several floodplain areas in Knox County (see Section 3.7). Consistent with EO 11988, the construction of an overhead transmission line and related support structures is considered to be a repetitive action in the 100-year floodplain. The construction of the support structures for the power line within the 100-year floodplain is not expected to cause any increase in flood hazard either because of changes in flood elevations or flow-carrying capacity of the streams being crossed. However, to minimize adverse impacts on natural and beneficial floodplain values, the ROW would be revegetated where natural vegetation is removed, as described in Appendix F.

The proposed Dumplin Valley-Nixon Road 161-kV Loop Line route does not cross any floodplains in Knox County. The existing Volunteer 500-kV Substation is located outside of the 100-year floodplain. Also, the proposed TVA 161-kV Switching Station and KUB 161-kV Substation would be located outside of the 100-year floodplain. Several access roads

would cross the 100-year floodplain. Consistent with EO 11988, an access road is considered to be a repetitive action in the 100-year floodplain. To minimize adverse impacts, new road construction in the floodplain would be done in such a manner that upstream flood elevations would not be increased. Therefore, the proposed project would be consistent with EO 11988.

#### **4.8 Wetlands**

Activities in wetlands are regulated under Section 401 and 404 of the Clean Water Act and are addressed by EO 11990 (Protection of Wetlands). Section 401 requires water quality certification by the state for projects permitted by the federal government (Strand 1997). Section 404 implementation requires activities resulting in the discharge of dredge or fill into waters of the United States to be authorized through a Nationwide General Permit or Individual Permit issued by the USACE. EO 11990 requires federal agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values, while carrying out agency responsibilities. TVARAM is used to guide wetland mitigation decisions consistent with TVA's independent responsibilities under NEPA and the EO 11990.

##### **4.8.1 No Action Alternative**

Under the No Action Alternative, the transmission lines and TVA switching station would not be built and no project-related disturbance to wetlands within the proposed ROWs would occur. Therefore, no wetlands would be affected directly under this alternative. Changes to wetlands could nonetheless occur over time as other factors, such as population trends, land use and development, quality of air/water/soil, recreational patterns, and cultural, ecological, and educational interests change within the area.

##### **4.8.2 Action Alternative**

Under the Action Alternative, 0.27 acre of forested wetland across four separate wetlands (W001, W004, W005, W006) located within the ROWs would be affected by conversion to scrub-shrub/emergent wetlands. All of the wetland areas (0.6 acre) located within the proposed Volunteer-East Knox 161-kV Transmission Line ROW boundaries would be spanned by the transmission lines. These areas would be subject to a periodic ROW vegetation management and would be maintained as open water habitat or emergent/scrub-shrub wetlands. No significant loss of wetland function is anticipated due to the nominal amount of tree clearing proposed within these wetlands. No wetlands were located within the proposed Dumplin Valley-Nixon Road 161-kV Transmission Line ROW, the 34.85-acre substation site, or access roads.

Clearing and converting the small patches of forested wetland within the ROW is not anticipated to significantly diminish the current functional capacity of these wetlands, due to their existing condition and the expanse of forested wetlands outside the ROW that would remain intact. No wetlands are located on the proposed East Knox 161-kV Substation site. Therefore, no significant direct or indirect wetland impacts are anticipated as a result of the proposed project.

Cumulative impact analysis of wetland effects takes into account wetland loss and conversion at a watershed-level scale. Proposed wetland impacts would be considered insignificant, on a cumulative scale, due to the nominal acreage of wetland clearing proposed. Therefore, no cumulative wetland impacts are anticipated from construction or maintenance of the proposed transmission lines or substation.

Consistent with EO 11990, potential wetland impacts would be reduced to an insignificant level during the construction and ROW maintenance activities through implementation of appropriate BMPs (Muncy 1999). Because of these measures, the proposed project would have no significant adverse direct, indirect, or cumulative impacts to wetland areas or to the associated wetland functions and values provided within the general watershed.

## **4.9 Aesthetics**

Potential impacts to scenic resources were examined based on changes between the existing landscape and the landscape character after alteration, identifying changes in the landscape character based on commonly held perceptions of landscape beauty and the aesthetic sense of place.

### **4.9.1 No Action Alternative**

Under the No Action Alternative, the proposed transmission line ROW corridors and TVA switching station would not be constructed. Aesthetics, including visual resources, noise, and air quality, would not be affected. Changes to scenic quality of the area, noise levels, and air quality would nonetheless occur over time as other factors, such as population trends; land use and development; quality of air/water/soil, recreational patterns; and cultural, ecological, and educational interests change within the area.

### **4.9.2 Action Alternative**

#### **4.9.2.1 Visual Resources**

The visual attributes of existing scenery, along with the anticipated attributes resulting from the proposed action, are reviewed and classified in the visual analysis process. The classification criteria are adapted from a scenic management system developed by the USFS and integrated with planning methods used by TVA. The classifications are based on methodology and descriptions from the USDA (1995) and TVA (2003). Sensitivity of viewing points available to the general public, their viewing distances, and visibility of proposed changes are also considered during the analysis. Scenic integrity indicates the degree of intactness or wholeness of the landscape character. These measures help identify changes in visual character, based on commonly held perceptions of landscape beauty, and the aesthetic sense of place. The foreground, middleground, and background viewing distances were previously described in Section 3.9.

### **East Knox 161-kV Substation**

The proposed substation would be seen by nearby residents and motorists along local roads. Adding new industrial elements would increase the number of intrusive elements seen in the landscape. Scenic value class, which is determined by combining the levels of scenic attractiveness, scenic integrity, and visibility could be negatively affected. However, with plant screening along a portion of the western boundary of the TVA switching station site, as proposed in Section 2.2.1.2, scenic value class would likely not change by two levels or more (Appendix L). New switching station lighting would comply with the TVA Substation Lighting Guidelines (Appendix B) and these guidelines contain measures to reduce potential lighting impacts. Therefore, with the following commitment no significant visual impacts anticipated.

- TVA would provide a vegetative screening along a portion of the western boundary of the site to reduce the visual effects of their new facility.

### **Dumplin Valley-Nixon Road Loop Line**

The proposed transmission line loop would potentially add to the number of discordantly contrasting elements seen in the landscape. These visually intrusive elements, as seen from a number of viewing positions, would not likely add to the cumulative impacts in the landscape seen from foreground and middleground distances. Intrusive elements can currently be seen along the proposed transmission line route, including service poles and other industrial elements, such as repeater stations, up to background distances in all directions. These elements contribute to the landscape's ability to absorb negative visual change. New access roads would be visually similar to other roads seen in the landscape now. Therefore, insignificant impacts would be expected on visual resources with the addition of the the Dumplin Valley-Nixon Road 161-kV Loop Line.

### **Volunteer-East Knox 161-kV Transmission Line**

The proposed transmission line route would pass over a variety of terrain, ranging from relatively flat to mild and steep slopes. The transmission line would be seen by local residents and motorists along local roads. These views would be from foreground distances. Portions of the transmission line are routed behind dense vegetation and may be difficult to discern in the landscape from various viewing positions. New poles and lines would have minor long-term impacts. Trees and other tall vegetation would be cleared along the routes for ROW, access roads, and substation access. These activities would contribute to a cumulative reduction of visual integrity in the rural landscape.

Operation, construction, and maintenance of the proposed transmission lines would be visually insignificant. New access roads would be visually similar to other roads seen in the landscape now. There may be some minor visual discord during the construction period due to an increase in personnel and equipment and the use of laydown and materials storage areas. These minor visual obtrusions would be temporary until the proposed ROWs, laydown, and access road areas are restored through the use of TVA standard BMPs (Muncy 1999). Therefore, overall visual impacts are anticipated to be minor and insignificant as a result of this project.

#### **4.9.2.2 Noise**

##### **Construction Noise**

Sources of noise expected during construction would include standard construction equipment outlined in Section 2.2.2.1. This equipment would be used for clearing the ROWs, transporting structures and conductors to the site, construction of the transmission lines and associated access roads, revegetation of the ROWs, and construction of the substation. These sources would generate noise above ambient levels in areas that are undergoing clearing and construction. Construction noise impacts would vary with the number and specific types of equipment on the job, the construction methods, the scheduling of the work, and the distance to sensitive noise receptors, such as houses. Typical substation and transmission line construction activities are described in Sections 2.2.1 and 2.2.2, respectively. Maximum noise levels generated by the various pieces of construction equipment typically range from about 70 to 85 dBA at 50 feet (Bolt, Beranek, and Newman 1971).

Project-related construction noise levels would likely exceed background noise levels by more than 10 dBA at distances from within 500 feet in developed areas to over 1,000 feet in rural areas with little development. A 10-dBA increase would be perceived as a large

increase over the existing noise level and could result in annoyance to adjacent residents. The residential noise level guideline of 55 dBA could also be temporarily exceeded for residences near construction activities.

Noise-related effects associated with construction of the transmission lines are expected to be temporary and insignificant because of the short construction period. In the more densely populated areas along the ROWs, construction techniques would be used to limit noise as much as possible. These techniques include limiting construction activities when practicable to daylight hours and ensuring that construction equipment would be adequately muffled and maintained. Because of the sequence of construction activities, construction noise at a given point along the transmission lines would be limited to a few periods of a few days each. The temporary nature of construction would reduce the duration of noise impacts on nearby residents.

### **Operational Noise**

Under certain weather conditions, high-voltage transmission lines, such as the proposed 161-kV line, may produce an audible low-volume hissing or crackling noise that is different from other noise sources (such as traffic). This noise is generated by the corona resulting from the dissipation of energy and heat as high voltage is applied to a small area. Corona discharge is the electrical breakdown of air into charged particles. Corona noise is composed of both broadband noise, characterized as a crackling noise, and pure tones, characterized as a humming noise. Corona noise is greater with increased voltage and is also affected by weather. It occurs during all types of weather when air ionizes near irregularities, such as nicks, scrapes, dirt, and insects on the conductors. During dry weather, the noise level is low and often indistinguishable off the ROW from background noise. In wet conditions, water drops that collect on the conductors can cause louder corona discharges.

The human response to corona-generated noise is subjective and depends on the background noise. For example, corona intensifies during rain, but at the same time, background noise levels are also much higher, thus the annoyance level is lower. During very moist, nonrainy conditions, such as heavy fog, the resulting small increase in the background noise levels is not expected to result in annoyance to adjacent residents.

As reference for audible noise related to transmission lines, fair weather values are accepted. It is generally accepted that noise between 35 and 45 dBA corresponds to a quiet library environment. Audible noise levels generated by 161-kV lines during fair weather are very low (below 30 dB) and in rainy weather would be at no point higher than 35 dB. Therefore, in all cases, the audible noise generated by the proposed 161-kV transmission lines would be well below the recommended maximums of the USEPA DNL sound levels (Dezé Energy Corporation 2008).

Periodic maintenance activities, particularly vegetation management, would produce noise comparable to that of some phases of transmission line construction. This noise, particularly from bush hogging or helicopter operation, would be loud enough to cause some annoyance. Maintenance activities would be of short duration and of infrequent occurrence and, therefore, expected to be insignificant. In residential areas, the need for periodic ROW vegetation management would be limited or nonexistent.

#### **4.9.2.3 Odors**

Vehicles and equipment used during construction and operation would emit exhaust fumes. To limit exhaust emissions, equipment and vehicles would be properly muffled and maintained. Additionally, trees and other vegetation cleared from the ROW during construction may be burned. The resulting odors may be noticeable by nearby residents, but would be expected to be temporary and insignificant because of the relatively short-term activities of construction. Appendices E and F contain procedures to address objectionable odors caused by smoke or fumes that could result during the construction and operation of the proposed transmission lines. Construction and operation of the transmission lines is not expected to produce any other noticeable odors.

### **4.10 Archaeological and Historic Resources**

Historic and cultural resources, including archaeological resources, are protected under various federal laws, including the Archeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, and the NHPA. Section 106 of the NHPA requires federal agencies to afford the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment on the possible effects of their undertakings on historic properties. The Advisory Council's regulations in 36 CFR Part 800 require agencies to consult with the appropriate SHPO when proposed federal actions could affect these resources.

#### **4.10.1 No Action Alternative**

Under the No Action Alternative, there would be no direct, indirect, or cumulative impacts to historic or archaeological resources because there would be no changes to the project area. Changes to cultural resources may occur over time, independently of TVA's actions, due to factors such as population increases, changes in land use, and the potential for development to occur in the area.

#### **4.10.2 Action Alternative**

##### **4.10.2.1 Archaeological Resources**

Based on findings in the five studies completed between 2008 and 2012, one NRHP-eligible archaeological site (40KN303) was found within the APE. This site, located in an alluvial setting, has potential for deeply buried deposits. Transmission line construction within the site boundaries would have an adverse effect on the site. Soil compaction and disturbance from mechanized clearing, grading, auguring, and the installation of transmission line pole structures would directly affect the site by the removal of material and mixing of stratigraphic levels. Cumulative effects resulting from periodic ROW clearing could also occur, and could include both ground disturbance and increased erosion from vegetation removal. With the implementation of TVA's standard BMPs (Muncy 1999) and avoidance measures described below, these effects would be insignificant.

To avoid impacts to Site 40KN303, TVA proposes the following avoidance measures:

- TVA would not place any transmission line structures within the site boundary.
- TVA would conduct all work within the boundaries of the site related to construction, operation, or maintenance of the transmission line during dry conditions or with low, ground-pressure tire equipment so that no rutting or excavation would occur.

With these avoidance measures in place, TVA determined that no archaeological sites eligible for the NRHP would be adversely affected by the proposed undertaking, and no further investigations are recommended. Pursuant to regulations (36 CFR Part 800) implementing Section 106 of the NHPA, TVA consulted with the SHPO, by letter dated June 11, 2008, regarding TVA's determination that no archaeological sites would be affected by the Action Alternative, and the SHPO concurred on July 16, 2008 (Appendix A).

#### **4.10.2.2 Architectural Resources**

Based on the most recent architectural survey of the proposed transmission line route (Barrett and Karpynec 2012b), TVA determined that the project would have a visual effect on the Strong Stock Farm due to the visibility of the transmission line from the property's southwestern extremity. However, TVA determined the effect would not be adverse because of the distance between the eligible historic structures on the property and the proposed transmission line (0.5 mile or more) and because the eligible historic structures would not be within a line-of-sight of the proposed transmission line. The historic setting of the Rising Sun Church, an eligible property, has been compromised by modern residential development and, because of this, the addition of a transmission line within the property's line-of-sight would not cause further adverse effects. Therefore, TVA determined that the proposed project would not have an adverse effect on any NRHP-eligible or listed architectural resources. In a letter dated April 16, 2012 (Appendix A), TVA sought concurrence from the SHPO with its findings and determinations. The SHPO requested additional documentation regarding TVA's finding of no adverse effect for historic properties in a letter dated April 27, 2012 (Appendix A). TVA prepared additional documentation pursuant to this request and provided this information to the SHPO. The SHPO agreed with TVA's determination by letter dated August 7, 2012 (Appendix A).

TVA determined that five previously recorded and three previously unrecorded architectural properties within the APE of the 1-mile long Dumplin Valley-Nixon Road 161-kV Loop Line were ineligible for the NRHP. In a letter dated September 15, 2011 (see Appendix A), TVA sought concurrence from the SHPO with TVA's findings and recommendations that the architectural resources in the APE are ineligible for listing in the NRHP. The SHPO agreed with these findings and determinations by letter dated October 3, 2011 (Appendix A).

Based on the findings of the substation survey, TVA determined that construction of the substation would not affect any historic properties. TVA sought concurrence from the SHPO with this determination in a letter dated June 8, 2012, and the SHPO agreed by letter dated June 20, 2012 (Appendix A).

In summary, pursuant to regulations (36 CFR Part 800) implementing Section 106 of the NHPA, TVA has consulted with the SHPO regarding TVA's determination of "no adverse effect" on the Strong Stock Farm and the Rising Sun Church, and "no effect" on all other historic properties. In letters dated July 16, 2008, October 3, 2011, June 20, 2012, and August 7, 2012, the SHPO concurred with TVA's findings and determinations (Appendix A).

#### **4.10.2.3 Tribal Consultation**

Pursuant to 36 CFR Parts 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b), TVA consulted with the appropriate federally recognized tribes in letters dated June 23, 2008, October 20, 2011, April 17, 2012, and June 11, 2012, regarding historic properties within the proposed project's APE that may be of religious and cultural significance to tribes and that are eligible for listing in the NRHP (see Appendix A). No issues or objections regarding the proposed project were identified by the tribes contacted.

## **4.11 Recreation, Parks, and Natural Areas**

### **4.11.1 No Action Alternative**

Under the No Action Alternative, no changes to the project area would occur and no direct, indirect, or cumulative effects to local recreational opportunities or experiences, natural areas, NRI streams, or Wild and Scenic Rivers are anticipated. Changes to these features, as well as their management objectives, would nonetheless occur over time as other factors such as population trends, land use and development, quality of air/water/soil, recreational patterns, and cultural, ecological, and educational interests within the area change.

### **4.11.2 Action Alternative**

Under the Action Alternative, the proposed Volunteer-East Knox 161-kV Transmission Line would cross the Holston River, an NRI stream, parallel to a KUB transmission line on an existing TVA-owned transmission line ROW. Because the Holston River is listed on the NRI, TVA contacted the NPS regarding the proposed project. TVA indicated in the correspondence that a new transmission line would be constructed parallel to an existing transmission line. The NPS responded in an email dated February 13, 2012, but did not provide comments to TVA regarding the proposed project (Appendix A).

TVA determined that because of the existing transmission line in this area of the river, the proposed Volunteer-East Knox 161-kV Transmission Line is not expected to result in a significant impact on the recreational character or recreational use of the river. Furthermore, SMZs and BMPs, as outlined in Muncy (1999), would be implemented to minimize or avoid any impacts resulting from the proposed transmission line construction and operation (see Section 4.4.2). These measures are designed to minimize disturbance resulting from construction activities in or around streams to prevent sediment and debris from entering the river. No direct, indirect, or cumulative impacts to the Holston River NRI Stream or the Lower French Broad and Lower Holston Nonessential Experimental Population are anticipated.

House Mountain Designated SNA and Tuckahoe Creek State Scenic River are located more than one mile from the proposed project area. Because of this physical separation, no direct, indirect, or cumulative impacts to these natural areas are anticipated as a result of the proposed action.

Construction and maintenance of the proposed transmission lines could cause some minor shifts in any informal outdoor recreation activities that may currently take place in the immediate vicinity of this project. However, the extent of any such impacts would be minor and insignificant. Development of the proposed substation site would also have no significant impacts on public outdoor recreation activity in the immediate area.

## **4.12 Land Use and Prime Farmland**

The FPPA directs federal agencies to evaluate land use prior to permanently converting an area to a nonagricultural land use and to minimize the extent to which federal actions contribute to the unnecessary conversion of farmland to nonagricultural uses.

#### **4.12.1 No Action Alternative**

Under the No Action Alternative, TVA would not build the transmission lines or switching station, and areas considered as prime farmland or farmland of statewide importance would not be affected. TVA would not acquire easements for new ROW and thus, there would be no changes in land use due to ROW clearing or from the imposition of use restrictions along the route of the proposed transmission line. Over time, some changes in land use in the area could occur due to future residential, commercial, or industrial development. However, the lack of a reliable and adequate power supply locally would tend to retard such development in the long term. There would be no direct, indirect, or cumulative impacts to prime farmland because there would be no physical changes to the current conditions of the land.

#### **4.12.2 Action Alternative**

Under the Action Alternative, 14.4 miles of new transmission lines would be constructed on approximately 170 acres of ROW. Most of the ROW for the proposed transmission lines is currently in agricultural or residential use, or in a forested condition. Agricultural operations are consistent with transmission line operations, and no prime farmland would be removed from production by the proposed transmission lines. Approximately 90 acres of forested land within the proposed transmission line ROWs would be cleared (see Section 4.4.2). No noticeable changes in land use or restrictions on uses of adjacent properties would result from the construction and operation of the proposed transmission lines.

Under the Action Alternative, the East Knox 161-kV Substation would be constructed in Knox County, utilizing about 28 acres of a 34.85-acre site that would be graded and graveled to accommodate the placement of substation facilities (see Section 2.2.1). This action would permanently convert this land to nonfarm use.

Soils on approximately 18 acres of the substation site are classified as prime farmland or farmland of local importance. In order to determine if farmland should be protected under the FPPA, a Farmland Conversion Impact Rating is normally completed using a Form AD 1006 (Appendix K). The maximum score is 260 points, and a score of 160 or better prompts the federal agency to consider means to protect or minimize impacts to farmland.

The NRCS completed the Farmland Conversion Impact Rating form for the proposed substation site assigning a rating of 73 (Appendix K). This rating is out of a possible maximum of 100 for the relative value of the prime farmland soils in the project area. Based on this input and assessment criteria that focused on the current status of the site, surrounding land use and the lack of impacts to nearby farming and agricultural support services, the substation site assessment score is 79. The sum of these two scores yields a total impact rating of 152 which falls below the score of 160 required to warrant consideration of other alternatives.

Farmland preservation, therefore, would not be considered a viable reason to alter TVA's actions associated with the construction of the proposed East Knox 161-kV Substation at the Site 4 location. Therefore, the proposed actions are not expected to result in significant direct, indirect, or cumulative impacts to prime farmland.

## **4.13 Socioeconomic and Environmental Justice**

### **4.13.1 No Action Alternative**

Under the No Action Alternative, no new facilities or transmission lines would be constructed. However, a decline in the reliability of electric service for some KUB customers would be likely in the future. Service problems and interruptions likely would gradually become more frequent and severe. These outages would have negative impacts on the ability of businesses in the area to operate. Residents of the area would also incur negative impacts from outages, including more frequent loss of heating or cooling, as well as other household activities such as cooking or clothes washing. These conditions would clearly diminish the quality of life for residents in the area and would have negative impacts on property values in the area. Any such impacts would negatively affect all populations in the region, especially the low-income residents.

### **4.13.2 Action Alternative**

Under the Action Alternative, the proposed transmission lines would help maintain reliable service in the area, thereby avoiding the potential increase in negative impacts from lack of reliability. Most homes in the area are located far enough from the proposed transmission lines that property values would not be impacted. Various studies have concluded that such transmission lines have little or no impact on the value of nearby properties, and that if impacts do occur, they tend to dissipate over time (Kroll and Priestley 1992; Des Rosier 2002; Electric Power Research Institute 2003; Pitts and Jackson 2007; Chalmers and Voorvaart 2009). Construction activity would be temporary and would generally have little impact on residents of the area.

The proposed transmission lines would be constructed largely adjacent to existing transmission lines, and the population in the areas near the proposed transmission lines is generally small. Minority population shares and poverty levels are both below the county, state, and national levels. In addition, no significant negative impacts are expected as a result of the project. Therefore, no disproportionate impacts to disadvantaged populations are likely.

## **4.14 Long-Term and Cumulative Effects**

Long-term effects are consequences of the proposed action that either persist for an extended period or that are manifested at a point later in time following the action. Cumulative effects are those effects that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of the entity undertaking those actions.

### **4.14.1 No Action Alternative**

As stated in Section 2.1.1, KUB could proceed with construction of the planned East Knox 161-kV Substation and could independently provide transmission service to power its new substation. However, if KUB were to choose not to construct the new substation or a transmission line to power the planned substation, the reliability of the power system in the areas of Knox, Sevier, and Jefferson counties would continue to degrade. This could lead to long-term and cumulative socioeconomic effects, as the area would not be especially attractive to new or additional residential, commercial, or industrial development.

#### 4.14.2 Action Alternative

In conducting the analysis of potential cumulative effects, reasonably foreseeable actions in the local area, as well as likely regional trends in environmental conditions, were considered. The predominant land use along the proposed 14.4-mile transmission routes are forest, residential, and agriculture. Other than construction of the planned East Knox 161-kV Substation, no other major land-clearing activities or large-scale changes in local land use are foreseeable. The proposed transmission line ROWs would occupy about 115 acres of new ROW and 55 acres of existing ROW, and construction of the lines would require clearing of about 90 acres of forest. The terrestrial communities are common locally and regionally; thus, any project-related cumulative effects to terrestrial life would be minor and insignificant.

Potential cumulative effects to surface water and groundwater quality and to aquatic life would be insignificant with the application of protective measures (such as BMPs and SMZs) during construction and maintenance of the proposed transmission lines. KUB's construction and operation of the proposed East Knox 161-kV Substation could affect surface water quality, depending on the control measures employed. Applicable requirements under the federal Clean Water Act would mitigate such impacts. Overall, any cumulative effects to local water quality and aquatic life resulting from TVA's proposed action would be insignificant.

As stated in Section 4.7.2, construction of the proposed transmission lines would affect about 0.27 acre of a forested wetland, resulting in conversion to scrub/shrub/emergent habitat, but the functional capability of this wetland would not be significantly reduced. Cumulatively, effects to local wetlands would be insignificant.

Although the proposed transmission line routes would cross several minor floodplain areas, the placement of transmission line structures within such areas would not cause an increase in flood hazard due to changes in flood elevations or in flow-carrying capacity. Several access roads would cross the 100-year floodplain, but they would be designed so that upstream flood elevations would not be increased. Therefore, any cumulative effects to floodplain functions would be insignificant.

TVA determined that no historic properties potentially eligible for inclusion in the NRHP would be adversely affected by the proposed undertaking. In letters dated July 16, 2008, October 3, 2011, June 20, 2012, and August 7, 2012, the SHPO concurred with TVA's findings and determinations (Appendix A).

Some visual effects would be experienced during TVA's construction of the proposed transmission lines and switching station, and during the construction of the adjacent substation by KUB. However, after construction, changes in visual character would be long term, but nevertheless insignificant. Because there are no reasonably foreseeable changes in the visual character of the area, the cumulative visual effects of TVA's action are expected to be minor and insignificant.

The provision of a local power supply under the Action Alternative would provide a long-term (20 years or more) solution to the power reliability problems in the Knox, Sevier, and Jefferson county area. Consequently, this could result in some localized long-term and cumulative socioeconomic benefits compared to the No Action Alternative, in that the area could accommodate residential, commercial, and industrial expansion or development.

#### 4.15 Postconstruction Effects

Transmission lines, like all other types of electrical wiring, generate both electric and magnetic fields (EMFs). The voltage on the conductors of a transmission line generates an electric field that occupies the space between the conductors and other conducting objects such as the ground, transmission line structures, or vegetation. A magnetic field is generated by the current (the movement of electrons) in the conductors. The strength of the magnetic field depends on the current, the design of the line, and the distance from the line.

The fields from a transmission line are reduced by mutual interference of the electrons that flow around and along the conductors and between the conductors; the result is even greater dissipation of the low energy. Most of this energy is dissipated on the ROW, and the residual very low amount is reduced to background levels near the ROW or energized equipment.

Magnetic fields can induce currents in conducting objects. Electric fields can create static charges in ungrounded, conducting materials. The strength of the induced current or charge under a transmission line varies with the strength of the electric or magnetic field, the size and shape of the conducting object, and whether the conducting object is grounded. Induced currents and charges can cause shocks under certain conditions by making contact with objects in an electric or magnetic field.

The proposed transmission lines, like other transmission lines, have been designed to minimize the potential for such shocks. This is done, in part, by maintaining sufficient clearance between the conductors and objects on the ground. Stationary conducting objects, such as metal fences, pipelines, and highway guardrails, that are near enough to the transmission line to develop a charge (typically, these would be objects located within the ROW) would be grounded by TVA to prevent them from being a source of shocks.

Other public interests and concerns have included potential interference with AM radio reception, television reception, satellite television, and implanted medical devices. Interference with radio or television reception is typically due to unusual failures of powerline insulators or poor alignment of the radio or television antenna and the signal source. Both conditions are correctable and would be repaired if reported to TVA.

Implanted medical devices historically had a potential for power equipment strong-field interference when they came within the influence of low-frequency, high-energy workplace exposure. However, the older devices and designs (those beyond 5 to 10 years old) have been replaced with different designs and different shielding that prevent potential for interference from external field sources up to and including the most powerful magnetic resonance imaging medical scanners. Unlike high-energy radio frequency devices that can still interfere with implanted medical devices, low-frequency and low-energy powered electric or magnetic devices no longer potentially interfere (American Medical Association 2007).

Research has been done on the effects of EMFs on animal and plant behavior, growth, breeding, development, reproduction, and production. Research has been conducted in the laboratory and under environmental conditions, and no adverse effects or effects on health or the above considerations have been reported for the low-energy power frequency fields (World Health Organization [WHO] 2007a). Effects associated with ungrounded, metallic object's static charge accumulation and discharge in dairy facilities have been

found when the connections from a distribution line meter have not been properly installed on the consumer's side of a distribution circuit.

There is some public concern as to the potential for adverse health effects that may be related to long-term exposure to EMFs. A few studies of this topic have raised questions about cancer and reproductive effects on the basis of biological responses observed in cells or in animals or on associations between surrogate measures of powerline fields and certain types of cancer. Research has been ongoing for several decades.

The consensus of scientific panels reviewing this research is that the evidence does not support a cause-and-effect relationship between EMFs and any adverse health outcomes (American Medical Association 1994; National Research Council 1997; National Institute of Environmental Health Sciences [NIEHS] 2002). Some research continues on the statistical association between magnetic field exposure and a rare form of childhood leukemia known as acute lymphocytic leukemia. A review of this topic by the WHO (International Association for Research on Cancer 2002) concluded that this association is very weak, and there is inadequate evidence to support any other type of excess cancer risk associated with exposure to EMFs.

TVA follows medical and health research related to EMFs, along with media coverage and reports that may not have been peer reviewed by scientists or medical personnel. No controlled laboratory research has demonstrated a cause-and-effect relationship between low-frequency electric or magnetic fields and health effects or adverse health effects, even when using field strengths many times higher than those generated by power lines. Statistical studies of overall populations and increased use of low-frequency electric power have found no associations (WHO 2007b).

Neither medical specialists nor physicists have been able to form a testable concept of how these low-frequency, low-energy power fields could cause health effects in the human body where natural processes produce much higher fields. To date, there is no agreement in the scientific or medical research communities as to what, if any, electric or magnetic field parameters might be associated with a potential health effect in a human or animal. There are no scientifically or medically defined safe or unsafe field strengths for low-frequency, low-energy power substation or line fields.

The current and continuing scientific and medical communities' position regarding the research and any potential for health effects from low-frequency power equipment or line fields is that there is no reproducible or conclusive data demonstrating an effect or an adverse health effect from such fields (WHO 2007c). In the United States, national organizations of scientists and medical personnel have recommended no further research on the potential for adverse health effects from such fields (American Medical Association 1994; United States Department of Energy 1996; NIEHS 1998).

Although no federal standards exist for maximum EMF strengths for transmission lines, two states (New York and Florida) have regulations limiting magnetic field strength at the edge of a ROW. Florida's regulation is the more restrictive of the two, with field levels being limited to 150 milligauss at the edge of the ROW for lines with voltages of 230 kV and less. The expected magnetic field strengths at the edge of the proposed ROW would fall well below these standards. Consequently, the construction and operation of the proposed transmission lines are not anticipated to cause any significant impacts related to EMFs.

#### **4.15.1 Lightning Strike Hazard**

TVA transmission lines are built with overhead ground wires that lead a lightning strike into the ground for dissipation. Thus, a safety zone is created under the ground wires at the top of transmission line structures and along the line for at least the width of the ROW. The NESC is strictly followed when installing, repairing, or upgrading TVA lines or equipment. Transmission line structures are well grounded, and the conductors are insulated from the structure. Therefore, touching a structure supporting a transmission line poses no inherent shock hazard.

#### **4.15.2 Transmission Structure Stability**

The steel-pole structures that would be used on the proposed 161-kV transmission lines (see Figure 2-1) have demonstrated a good safety record. They are not prone to rot or crack, like wooden poles, nor are they subject to substantial storm damage due in part to increasingly stringent NESC loading criteria. They have an expected life cycle of about 50 years.

Additionally, as mentioned in Section 2.2.2.1, all TVA transmission structures are visually examined at least once a year. Thus, the proposed structures do not pose any significant physical danger. TVA does not typically construct barricades or fences around structures.

### **4.16 Summary of TVA Commitments and Proposed Mitigation Measures**

The following routine measures would be employed to reduce the potential for adverse environmental effects during site preparation for the proposed East Knox 161-kV Substation site and construction of the proposed transmission lines and switching station.

- To retard the introduction and spread of invasive species in the project area, TVA would employ the standard operating procedure of revegetating with noninvasive plant species.
- Wet-weather conveyances that could be affected by the proposed transmission line routes would be protected by implementing standard BMPs, as identified in Muncy (1999).
- Twelve perennial and five intermittent streams that would be crossed by the proposed transmission lines, as well as three ponds, would be protected by the implementation of Standard Stream Protection (Category A), as defined in Muncy (1999) and Appendix I.
- TVA would utilize BMPs, as described by Muncy (1999), to minimize erosion during construction and operation.
- BMPs dealing with herbicide application would be used to prevent impacts to groundwater.
- In areas requiring chemical treatment, only USEPA-registered herbicides would be used, in accordance with label directions that are designed, in part, to restrict applications near receiving waters and to prevent unacceptable aquatic impacts.

- To minimize adverse impacts on natural and beneficial floodplain values, the ROWs would be revegetated where natural vegetation is removed, as described in TVA's *Environmental Quality Protection Specifications for Transmission Line Construction* (Appendix F).
- To minimize adverse floodplain impacts, any new road construction in the floodplain would be done in such a manner that upstream flood elevations would not be increased.

The following nonroutine measures would be implemented during construction, operation, and maintenance of the proposed transmission lines to reduce the potential for adverse environmental effects.

- Any tree clearing activities between Carter Mill Drive and Cooper Road that are associated with construction and maintenance practices of the Volunteer-East Knox 161-kV Transmission Line ROW would occur between November 15 and March 31.
- Any tree clearing activities in areas defined as immediately north and south of I-40 that are associated with construction and maintenance practices of the Dumplin Valley-Nixon Road Loop line ROW would occur between November 15 and March 31.
- TVA would not place any transmission line structures within the boundary of Site 40KN303.
- TVA would conduct all work within the boundaries of Site 40KN303 related to the construction, operation, or maintenance of the transmission line during dry conditions or with low, ground-pressure tire equipment so that no rutting or excavation would occur.
- TVA would provide a vegetative screening along a portion of the western boundary of the East Knox 161-kV Substation site to reduce the visual effects of the new facility.

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## CHAPTER 5

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Involvement: Cultural Resources

## CHAPTER 6

### 6.0 ENVIRONMENTAL ASSESSMENT RECIPIENTS AND PERSONS TO WHOM COPIES ARE SENT

#### Federal Agencies

- National Park Service
- United States Fish and Wildlife Service

#### State Agencies

- Tennessee Department of Environment and Conservation
- Tennessee Historical Commission

#### Federally Recognized Tribes

- Absentee Shawnee Tribe of Oklahoma
- Alabama-Quassarte Tribal Town
- The Cherokee Nation
- The Chickasaw Nation
- Choctaw Nation of Oklahoma
- Eastern Band of Cherokee Indians
- Eastern Shawnee Tribe of Oklahoma
- Jena Band of Choctaw Indians
- Kialegee Tribal Town
- The Muscogee (Creek) Nation
- Mississippi Band of Choctaw Indians
- Seminole Nation of Oklahoma
- Seminole Tribe of Florida
- The Shawnee Tribe
- Thlopthlocco Tribal Town
- United Keetoowah Band of Cherokee Indians in Oklahoma

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## CHAPTER 7

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