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FINAL ENVIRONMENTAL ASSESSMENT

GALLATIN FOSSIL PLANT-ANGELTOWN 161-KILOVOLT TRANSMISSION LINE AND SWITCHING STATION - POWER SYSTEM IMPROVEMENTS

Sumner County, Tennessee

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

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TABLE OF CONTENTS

1.0 PURPOSE OF AND NEED FOR ACTION 1

1.1. Proposed Action – Improve Power Supply 1
1.2. Need for the Proposed Action 1
1.3. Decisions 2
1.4. Other Pertinent Environmental Reviews or Documentation 2
1.5. The Scoping Process and Public Involvement 6
1.6. Issues to be Addressed 9
1.7. Necessary Federal Permits or Licenses 10

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION 11

2.1. Alternatives 11
2.1.1. Alternative A – Do Not Improve the TVA Power Supply System (No Action Alternative) 11
2.1.2. Alternative B – Construct and Operate New 161-kV Transmission Lines and a New Switching Station and Modify Various Existing TVA Facilities (Action Alternative) 12
2.1.3. Other Alternatives Considered But Eliminated 14
2.1.3.1. Upgrade Existing Transmission Lines and Install Capacitor Banks 14
2.1.3.2. Construct and Operate a New Transmission Line 14
2.1.3.3. Construct Paradise-Wilson 500-kV Transmission Line and Bowling Green 500-kV Substation 14
2.1.3.4. Construct and Operate Other Transmission Lines 14
2.1.3.5. Install Underground Utility Lines 15
2.2. Construction, Operation, and Management of the Proposed Transmission Line and Switching Station 15
2.2.1. Transmission Line Construction 15
2.2.1.1. Right-of-Way Acquisition and Clearing 15
2.2.1.2. Access Roads 16
2.2.1.3. Construction Assembly Areas 16
2.2.1.4. Structures and Conductors 17
2.2.1.5. Conductor and Ground Wire Installation 19
2.2.2. Switching Station Construction 19
2.2.3. Operation and Maintenance 20
2.2.3.1. Inspection 20
2.2.3.2. Vegetation Management 20
2.2.3.3. Structure Replacement 21
2.3. Siting Process 21
2.3.1. Definition of Study Area 21
2.3.2. Data Collection 24
2.3.3. Establish and Apply Siting Criteria 25
2.3.3.1. Transmission Line Routing Criteria 25
2.3.3.2. Switching Station Site Criteria 26
2.3.4. Development of General Route Options and Potential Transmission Line Routes 27
2.3.5. Development of Potential Switching Station Sites 30
2.3.6. Route Identification and Evaluation 31

2.4. Comparison of Alternative Routes and Switching Station Sites 32
2.4.1. Alternative Transmission Line Segments as Related to Alternative Routes 32
2.4.2. Alternative Switching Station Sites 33
2.4.3. Identification of Preferred Transmission Line Route and Switching Station 34
2.4.4. Modifications at Existing TVA Facilities 35
2.5. The Preferred Alternative 36

3.0 AFFECTED ENVIRONMENT 37

3.1. Groundwater and Geology 37
3.2. Surface Water 38
3.3. Aquatic Ecology 38
3.4. Vegetation 40
3.5. Wildlife 42
3.6. Endangered and Threatened Species 43
3.6.1. Aquatic Animals 43
3.6.2. Plants 44
3.6.3. Terrestrial Animals 45
3.7. Wetlands 46
3.8. Floodplains 48
3.9. Prime Farmland 48
3.10. Aesthetics 48
3.10.1. Visual Resources 48
3.10.2. Noise 50
3.10.3. Odors 51
3.11. Recreation, Parks, and Natural Areas 51
3.12. Historical and Archaeological Resources 52
3.13. Socioeconomics 53
3.14. Environmental Justice 54

4.0 ENVIRONMENTAL CONSEQUENCES 55

4.1. Groundwater and Geology 55
4.1.1. No Action Alternative 55
4.1.2. Action Alternative 55
4.2. Surface Water 55
4.2.1. No Action Alternative 55
4.2.2. Action Alternative 55
4.3. Aquatic Ecology 56
4.3.1. No Action Alternative 56
4.3.2. Action Alternative 56
4.4. Vegetation 57
4.4.1. No Action Alternative 57
4.4.2. Action Alternative 57
4.5. Wildlife 58
4.5.1. No Action Alternative 58
4.5.2. Action Alternative 58
4.6. Endangered and Threatened Species 59
4.6.1. No Action Alternative 59

4.6.2. Action Alternative 60
4.6.2.1. Aquatic Animals 60
4.6.2.2. Plants 60
4.6.2.3. Terrestrial Animals 61
4.7. Wetlands 62
4.7.1. No Action Alternative 62
4.7.2. Action Alternative 62
4.8. Floodplains 63
4.8.1. No Action Alternative 63
4.8.2. Action Alternative 63
4.9. Prime Farmland 64
4.9.1. No Action Alternative 64
4.9.2. Action Alternative 64
4.10. Aesthetics 64
4.10.1. No Action Alternative 64
4.10.2. Action Alternative 65
4.10.2.1. Visual Resources 65
4.10.2.2. Noise 66
4.10.2.3. Odors 67
4.11. Recreation, Parks, and Natural Areas 68
4.11.1. No Action Alternative 68
4.11.2. Action Alternative 68
4.12. Historical and Archaeological Resources 69
4.12.1. No Action Alternative 69
4.12.2. Action Alternative 69
4.13. Socioeconomics 69
4.13.1. No Action Alternative 69
4.13.2. Action Alternative 70
4.14. Environmental Justice 70
4.14.1. No Action Alternative 70
4.14.2. Action Alternative 71
4.15. Post-Construction Effects 71
4.15.1. Electric and Magnetic Fields 71
4.15.2. Lightning Strike Hazard 73
4.15.3. Transmission Structure Stability 74
4.15.4. Other Impacts 74
4.16. Unavoidable Adverse Impacts 74
4.17. Relationship of Short-Term Uses and Long-Term Productivity 74
4.18. Irreversible and Irretrievable Commitments of Resources 75
4.19. Summary of TVA Commitments and Proposed Mitigation Measures 75

5.0 LIST OF PREPARERS 77

5.1. NEPA Project Management 77
5.2. Other Contributors 77

6.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES ARE SENT 81

7.0 LITERATURE CITED 83

LIST OF APPENDICES

Appendix A – Correspondence 89

Appendix B – Tennessee Valley Authority Right-of-Way Clearing Specifications 107

Appendix C – Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Line Construction 113

Appendix D – Tennessee Valley Authority Transmission Construction Guidelines Near Streams 119

Appendix E – Tennessee Valley Authority Site Clearing and Grading Specifications 125

Appendix F – Tennessee Valley Authority Substation Lighting Guidelines 131

Appendix G – Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Substation or Communications Construction 135

Appendix H – Tennessee Valley Authority Environmental Protection Procedures Right-of-Way Vegetation Management Guidelines 141

Appendix I – Analysis of the Alternative Transmission Line Routes and Switching Station Sites for the Gallatin Fossil Plant-Angeltown 161-kV Transmission Line and Switching Station Power System Improvement Project in Sumner County, Tennessee 147

Appendix J – Stream Crossings Along the Proposed Gallatin-Angeltown 161-kV Transmission Line, Access Roads, and Switching Station Site in Sumner County, Tennessee 167

Appendix K – Nonnative, Noninvasive Species Suitable For Public Use Areas, Erosion Control/Stabilization, and Wildlife Habitat Plantings 175

Appendix L – Prime Farmland Analysis – U.S. Department of Agriculture Farmland Conversion Impact Assessment and Farmland Classification of the Proposed Angeltown 161-kV Switching Station Site in Sumner County, Tennessee 181

Appendix M – Tennessee Valley Authority Visual Resources – Scenic Value Criteria for Scenery Inventory and Management 187

LIST OF TABLES

Table 2-1. Top 20 Alternative Route Corridors 30

Table 2-2. Top 20 Alternative Route Corridor Scores 32

Table 3-1. Riparian Condition of Streams Located Within the Proposed 161-kV Transmission Line Right-of-Way 40

Table 3-2. Invasive Plant Species Observed Within the Proposed 161-kV Transmission Line Right-of-Way and on the Switching Station Site 41

Table 3-3. Federally and State-Listed Aquatic Species Known From Sumner County and/or Within a 10-Mile Radius of the Proposed Project Area 43

Table 3-4. Federally and State-Listed Species Known From Sumner County, Tennessee, and/or Within a 5-Mile Radius of the Proposed Project Area 45

Table 3-5. Federally and State-Listed Terrestrial Animal Species From Sumner County, Tennessee, and/or Within a 3-Mile Radius of the Proposed Project Area 45

Table 3-6. Wetlands Within the Proposed Gallatin-Angeltown 161-kV Transmission Line Right-of-Way and Along Proposed Access Roads 47

Table 3-7. Estimated Annoyance From Background Noise 50

Table 3-8. Population of Census Tracts and Block Groups Along Proposed Route, 2000 54

Table 3-9. Minority and Low-income Populations, 2000 54

LIST OF FIGURES

Figure 1-1. Proposed Gallatin-Angeltown 161-kV Transmission Line and Angeltown 161-kV Switching Station in Sumner County, Tennessee 3

Figure 1-2. Existing and Proposed Transmission Facilities in the Gallatin-Angeltown 161-kV Transmission Line and Switching Station Project Study Area 5

Figure 1-3. Proposed Alternative Route Segments for the 161-kV Transmission Line and the Proposed Switching Station Sites in Sumner County, Tennessee 7

Figure 2-1. Proposed Angeltown 161-kV Switching Station Layout in Sumner County, Tennessee 13

Figure 2-2. Examples of Double-Circuit Single and Double Steel-Pole 161-kV Transmission Line Structures 17

Figure 2-3. Examples of Single-Circuit Single and Double Steel-Pole 161-kV Transmission Line Structures 18

Figure 2-4. Example of a Single-Circuit Triple Steel-Pole 161-kV Transmission Line Structure 18

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ACRONYMS, ABBREVIATIONS, AND GLOSSARY OF TERMS USED

§	Section
acre	A unit measure of land area equal to 43,560 square feet
APE(s)	Area(s) of potential effects
ARPA	Archaeological Resources Protection Act
BMPs	Best management practices, i.e., accepted construction practices designed to reduce environmental effects
CT	Census Tract
CFR	Code of Federal Regulations
conductors	Cables that carry electrical current
constraint	An object or area that could restrict routing of a transmission line or locating of other equipment
constraint map	A GIS-based map that identifies various constraints within the study area (e.g., roads, streams, wetlands, houses and other buildings, historic sites, cemeteries)
CRM	Cumberland River Mile
cultural resources	Archaeological and historic resources
danger tree	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
dB	Decibels
dBA	A-weighted decibel
DBH	Diameter at breast height
distribution line	A series of electrical conductors (“wires”) and their supporting structures used to transfer electric power locally between substations or from substations to power consumers
DNL	Day/night levels
double circuit	A double-circuit transmission line is where two circuits composed of three conductors each are carried on a tower or pole line
EA	Environmental assessment
easement	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
EMF(s)	Electric and magnetic field(s)
endangered species	A species in danger of extinction throughout all or a significant part of its range
EO	Executive order
ESA	Endangered Species Act
feller-buncher	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 prevents trees falling into a sensitive area, such as a wetland
FICON	Federal Interagency Committee on Noise
forb	A herbaceous plant other than a grass or a fern
FP	Fossil plant

GAF	Gallatin Fossil Plant
GIS	Geographic information system
groundwater	Water located beneath the ground surface in the soil pore spaces or in the pores and crevices of rock formations
guy	A cable connecting a structure to an anchor that helps support the structure
HUD	United States Department of Housing and Urban Development
I-	Interstate Highway
kV	Kilovolt (1 kV equals 1,000 volts)
load	That portion of the entire power in a network consumed within a given area; also synonymous with “demand” in a given area
loop	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
MSA	Metropolitan Statistical Area
n.d.	Indicates “no date,” or date which Web site was accessed is unknown
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NWI	National Wetlands Inventory
opportunity	An area free of constraints
OSHA	Occupational Safety and Health Administration
outage	An interruption of the electric power supply to a user
PI	Point(s) of intersection; the point at which a transmission line changes direction (or angles)
right(s)-of-way (ROWs)	Corridor(s) containing a transmission line
riparian	Related to or located on the banks of a river or stream
ROC	Regional Operations Center
Regional Transportation Authority	A nonprofit organization in Nashville funded by both the City of Nashville and the State of Tennessee
runoff	That portion of total rainfall that eventually enters a stream or river
SHPO	State Historic Preservation Officer
single-circuit	A single-circuit transmission line is where one circuit composed of three conductors is carried on a tower line
SMZs	Streamside management zones
SOC	System Operations Center
SR	State route

structure	A pole or tower that supports a transmission line
substation	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
surface water	Water collecting on the ground or in a stream, river, lake, or wetland; it is naturally lost through evaporation and seepage into the groundwater
switch	A device used to complete or break an electrical connection
switching station	A facility connected to a transmission line used to change line connections or sectionalize lines
tap line	An electric power line that connects an existing transmission line to a substation
tap point	A connection point between a tap line and an existing transmission line
TDEC	Tennessee Department of Environment and Conservation
transmission line	A series of electrical conductors (“wires”) and their supporting structures used to transmit electric power from one location to another
TVA	Tennessee Valley Authority
TVARAM	TVA Rapid Assessment Method for categorizing wetlands, a version of the Ohio Rapid Assessment Method designed specifically for the TVA region
TWRA	Tennessee Wildlife Resources Agency
US	United States Highway
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
wetland	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
WHO	World Health Organization
WMA(s)	Wildlife management area(s)
WWC(s)	Wet-weather conveyance(s)

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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 the Middle Tennessee area by constructing and operating approximately 19.6 miles of new 161-kilovolt (kV) transmission line and a new switching station (Figure 1-1). TVA would complete construction and begin operation of the proposed transmission line and switching station in Sumner County, Tennessee, by June 2012.

The proposed project would add approximately 3.7 miles of 161-kV transmission line to the vacant side of the existing double-circuit Gallatin Fossil Plant (FP)-Hoeganaes 161-kV Transmission Line and rebuild about 2.5 miles of the existing Gallatin-Hartsville 69-kV Transmission Line with a new double-circuit 161-kV transmission line. This 6.2-mile section of transmission line would be constructed on approximately 75 acres of existing, 100-foot-wide right-of-way (ROW). In addition, TVA would construct about 13.4 miles of single-circuit transmission line on new 100-foot-wide ROW occupying about 163 acres.

The transmission line would utilize mostly single- and double-pole steel structures, as well as a few three-pole structures. The transmission line would connect the Gallatin Fossil Plant (GAF) to a new TVA Angeltown 161-kV Switching Station (Figures 1-1 and 1-2). The switching station would occupy 10 acres and be located adjacent to TVA's existing Portland-Westmoreland 161-kV Transmission Line. TVA would also construct a new 750-foot-long section of transmission line to connect the switching station to the Portland-Westmoreland 161-kV Transmission Line.

In order to facilitate the operation of the new transmission line and switching station, TVA would install a new 161-kV breaker and associated relay equipment at the GAF switchyard; replace relays at the Portland 161-kV Switching Station and the Lafayette 161-kV Substation; and add new telecommunications connections at the Wilson 500-kV and South Nashville 161-kV Substations. The TVA system's mapboard at the System Operations Center (SOC) and Regional Operations Center (ROC) in Chattanooga would be modified to include the names and numbers of the new transmission lines and switching station.

1.2. Need for the Proposed Action

TVA plans its transmission system according to industry-wide standards provided by the North American Electric Reliability Corporation (NERC) and the National Electrical Safety Code (NESC). The standards state that the power supply system must be able to serve customer loads with adequate voltage and no equipment damage while maintaining adequate line clearances.

Both the East Gallatin-Portland and the Gallatin FP-Lafayette 161-kV Transmission Lines have been upgraded within the last three years. These lines, as well as other major transmission facilities in the area, are shown in Figure 1-2. Within the region, however, there is a growing demand for electric power that is causing electric loads to continue to increase. Models forecast that based on normal electric load growth, by summer 2011, the potential failure of the East Gallatin-Portland 161-kV Transmission Line would cause the Gallatin FP-Lafayette 161-kV Transmission Line to overload. This could result in the

voltage at the East Gallatin 161-kV Substation dropping below TVA transmission planning criteria.

This event would seriously jeopardize electrical service to a large number of electric customers in the Gallatin, Portland, and Lafayette areas. In addition, both of these transmission lines, at different times in the past, have been lost from service because of tornado damage. Based on the current projected load growth, should either of these lines be lost again, the remaining line would very likely overload.

To ensure that the Gallatin, Portland, and Lafayette areas have continuous, reliable service, TVA needs to provide additional electric service to the area. The construction of a transmission line, switching station, and a short connection line would meet this need by relieving the overloading of existing equipment and improving reliability in the Sumner County area and thereby allowing TVA to meet NERCTransmission Planning Reliability Standards.

Additionally, the proposed project would allow TVA to ensure the area continues to be provided with a reliable, affordable source of power for continued economic health and residential and commercial growth in the area.

1.3. Decisions

The primary decision before TVA is whether to provide additional electric power to the Gallatin, Portland, and Lafayette areas by constructing two new 161-kV transmission lines and a switching station. If the proposed transmission lines and a switching station are to be built, other secondary decisions are involved including the determination of:

- The timing of improvements
- The most suitable route for the transmission lines
- The most suitable site for the switching station
- The implementation of any necessary mitigation and/or monitoring measures to meet TVA standards and 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 1995, TVA completed *Energy Vision 2020: An Integrated Resource Plan and Programmatic Environmental Impact Statement* (TVA 1995). This study, which addressed short- and long-term strategies that would enable TVA to meet the needs of its customers for electricity through the year 2020, includes a description of TVA's transmission system.

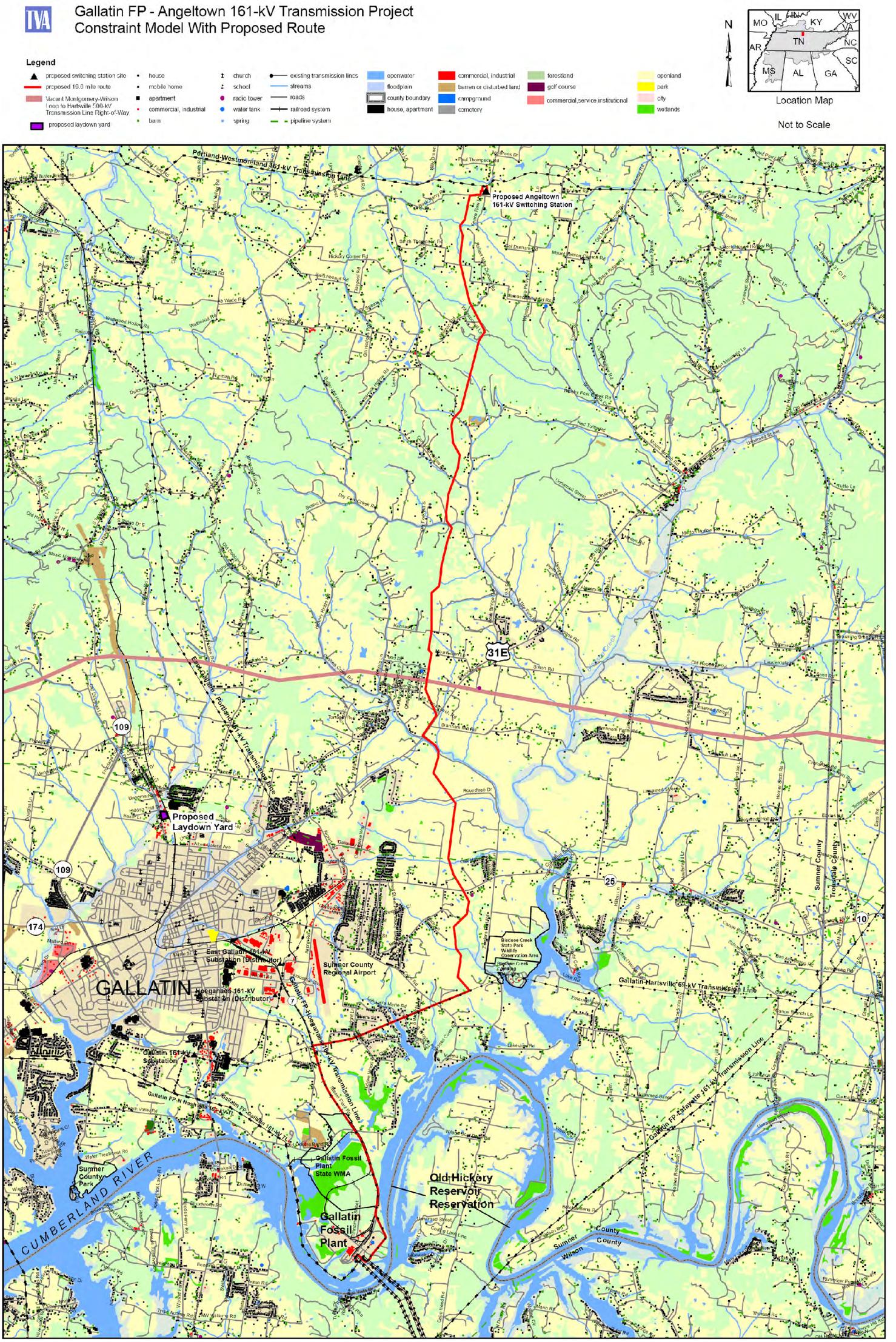

Figure 1-1. Proposed Gallatin-Angeltown 161-kV Transmission Line and Angeltown 161-kV Switching Station in Sumner County, Tennessee

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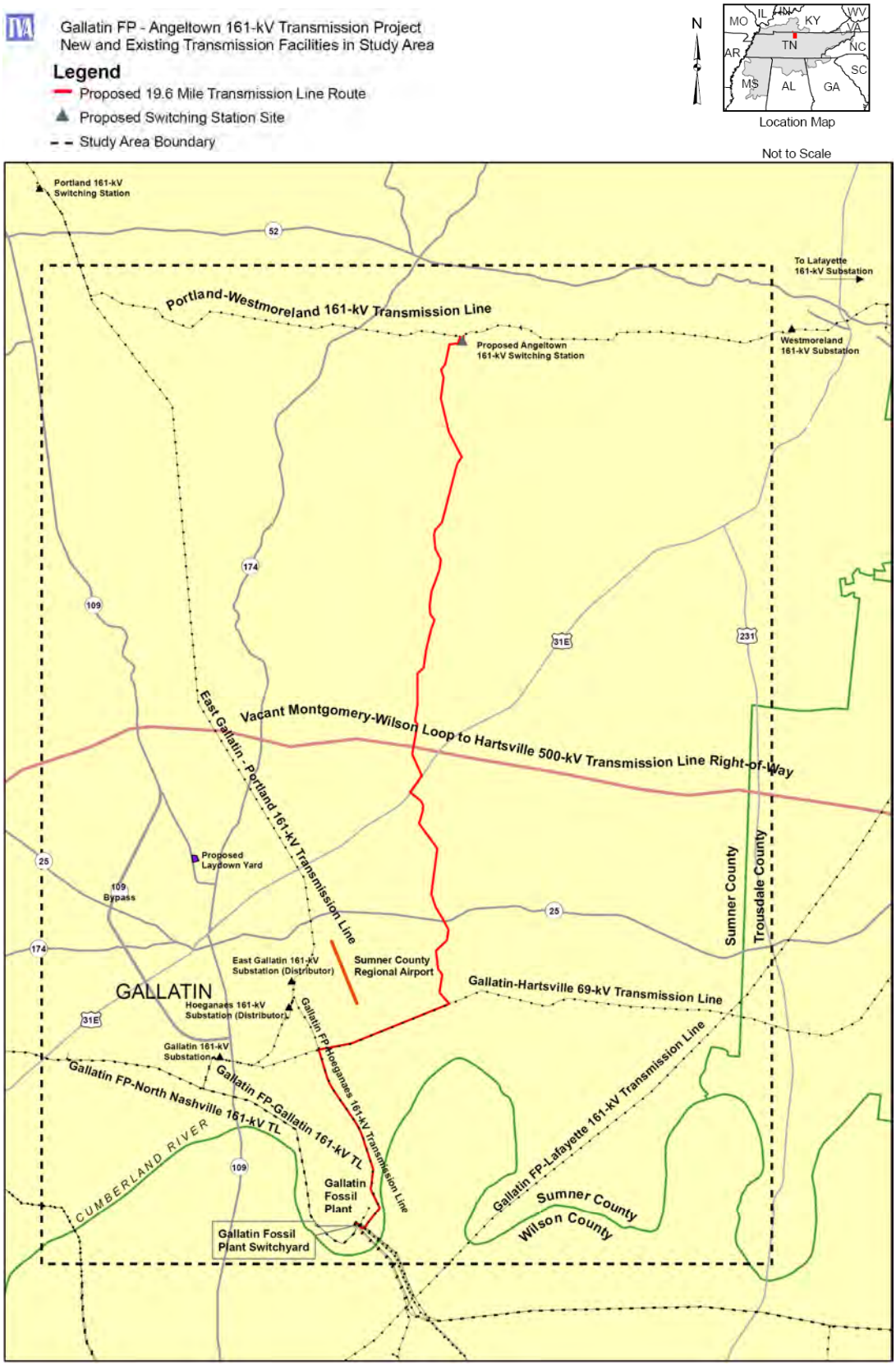

Figure 1-2. Existing and Proposed Transmission Facilities in the Gallatin-Angeltown 161-kV Transmission Line and Switching Station Project Study Area

1.5. The 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.

- Absentee Shawnee Tribe of Oklahoma
- Alabama-Quassarte Tribal Town
- Cherokee Nation
- Chickasaw Nation
- Eastern Band of the Cherokee Indians
- Eastern Shawnee Tribe of Oklahoma
- Kialegee Tribal Town
- Muscogee (Creek) Nation of Oklahoma
- Shawnee Tribe
- Tennessee Department of Archives and History
- Tennessee Department of Environment and Conservation
- Tennessee Natural Heritage Program
- Thlopthlocco Tribal Town
- United Keetoowah Band of Cherokee Indians in Oklahoma
- U.S. Fish and Wildlife Service

TVA also conducted an internal review by a network of designated environmental specialists. This proposal was reviewed in accordance with Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Protection of Wetlands), EO 12372 (Intergovernmental Review), the Farmland Protection Policy Act, the Archaeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), the National Historic Preservation Act (NHPA), the Endangered Species Act (ESA), and Section 404 of the Clean Water Act. Correspondence received related to this coordination is contained in Appendix A.

TVA developed a public communication plan that included a Web site with information about the project, a map of the alternative routes, and feedback mechanisms. Public officials were briefed on the proposed transmission line and switching station project. A total of 710 property owners who could potentially be affected by any of the route alternatives were invited to a project open house. TVA used local news outlets and placed notices in the local newspapers to notify other interested members of the public of the open house. TVA held the open house on December 4, 2008, at the Cragfont Baptist Church in Castalian Spring, Tennessee, and 320 people attended.

At the open house, TVA presented three alternative switching station sites and a network of 49 different line segments that comprise portions of 102 potential alternative transmission line routes (Figure 1-3) to the public for comment. These segments, the two segments added following the open house, and the switching station sites are described in Section 2.3.4 and 2.3.5, respectively. The primary concern expressed by the public was the impact

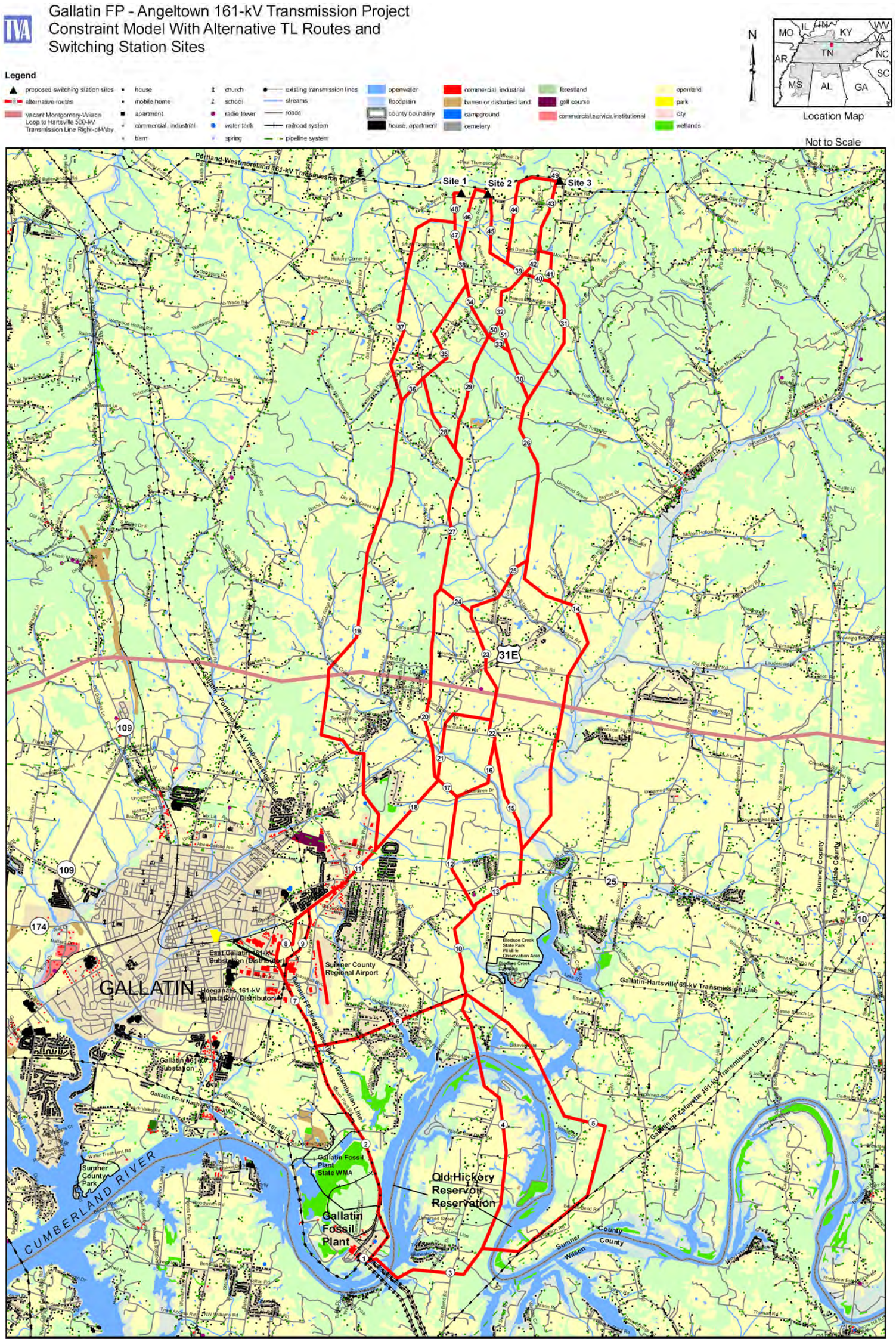

Figure 1-3 Proposed Alternative Route Segments for the 161-kV Transmission Line and the Proposed Switching Station Sites in Sumner County, Tennessee

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of the new line to residential and commercial development in the area. Additionally, because a major natural gas pipeline had recently been installed in the area, some people were especially guarded about another major project in their community. Open house attendees also voiced concerns relative to health issues, property value, and impacts of the proposed line on visual quality, along with natural, historical, and archaeological resources.

Typically, TVA provides a 30-day public comment period following the open house in which public comments are accepted on the alternative transmission line routes, switching station locations, and other issues. However, because the open house was held just after the Thanksgiving holiday and just before the Christmas and New Year's holidays, TVA wanted to ensure that everyone had an opportunity to express his or her concerns. TVA extended the comment period by accepting public comments until the end of January 2009. A toll-free phone number and facsimile number were available to facilitate comments.

During the comment period, numerous landowners and members of the public contacted TVA to express their concerns. The primary concerns included the following:

- The effect on residences in the Wilson County area near Cairo Bend Road
- The expansion of the existing Sumner County Regional Airport and the potential effect on the airport glide path
- The potential impacts to existing farmland and how the line would affect future development plans
- The impact of the addition of another transmission line and how that would affect property already utilized for other utility easements

At the conclusion of the extended comment period, TVA made slight adjustments to the segments based on these and other comments received.

1.6. Issues to be Addressed

TVA identified resources that could potentially be affected by the proposed transmission line route alternatives or switching station locations 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 resource issues that are addressed in this environmental assessment (EA) are the following:

- Water quality for both surface water and groundwater
- Aquatic ecology
- Vegetation
- Wildlife
- Endangered and threatened species and their critical habitats
- Wetlands
- Floodplains
- Prime farmland
- Visual resources
- Managed areas and ecologically significant sites
- Recreation
- Archaeological and historic resources
- Socioeconomics
- Environmental Justice

Potential effects related to air quality, hazardous and nonhazardous wastes, and health and safety, because of the nature of the action, did not require detailed evaluation.

1.7. Necessary Federal Permits or Licenses

Permits would be required from the State of Tennessee for discharge of construction site storm water associated with the construction of the transmission line and switching station. TVA would prepare the required erosion and sedimentation control plans and coordinate them with the appropriate state and local authorities. A permit would also be required for burning trees and other combustible materials removed during transmission line construction. A Section 404 Nationwide Permit would be obtained from the United States Army Corps of Engineers (USACE) if construction activities would result in the discharge of dredge or fill into waters of the United States. Permits would be required from the Tennessee Department of Transportation for crossing state highways during transmission line construction.

CHAPTER 2

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As described in Chapter 1, TVA proposes to improve the existing power supply system in the Sumner County, Tennessee, area by constructing and operating approximately 19.6 miles of new 161-kV transmission line and a new switching station.

This chapter contains the following five major sections:

- Description of Alternatives
- Description of Construction, Operation, and Maintenance of the Proposed Transmission Lines and Switching Station
- Project Siting Process
- Comparison of the Alternative Routes and Switching Station Sites
- Identification of the Preferred Alternative

A description of all alternatives evaluated and additional background information about the switching station and transmission line construction, operation, and maintenance are provided.

2.1. Alternatives

Two alternatives—No Action and Action—are addressed in this EA. Under the No Action Alternative, TVA would not undertake the proposed action. Under the Action Alternative, TVA would construct the proposed transmission lines and a new switching station.

During the development of this proposal, other alternatives were considered involving the construction of new transmission lines and, in one case, a substation, in nearby areas. These other alternatives had high costs, associated environmental impacts, and did not meet the project purpose and need as well as the Action Alternative does. The other alternatives considered are briefly described below in Section 2.1.3.

2.1.1. Alternative A – Do Not Improve the TVA Power Supply System (No Action Alternative)

Under the No Action Alternative, TVA would not construct approximately 19.6 miles of proposed transmission lines or a switching station, and the TVA power system in the Gallatin, Portland, and Lafayette areas of Middle Tennessee would continue under the current operating conditions. Based on normal load growth projections, by summer 2011, the failure of the East Gallatin-Portland 161-kV Transmission Line would result in an overload of the Gallatin FP-Lafayette 161-kV Transmission Line, and under-voltage problems could result at the East Gallatin 161-kV Substation. As a result, the TVA power system would operate with decreasing reliability in the Gallatin, Portland, and Lafayette areas, and thus, TVA would not meet NERC Transmission Planning Reliability Standards.

2.1.2. Alternative B – Construct and Operate New 161-kV Transmission Lines and a New Switching Station and Modify Various Existing TVA Facilities (Action Alternative)

Under the Action Alternative, TVA would upgrade the power supply system in the Gallatin, Lafayette, and Portland area of Middle Tennessee by constructing an approximately 19.6-mile-long new Gallatin FP-Angeltown 161-kV Transmission Line, a new Angeltown 161-kV Switching Station, and a 750-foot-long connector line to the proposed switching station (shown on Figures 1-1 and 1-2).

The proposed project would add approximately 3.7 miles of 161-kV transmission line to the vacant side of the existing double-circuit Gallatin FP-Hoeganaes 161-kV Transmission Line and rebuild about 2.5 miles of the existing Gallatin-Hartsville 69-kV Transmission Line with a new double-circuit 161-kV transmission line. This 6.2-mile section of transmission line would be constructed on approximately 75 acres of existing, 100-foot-wide ROW. In addition, TVA would construct about 13.4 miles of single-circuit transmission line on new 100-foot-wide ROW occupying about 163 acres (Figures 1-1 and 1-2).

The proposed switching station would be located on a 10-acre site in the Angeltown area adjacent to the existing Portland-Westmoreland 161-kV Transmission Line (Figure 2-1). This existing transmission line would be connected to the new switching station by approximately 750 feet of new 161-kV transmission line. The proposed Gallatin FP-Angeltown 161-kV Transmission Line would connect GAF with the new switching station.

Additional information detailing the implementation of the Action Alternative, as well as how the most suitable transmission line route and switching station site were determined, is provided in the following sections:

- Section 2.2. Construction, Operation, and Management of the Proposed Transmission Line and Switching Station
- Section 2.3. Siting Process
- Section 2.4. Comparison of Alternative Routes and Switching Station Sites

New access roads would be required for the construction and maintenance of the proposed transmission line. Prior to construction, TVA would also remove two barns that are currently located on the proposed ROW.

In order to facilitate the operation of the new transmission line and switching station, TVA would also install a new 161-kV breaker and associated relay equipment at the GAF switchyard; replace relays at the Portland 161-kV Switching Station and Lafayette 161-kV Substation; and add new telecommunications connections at the Wilson 500-kV and South Nashville 161-kV Substations. The TVA system's mapboard at the SOC and ROC in Chattanooga would be modified to include the names and numbers of the new transmission lines and switching station.

Implementation of this alternative would relieve potential overloading of equipment and provide another source of power to the area to ensure a reliable power supply will be available to serve the electric power needs in the Middle Tennessee areas of Gallatin, Lafayette, and Portland.

Figure 2-1. Proposed Angeltown 161-kV Switching Station Layout in Sumner County, Tennessee

2.1.3. Other Alternatives Considered But Eliminated

2.1.3.1. Upgrade Existing Transmission Lines and Install Capacitor Banks

Under this alternative, TVA would upgrade the approximately 26.5 miles of the Gallatin FP-Lafayette 161-kV Transmission Line; approximately 15.6 miles of the Gallatin-Portland 161-kV Transmission Line; and install 161-kV capacitor banks at the Portland 161-kV Switching Station.

This alternative would require several outages on the two lines, creating a major reliability risk on the transmission system in the area. Furthermore, planning studies indicated that this option would only provide short-term benefits while the Action Alternative would provide a more reliable, long-term solution. In other words, three transmission lines coming out of GAF (Gallatin FP-Lafayette, Gallatin FP-Portland [which includes the East Gallatin 161-kV Substation], and Gallatin FP-Angeltown) would provide much greater transmission capability than two highly upgraded lines (Gallatin FP-Lafayette and East Gallatin-Portland). TVA's long-term planning studies indicated that two transmission lines would not be adequate for the area within 20-30 years. For these reasons, this alternative was eliminated from further consideration.

2.1.3.2. Construct and Operate a New Transmission Line

Under this alternative, TVA would construct a new 161-kV transmission line from GAF to the existing Portland-Westmoreland 161-kV Transmission Line. The only variation of this alternative from the proposed Action Alternative is that TVA would connect the new transmission line into an existing line rather than a new switching station. This alternative was rejected for two primary reasons. First, a three-terminal line would be less reliable because of the increased line exposure to distributor substations. Second, a switching station would allow for the possibility of future lines connecting into the area.

2.1.3.3. Construct Paradise-Wilson 500-kV Transmission Line and Bowling Green 500-kV Substation

Under this alternative, TVA would construct approximately 100 miles of 500-kV transmission line from the Paradise Fossil Plant to TVA's Wilson 500-kV Substation, along with a new Bowling Green 500-kV Substation. While this alternative would alleviate the reliability issues for the Gallatin, Portland, and Lafayette areas, the environmental impacts and costs associated with this option were overwhelmingly higher than the proposed Action Alternative due to the long length of line and increased width of transmission line ROW. Thus, this alternative was eliminated from further study.

2.1.3.4. Construct and Operate Other Transmission Lines

TVA also considered two other transmission line possibilities. The first was an approximate 15-mile-long 161-kV line from TVA's Portland 161-kV Switching Station to a new TVA Cross Plains 161-kV Switching Station. The second was an approximate 20-mile 161-kV loop line from the Portland-Lafayette 161-kV Transmission Line to GAF. However, because studies showed that neither alternative alleviated the load problems on the Gallatin FP-Lafayette and East Gallatin-Portland transmission lines, both of these alternatives were eliminated from further study.

2.1.3.5. Install Underground Utility Lines

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

Most buried lines tend to be low-voltage distribution lines, i.e., lines that are 13-kV or less. Although low-voltage lines can be buried without the need for special conduits, higher-voltage lines require armor casings for safety reasons. Burying power lines in the 69-kV, 161-kV, and 500-kV range requires extensive excavation and encasement in special conduits or tunnels. Measures to ensure proper cooling and adequate access are required. In addition, a road along or within the ROW where the lines are buried must be maintained for routine inspection and maintenance.

Although buried lines are less susceptible to catastrophic storm damage, especially wind damage, they are expensive to install and maintain. Conduit systems require ventilation systems to provide adequate cooling for the conductors. The lines must be protected from flooding, as this can cause a power outage. Repairs of buried lines may require reexcavation of the line, and the precise location of a problem can be difficult to determine. Burying a new proposed 161-kV line is cost prohibitive compared to the proposed alternative. For these reasons, this alternative is not considered reasonable and is eliminated from further consideration.

2.2. Construction, Operation, and Management of the Proposed Transmission Line and Switching Station

2.2.1. Transmission Line Construction

2.2.1.1. Right-of-Way Acquisition and Clearing

Some portions of the proposed transmission line would be constructed on new ROW, while others would be built on existing ROW. Approximately 3.7 miles of the proposed route would be constructed on the vacant side of the existing double-circuit Gallatin FP-Hoeganaes 161-kV Transmission Line, and 2.5 miles would be rebuilt double circuit along the existing Gallatin-Hartsville 69-kV Transmission Line. The remaining 13.4 miles of single-circuit transmission line would be constructed within new 100-foot-wide ROW. TVA would purchase ROW easements from landowners that would give TVA the rights to construct, operate, and maintain the transmission line, as well as to remove danger trees off the ROW. Danger trees include any trees that are located adjacent to the ROW, but that are tall enough to pass within 5 feet of a conductor or to strike a structure should the tree fall toward the transmission line. The fee simple ownership of the land within the ROW would remain with the landowner, who could continue to utilize the ROW property for many land uses. However, the terms of the easement agreement prohibit certain activities such as the construction of buildings and any other activities within the ROW that could interfere with the transmission line or create a hazardous situation.

Because of a need to maintain adequate clearance between tall trees and shrubs and transmission line conductors, as well as to provide access for construction equipment, most trees and shrubs would be removed from the entire width of the ROW during construction. Equipment used to clear the ROW would include chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller-bunchers. Marketable timber would be salvaged when

and 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 soon to 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 *Right-of-Way Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, Transmission Construction Guidelines Near Streams* (Appendices B, C, and D, respectively), and *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (Muncy 1999) would be followed in clearing and construction activities.

Subsequent to clearing and construction, vegetative cover on the ROW would be restored. Pasture areas would be reseeded with suitable grasses, and wooded areas would be restored using native grasses and other low-growing noninvasive species. Erosion controls installed during line construction would remain in place until vegetation becomes fully reestablished. Streamside areas are managed as described in Appendices B, C, D, and Muncy (1999).

2.2.1.2. Access Roads

Both permanent and temporary access roads would be needed in order to allow vehicular access to each structure and other locations within the ROW. Permanent (or temporary) access roads used for transmission lines would be located within the ROW when possible, and would be designed to avoid severe slope conditions and to minimize the crossing of streams. Access roads are typically about 20 feet wide and are either constructed of dirt or surfaced with gravel.

Culverts and other drainage structures, as well as fences and gates, would be installed as necessary. Culverts installed during construction in any permanent streams would be removed following construction. However, in wet-weather conveyances (i.e., surface waters that flow only following a rainfall), culverts would be left or removed, depending on the wishes of the landowner or on any permit conditions that might apply. If desired by a property owner, TVA would restore a new temporary access road(s) to the previous natural condition. TVA ROW clearing and environmental quality protection specifications are described in Appendices B and C.

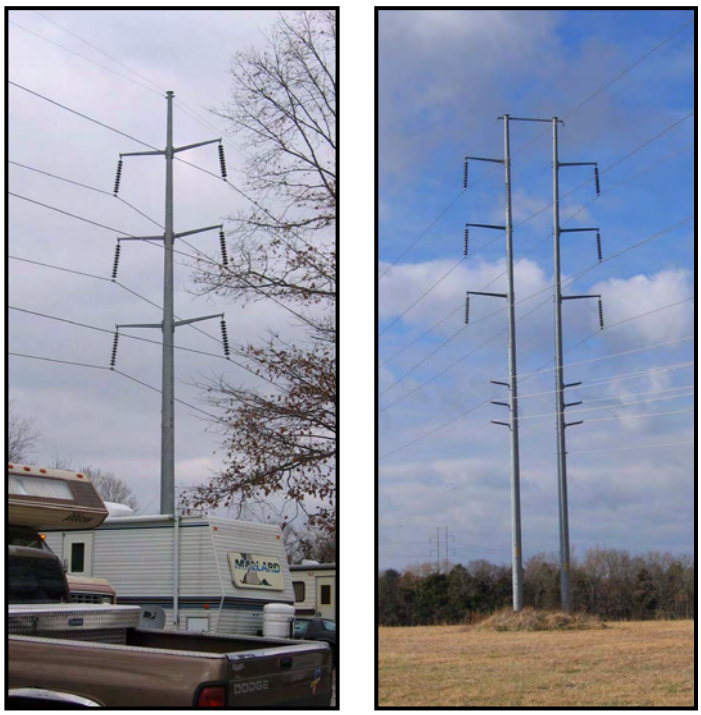
2.2.1.3. Construction Assembly Areas

A construction assembly area (laydown area) would be required for worker assembly, vehicle parking, and material storage. The site identified for the proposed project is a graveled, fenced lot located at 1072 Old State Route (SR) 109 North in Gallatin. This lot has been used by TVA several times in recent years and was previously reviewed by TVA when the property was initially leased in 2004 for the Gallatin-Portland 161-kV Transmission Line (Categorical Exclusion Checklist 7955). The site, which is approximately 8.3 acres in size, would be leased for the duration of the project beginning about one month prior to construction. The site consists of a relatively flat and previously cleared location near the proposed transmission line. 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 fencing installed by TVA and site restoration would be at the discretion of the landowner.

2.2.1.4. Structures and Conductors

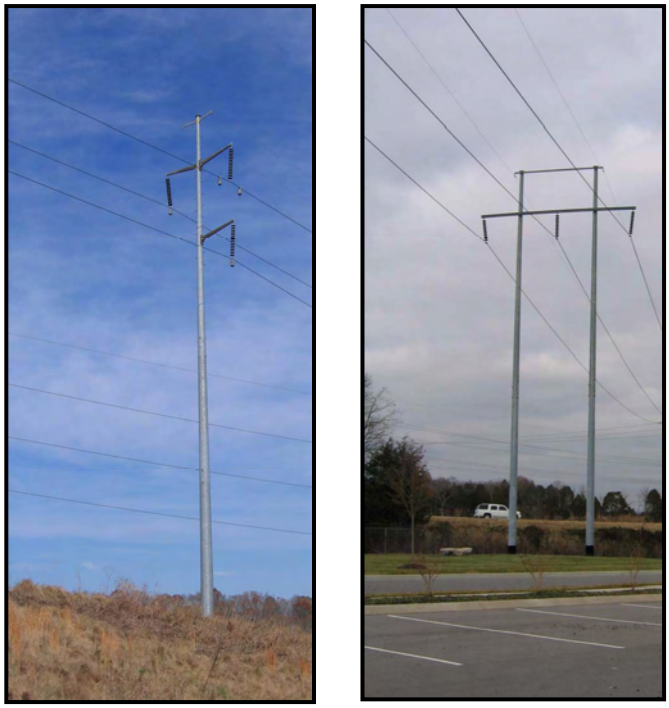
The proposed 161-kV transmission lines would utilize both single- and double-pole steel structures for the initial span out of GAF. The line would then use mostly existing structures of the Gallatin-Hoeganaes 161-kV Transmission Line for approximately 3.7 miles. Conductors would be strung along the vacant side of this double-circuit transmission line. Some single-circuit angle structures along this section would need to be replaced to accommodate the double-circuit line in this section. TVA would next replace about 2.5 miles of the existing single-circuit, single-pole Gallatin-Hartsville 69-kV Transmission Line with new single- and double-pole steel structures to create a double-circuit line in this section (Figure 2-2). The remainder of the transmission line construction would be single-circuit and would utilize single-, double-, and triple-pole steel structures (Figures 2-3 and 2-4). Structure type would depend on both the terrain and the resulting distance between structures. Structure heights would also vary according to the terrain and would range between 60 and 140 feet.



(a) Double-Circuit Single Steel-Pole Structure

(b) Double-Circuit Double Steel-Pole Structure

Figure 2-2. Examples of Double-Circuit Single and Double Steel-Pole 161-kV Transmission Line Structures



(a) Single Steel-Pole Structure (b) Double Steel-Pole Structure

Figure 2-3. Examples of Single-Circuit Single and Double Steel-Pole 161-kV Transmission Line Structures

Figure 2-4. Example of a Single-Circuit Triple Steel-Pole 161-kV Transmission Line Structure

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 would be attached to fiberglass or ceramic insulators suspended from the structure cross arms. A smaller overhead ground wire (or wires) would be attached to the top of the structures. This ground wire may contain fiber optic communication cables.

Poles at angles (i.e., angle points) in the transmission line may require supporting guy wires. Some structures for larger angles could require two or three poles. Most poles would be imbedded directly 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 cement-and-gravel mixture would be used. Screw-and-rock-anchored guys would be installed for angle structures.

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

2.2.1.5. 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.

2.2.2. Switching Station Construction

TVA would purchase approximately 10 acres for the Angeltown Switching Station site, which would be located adjacent to the existing Portland-Westmoreland Transmission Line (Figures 1-1 and 1-2). A total of approximately 6 acres of the site would be disturbed, including site grading and spoil areas. There would initially be three transmission line terminations at the Angeltown Switching Station–Gallatin FP, Portland, and Westmoreland. There would also be 1.5 vacant bays provided for future transmission line connections. In addition, space would be reserved on the site for future capacitor bank installation.

Approximately 10,000 cubic yards of cut and fill would be required for construction of the switching station. All of the earthwork would be on site. Several spoil areas would be located on the north side of the property. Silt fences would be installed, and approximately 6 acres of the site would be graded in accordance with TVA's Site Clearing and Grading Specifications (Appendix E). Site drainage structures would be installed. TVA would then cover the switching station yard with crushed stone and fence the yard with a 7-foot-tall chain link fence. A new access road would be constructed to the southeast corner of the graded area from Buck Perry Road. The length of the access road would be approximately 180 feet.

No fill would be needed to raise the elevation of the road. Stone would be added to support truck wheel loads as necessary. The amount of stone would not exceed the existing ground or road elevation. Areas that are not graveled at the switching station site would be restored as practicable to their state prior to construction.

The major equipment in the switching station would consist of three 161-kV gas breakers, eight switches, nine voltage transformers, nine surge arresters, one station service voltage transformer, bus (rigid overhead aluminum conductor) supports, a switch house, a potable water well, field lines (for the sewage disposal system), two bays, and three 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 F), 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 G) would be utilized during construction of the switching station.

2.2.3. Operation and Maintenance

2.2.3.1. Inspection

Periodic inspections of 161-kV transmission lines are performed from the ground and by helicopter aerial surveillance, occurring on five-year (approximately) cycles after operation begins. The inspections are conducted 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.

Certified TVA Transmission Operation and Maintenance personnel perform periodic inspections of the switching stations. These inspections are conducted to identify equipment issues or anything else that may cause equipment problems. Any concerns identified would be fixed immediately (i.e., hornet nest removal), if possible, or recorded and prioritized to be included in the maintenance program.

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, NESC standards 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 2.2.1.1, and vegetation control within the cleared ROW.

Management of vegetation within the cleared ROW would use 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 other 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 cranelike 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 there would be little additional area disturbance when compared to the initial installation of the structure.

2.3. Siting Process

The process of siting the proposed transmission line 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 general route options and potential routes
- Develop potential switching station sites
- Gather public input
- Incorporate public input into the final identification of the transmission line route and switching station site

2.3.1. Definition of Study Area

The study area (Figure 1-2) was chosen to meet three basic objectives: provide necessary transmission line access to the GAF switchyard and the future switching station site in the Angeltown Community; allow a large area for multiple candidate corridors to be identified in multiple alignments; and allow for the possible co-location of a transmission line on existing utility corridors to the maximum extent possible. The northern boundary of the study area lies just north of TVA's existing Portland-Westmoreland 161-kV Transmission Line, about 0.5 mile south of and parallel to SR 52. The locations for a possible Angeltown Switching Station are near the midpoint of the northern study area boundary. The southern boundary

is about 1.25 miles south of the GAF switchyard and roughly parallels the Cumberland River. The river is the boundary between Wilson County to the south and Sumner County to the north. The western boundary of the study area is about 2.75 miles west of downtown Gallatin, and the eastern boundary is about 10.7 miles east of downtown Gallatin. The total land area of the study area is approximately 242 square miles and lies predominately in Sumner County (205 square miles) and partially in Trousdale (9.5 square miles) and Wilson Counties (27.5 square miles). The following is a brief description of the study area.

Natural Features

The majority of the study area lies in Sumner County Outer Nashville Basin level IV ecoregion (Griffith et al. 1998). The geology in the study area generally consists of deposits of limestone, shale, chert, siltstone, sandstone, and dolomite in the northern half, with the addition of clay in the southern half. The waters in the northern portion flow toward the Barren River in Kentucky, and those in the southern portion flow south to the Cumberland River.

The northern half of the project area lies upon the Eastern Highland Rim level IV ecoregion (Griffith et al. 1998) and the southern half in the Outer Nashville Basin providing a physical contrast between the two parts of the study area. The northernmost portion of the project area is a high plateau, having an elevation of 800 to 1,000 feet above mean sea level, and the southern half is several hundred feet below that. The southern portion is more level, with rolling terrain consisting of cultivated farmlands, many of which are being developed into subdivisions east and north of Gallatin. The northern portion of the study area is steeper, predominantly wooded lands with less dense residential development.

The predominant water features in the study area are the Cumberland River (Old Hickory Reservoir); Bledsoe Creek, the study area's largest tributary of the Cumberland River; and several other shallow creeks and streams, such as Camp Creek, Town Creek, Deshea Creek, Dry Fork, East Fork, Brushy Fork, and Caney Fork.

There are very few wetlands in the study area, and most of these are located adjacent to the Cumberland River. The majority of the project area north of the river is rolling to hilly, well-drained terrain. There are no protected streams in the area.

Cultural Features

There are 104 churches in Sumner County, 95 of which are in the study area. Of the 139 known cemeteries in Sumner County, 97 cemeteries are located in the project study area. Many of the cemeteries are scattered throughout the rural areas and were likely family plots dating back to the 1800s. Shiloh Church is located along United States Highway (US) 31E near the Kansas Community northeast of Gallatin and has a historic marker at its location.

There are 463 historic properties in the study area, 13 of which are listed on the National Register of Historic Places (NRHP). The other 450 have not been assessed. There are four parks in the study area and 18 recreation areas of various kinds.

A noteworthy historic site in the rural portion of the study area is Cragfont. Built in 1798 by a family of traders who settled there after the Revolutionary War, it was the first manor house west of the Alleghenies. It is listed in the NRHP. Another site in the area, built in 1828, is Wynnewood, located on Old SR 25 in Castalian Springs. It is the largest log stagecoach inn in Tennessee. The building is considered a national historic landmark.

Bledsoe's Fort Historical Park, located north of SR 25 in Castalian Springs, was built in the early 1780s to protect settlers from the Indians. The archaeological digs at the original fort site are visible at this protected area.

Twelve radio or cell phone towers are located within the study area.

Land Use

Seventy-five percent of the land area in Sumner County is unplanned. The lower one-third of the study area is under the jurisdiction of municipal and regional planning influence. Sumner and Wilson counties have been two of the fastest-growing counties in the state of Tennessee since 1980.

Land uses in the study area range from the residential/commercial/light industrial mix inside a 4-mile radius of the city of Gallatin, to large tracts of undeveloped, forested tracts of land in the ridge lands in the northern portion. The areas in between are farmlands and scattered subdivision developments. The most rural areas require a minimum 0.92-acre lot size for home construction. The predominant use of the Cairo Bend Road area is residential development. This portion of the study area in Wilson County is located on the peninsula immediately east of GAF (Figure 1-3). One subdivision has already been developed in this area, and a few smaller ones are in the early stages of infrastructure development. Their completion may have been affected by the economic slowdown.

The Sumner County Regional Airport is located about 2 miles east of downtown Gallatin and 3.5 miles north of GAF. Plans are already underway to expand the airport runway to the south in the near future. There are a few industrial operations near the airport. Gallatin is the home of several major industries, including Hoeganaes Inc., GAP Inc., RR Donnelley Printing, and SERVPRO System Services.

There are two 18-hole golf courses in the study area. Boat launching ramps exist in various locations on the shoreline of Old Hickory Reservoir. There is a proposed greenway along an abandoned railroad ROW north of SR 25.

Wildlife management areas (WMAs) are located on GAF property north of the plant and along the shoreline of Old Hickory Reservoir east of the plant site. The 164-acre Bledsoe Creek State Park is located on the west side of Bledsoe Creek about 5 miles east of Gallatin. This park offers many recreational programs and is home to many species of wildlife. The bald eagle and golden eagle sometimes frequent the park in winter.

There are several existing TVA transmission lines in the study area that could possibly accommodate alternative paths for the new 161-kV circuit from GAF to the selected Angeltown Switching Station site (see Figures 1-2 and 1-3). The most obvious is the existing 161-kV line connecting GAF switchyard to the Hoeganaes 161-kV Substation to the north. It is a steel-pole transmission line designed for double circuit with only one side currently occupied by a transmission line conductor. There is also an existing 69-kV transmission line connecting the Gallatin 161-kV Substation to the Hartsville Substation. This line follows a west-to-east direction and crosses the Gallatin-Hoeganaes Transmission Line 3.4 miles north of the GAF switchyard.

Multiple 161-kV lines exit the GAF switchyard to the southeast and cross the Cumberland River (Old Hickory Reservoir) into Wilson County at the extreme south end of Cairo Bend Road. Additionally, a single-circuit 161-kV line extends from the Hoeganaes 161-kV

Substation northward to the East Gallatin 161-kV Substation then on northward to the Portland 161-kV Substation. A vacant, 350-foot-wide TVA easement follows a west-to-east direction. It was purchased in the 1970s for a 500-kV transmission line loop into the eventually canceled Hartsville Nuclear Plant. This easement is located approximately 4 miles north of downtown Gallatin and is identified as the Montgomery-Wilson Loop to Hartsville 500-kV Transmission Line in Figures 1-1, 1-2, and 1-3. The Portland-Westmoreland 161-kV Transmission Line crosses in an east-west direction near the northern edge of the study area. TVA's Gallatin FP-Lafayette 161-kV Transmission Line crosses the southeast corner of the study area in a northeast path.

Transportation

The primary transportation features in the study area are several major highways. SR 109 is a heavily used connection from the Gallatin area to the south to Interstate Highway (I-) 40 and the Nashville area and to the north to a connection to Portland and I-65 into Kentucky. SR 25 (known locally as Hartsville Pike) provides access to the counties east of Gallatin. US 31E (SR 6) provides connection to the northeast towns and into Scottsville and Glasgow, Kentucky. This is a heavily traveled road by commuters. Despite ongoing road improvement projects, traffic congestion is still a problem. Traffic counts jumped significantly on many major local highways between 2000 and 2009. The growth in population is showing up on the local streets. This is an issue common with other counties in Middle Tennessee.

There is one active railroad line between Gallatin and Portland near the western limit of the study area. A spur track off that line, which extends south into GAF, is owned by TVA. This rail line has been used to haul coal for the plant, but since 1997, TVA has instead been receiving coal by barge. In 2005, TVA proposed to begin again hauling coal on this rail line; however, at this time, TVA has made no decision (TVA 2005).

The Regional Transportation Authority has plans to expand the current Music City Star commuter railway to include a line running between Gallatin and Nashville, with a stop in Hendersonville. The Sumner County Regional Airport is the only commercial airport in the area. As mentioned previously, plans are underway for a 1,500-foot expansion to the south for its single runway. The primary users of the airport are private and corporate aircraft.

2.3.2. 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 Sumner, Trousdale, and Wilson counties' tax maps. Various proprietary data maintained by TVA in a corporate georeferenced database, including Heritage file data on sensitive plants and animals, as well as on archaeological and historical resources, were also used.

Additionally, TVA took new aerial color orthophotography in July 2008 of the proposed project area. These images were georeferenced 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 factors of the study area to be examined simultaneously to develop and evaluate numerous options and scenarios to determine the route or routes that would best meet project needs, including 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 environmental engineer.

2.3.3. Establish and Apply Siting Criteria

TVA uses a set of evaluation criteria that represent opportunities and constraints for development of switching station 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 economic elements. Application of these constraints is flexible, and TVA can deviate from them. Identifying feasible transmission line routes involves weighing and balancing of these criteria with adjustments to them as specific conditions dictate.

2.3.3.1. 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 give a transmission line route option a higher score and, thus, a worse score.

- **Engineering Criteria** include considerations such as total length of the transmission route, width of new ROW, and existing ROW, number of primary and secondary road crossings, the presence of pipeline and transmission line crossings, presence of slopes greater than 30 percent (due to the increased construction difficulty), 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 stream (i.e., those supporting endangered or threatened species) 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 WMAs.

- **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. (Broadly speaking, these are also environmental criteria.)

A tally of the number of occurrences for each of the individual criteria was calculated for each potential alternative route. Next, a normalized ranking of alternative routes was calculated 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 (i.e., the relative degree of constraint) were then developed for each individual criterion. These criterion-specific weights were then 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 by each alternative route for engineering, environmental, land use, cultural, and overall total (Appendix I, Table I-2). For each of these categories, a ranking of each alternative route was calculated based on the relationship of various routes' scores to one another (Appendix I, Table I-3).

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.

2.3.3.2. Switching Station Site Criteria

The switching station siting criteria used in evaluating the three potential locations included engineering and construction feasibility, environmental effects, land use compatibility, and feasibility of transmission line connections.

- **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 make up 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, creating lesser impacts.

2.3.4. Development of General Route Options and Potential Transmission Line Routes

Possible transmission line route segments were developed using current aerial photography of the study area, 7.5-minute USGS topographic maps, a GIS-based constraint map of the study area, and other data layers, such as property boundaries, digital elevation model results (which were used to identify steepness and terrain characteristics), and transportation. The constraint maps were produced by interpretation of aerial photographs and a search of existing records for important natural, historical, and archaeological resources (Figure 1-3). The GIS was used to locate segments that would best meet project needs while avoiding or reducing conflict with constraints (including sensitive environmental resources) and by using identified opportunities.

A network of 49 separate transmission line ROW segment possibilities was initially considered between the GAF (Appendix I) and three potential locations for the Angeltown Switching Station (described in Section 2.3.5). Following the open house and comment period, additional segments were included for consideration to provide a practical connection to other segments, bringing the total number of transmission line segments considered to 51 (Figure 1-3 and Appendix I). Additionally, because of information gathered as a result of the public open house, environmental field surveys, engineering considerations, and property owner concerns, some of the proposed segments have been adjusted from the routes presented at the open house (Appendix I, Table I-1). Portions of these segments would be utilized to develop potential transmission line routes. A discussion of how TVA selected the proposed route segments follows below.

In the immediate vicinity of GAF, opportunities for route segments were limited due to the geography of the area. The presence of existing transmission lines and the inlets of the Cumberland River, located just south of the GAF switchyard, limited the possibilities for potential routes heading west out of GAF. The existing double-circuit 161-kV transmission line (carrying the Gallatin FP-Gallatin and Gallatin FP-North Nashville Transmission Lines) to the west runs along the north side of the river and is located on property controlled by the USACE and a WMA administered by the Tennessee Wildlife Resources Agency (TWRA). For the proposed new line to follow this path, the existing line would have to be torn down, and a new multiple circuit line would have to be constructed. Additionally, several river crossing transmission line towers would be required, resulting in substantial environmental and economic impacts. After crossing the Cumberland River, route corridors heading north would be severely limited due to existing development in the city of Gallatin. Furthermore, these route corridors would be close to SR 109, which is currently being widened, and development of this highway corridor is ongoing. For these reasons, no segments were routed to the west of GAF.

Existing transmission line ROWs north of GAF provided the most feasible corridor for routes leaving GAF. TVA's best opportunity for exiting GAF is to utilize the vacant side of the existing double-circuit structures on TVA's existing Gallatin FP-Hoeganaes 161-kV Transmission Line along Steam Plant Road. Once north of the plant, the existing double

circuit line proceeds to just north of the intersection of Steam Plant Road and Airport Road. Additionally, approximately 3.5 miles north of the plant, TVA's existing Gallatin-Hartsville 69-kV Transmission Line could be rebuilt as a double-circuit transmission line. Possible segments proceeding along these corridors (1, 2, 6, and 7) were developed and presented to the public at the open house.

Routes heading out of the GAF switchyard and proceeding first east then north also presented challenges. First, multiple existing transmission lines, with no vacant sides, such as provided by the Gallatin FP-Hoeganaes Transmission Line, are in this path. Second, these corridors would cross the Cumberland River and USACE and TWRA property multiple times. These proposed segments (3, 4, and 5) were routed south crossing the river into Wilson County, proceeding east and then turning north, crossing the river back into Sumner County. TVA recognized that these corridors would likely result in much higher environmental and economic impacts than routes heading directly north out of GAF. In addition to these obstacles, public opposition to these routes was high.

Feasible areas for routes continuing north of GAF were still limited. To the northwest, in the area of the intersection of Airport Road and Steam Plant Road, commercial development, existing airport facilities and existing transmission lines and substations limited TVA's routing options. North of this intersection, an existing railroad path, SR 25, a hospital, and commercial and residential development narrowed the route possibilities. Segments in this area included 8, 9, 11, and 18. Prior to TVA's formal analysis, consideration of Segment 9 was eliminated due to commercial development in the area and the proximity of the airport.

TVA faced fewer restrictions to the northeast because this area consists primarily of farmland and pasture. Some residential development did hinder routing, but the area was much more conducive to routing transmission lines than the area to the west. Bledsoe Creek State Park and Wildlife Observation Area to the east of these segments limited the routing opportunities. Proceeding north, this corridor crosses over SR 25 and some residential development, which TVA avoided with the proposed segments. Small stream crossings and other minor obstacles were in this area. Segments 10, 12, 13, 15, 16, and 17 are in this immediate area.

The land use north of SR 25 is mostly farmland and pasture, with some residential development. This was helpful for several routing options in the areas. The topography in this region is mostly flat, with occasional undulating areas. However, after crossing US 31 heading north, the terrain is much steeper. This provided challenges in finding suitable routes for the proposed transmission line because of constructability concerns. The difficulty was compounded by the requirement that any points where the direction of the route changes (angle points called points of intersection or PI) must be on a flat or elevated portion of the land and must have room for the required structure guys. Furthermore, it is not desirable to route transmission lines on terrain with a slope greater than 30 percent due to the increased construction difficulty, safety concerns, and the increased potential for erosion on the cleared ROW. In this section, there are three corridors for segments. All segments in this portion of the study area cross over the vacant Montgomery-Wilson Loop to Hartsville 500-kV Transmission Line ROW.

The corridor to the west consists of only one segment, 19, the longest proposed segment. Routing possibilities were restricted by sporadic residential development in the southern section of the corridor. Options were limited by both residential development and terrain farther north.

The middle corridor includes Segments 20, 21, 22, 23, 24, 25, and 27. This corridor also consists of sporadic residential development, mostly clustered around US 31. The Kansas Community is located in this corridor, west of US 31. Segments in the middle corridor range from mostly rolling, flat pasture to increasingly steep terrain and foothills north of US 31. Some minor stream crossings and other minor road crossings in the area provide some restrictions to route development.

The eastern corridor in this area consists of Segments 14 and 26. Streams and existing residential development in the area on the southern portion of this corridor dictate that the routing of the segment heads in an eastward direction before proceeding north. Approaching US 31, the routing options were again restricted by existing residential development. After crossing US 31, there were fewer restrictions based on development and land use, but the steeper terrain in this area imposes some limitations.

The remaining portion of the transmission line route corridors approach the proposed switching station sites in the Angeltown area. This area is extremely hilly and consists mostly of some larger residential tracts and farmland. There are essentially three corridors in this area.

The western corridor is in very hilly terrain. Restrictions in this area include some minor stream crossings along with residential development. Some of this corridor is heavily wooded. Segments for this corridor include 28, 35, 36, 37, 47, and 48. This corridor terminates into the proposed alternative switching station Site 1 (Figure 1-3).

The middle corridor of this final section also crosses over hilly terrain, thus limiting route segment development. In addition, existing residential development and infrastructure restrict route possibilities. The segments in this corridor are 29, 34, 38, 45, and 46. The corridor terminates into the proposed alternative switching station Site 2 (Figure 1-3).

The eastern corridor for the final portion lies in hilly, rugged terrain and crosses some small streams, which limit the route development. In addition, residential development and roads in the area further curb possible route avenues. The segments in this corridor are 30, 31, 32, 33, 39, 40, 41, 42, 43, 44, 49, 50, and 51. The corridor terminates into the proposed alternative switching station Site 3 (Figure 1-3).

In summary, the general route corridors resulted in a north-south configuration due to the geometry of the end points of the project. In the area leaving GAF, the plant's location, coupled with the proximity of the Cumberland River, resulted in two general corridors of possible route options, heading north or east. Once the segments crossed SR 25, the existing land features, in addition to the less dense amount of residential and commercial development, resulted in western, middle, and eastern corridors heading north through the study area to the alternative switching station sites. Interconnections between the various corridors were used when available and practical. However, in many instances interconnections between corridors were not feasible because of potential impacts to environmental features or land uses. Following the development of the corridors and identification of potential route segments, TVA developed potential transmission line routes.

Using combinations of the 51 constituent segments, 102 alternate transmission line routes were then developed (see Figure 1-3 and Appendix I). These routes connect GAF to the proposed Angeltown Switching Station. As mentioned previously, TVA learned after the open house and prior to formal analysis of the potential transmission line routes that

Segment 9 was not practical due to existing commercial development and airport flight path restrictions. Consequently, Alternative Route Options 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20 were eliminated from the formal analysis, and TVA considered only 92 route options. The final scores and rankings of the 92 transmission line routes and three switching station sites are shown in Appendix I, Tables I-2 and I-3. The top 20 routes are presented in Table 2-1 (see Appendix I, Table I-4 for the complete list). All 92 routes were evaluated as described beginning in Section 2.3.3. As a result of information gathered at the public open house, environmental field surveys, engineering considerations, and property owner concerns, some of these segments have been adjusted from the routes presented at the open house. These adjustments are described in Section 2.4.3 and in Appendix I, Table I-1.

Table 2-1. Top 20 Alternative Route Corridors

Route Rank	Alternative Route Option	Alternative Switching Station Site	Constituent Segments
1	22	2	1, 2, 6, 10, 12, 17, 20, 27, 29, 34, 38, 46
2	21	2	1, 2, 6, 10, 12, 17, 20, 27, 28, 35, 38, 46
2	24	2	1, 2, 6, 10, 12, 17, 21, 23, 24, 27, 29, 34, 38, 46
4	92	3	1, 2, 6, 10, 12, 17, 20, 27, 29, 50, 32, 42, 43, 49
4	96	1	1, 2, 6, 10, 12, 17, 20, 27, 29, 34, 38, 47, 48
6	95	3	1, 2, 6, 10, 13, 15, 22, 23, 24, 27, 29, 50, 32, 42, 43, 49
7	26	2	1, 2, 6, 10, 12, 16, 22, 23, 24, 27, 29, 34, 38, 46
8	23	2	1, 2, 6, 10, 12, 17, 21, 23, 24, 27, 28, 35, 38, 46
8	93	3	1, 2, 6, 10, 12, 17, 21, 23, 24, 27, 29, 50, 32, 42, 43, 49
8	99	1	1, 2, 6, 10, 12, 17, 20, 27, 28, 35, 38, 47, 48
11	27	2	1, 2, 6, 10, 12, 16, 22, 23, 25, 26, 30, 33, 34, 38, 46
11	97	1	1, 2, 6, 10, 12, 17, 21, 23, 24, 27, 29, 34, 38, 47, 48
13	25	2	1, 2, 6, 10, 12, 16, 22, 23, 24, 27, 28, 35, 38, 46
14	28	3	1, 2, 6, 10, 12, 16, 22, 23, 25, 26, 30, 51, 32, 42, 43, 49
15	94	3	1, 2, 6, 10, 12, 16, 22, 23, 24, 27, 29, 50, 32, 42, 43, 49
15	33	2	1, 2, 6, 10, 13, 15, 22, 23, 24, 27, 29, 34, 38, 46
17	29	2	1, 2, 6, 10, 12, 16, 22, 23, 25, 26, 31, 40, 39, 45
18	100	1	1, 2, 6, 10, 12, 16, 22, 23, 25, 26, 30, 33, 34, 38, 47, 48
19	98	1	1, 2, 6, 10, 12, 16, 22, 23, 24, 27, 29, 34, 38, 47, 48
20	34	2	1, 2, 6, 10, 13, 15, 22, 23, 25, 26, 30, 33, 34, 38, 46

2.3.5. Development of Potential Switching Station Sites

In order to minimize risk for line exposure for outages, the optimal location for the switching station site would be near the midpoint of the Portland-Westmoreland 161-kV Transmission Line. Furthermore, it was important for the switching station site to be located as close to the existing line as possible to minimize the length of loop line required. For example, TVA did not consider sites located north of SR 52 because all three transmission lines would have to cross a major road. As a result, TVA evaluated three sites, which also met accessibility and terrain requirements, along the midpoint of the existing Portland-Westmoreland Transmission Line (Figure 1-3). It was determined that a minimum of 10 acres would be required to allow for the switching station and associated line terminations.

The proposed Angeltown Switching Station site would require enough space to provide transmission line terminations for six transmission lines. The initial layout would allow for

the termination of three 161-kV transmission lines—Gallatin, Portland, and Westmoreland (Figure 1-2). If the proposed switching station and transmission lines are constructed, the transmission line connections would be made, and the three transmission lines would be referred to as Gallatin FP-Angeltown, Portland-Angeltown, and Westmoreland-Angeltown. The Gallatin FP-Angeltown Transmission Line would become a TVA system line and would provide a backup electrical feed for the East Gallatin-Portland and Gallatin FP-Lafayette 161-kV Transmission Lines, as described in Section 1.2. The other two transmission lines from the Angeltown Switching Station would provide backup capability for the Portland Switching Station and Westmoreland Substation.

All three of the proposed alternative switching station sites considered are currently on undeveloped land. Approximately 10 acres would be required for the new switching station. Site 1 is located on Buck Perry Road, west of the intersection of Buck Perry Road and West Mount Vernon Road. This approximately 19-acre site is currently a vacant lot used for pasture and hay production and is privately owned. Site 1 is located approximately 550 feet south of the Portland-Westmoreland Transmission Line, requiring the construction of a loop line about 900 feet in length.

Site 2 is located northwest of the intersection of Buck Perry Road and West Mount Vernon Road. This privately owned, approximately 19-acre vacant lot is currently used as pasture. This site is located approximately 400 feet south of the Portland-Westmoreland Transmission Line, requiring the construction of a loop line about 750 feet in length.

Site 3 is located north of the intersection of West Mount Vernon Road and Mount Vernon Road. This site is currently a vacant lot, approximately 40 acres in size, and is privately owned. The site is currently used for pasture and hay production. This site is located approximately 300 feet south of the Portland-Westmoreland Transmission Line, requiring the construction of a loop line about 500 feet in length.

2.3.6. Route Identification and Evaluation

Each of the 92 alternative routes offered different opportunities and constraints, as alluded to in Section 2.3.4. Opportunities included utilization of existing transmission lines or other utility easements, open undeveloped land areas, areas less suitable for development (commercial or residential) due to existing features or location, and property line geometry allowing the use of longer segments with shared easement between owners. Major constraints included the highly commercial and residential development in the city of Gallatin, which begins just 3 miles north of the GAF switchyard. As mentioned in Section 2.3.4, the Sumner County Regional Airport and its planned expansion to the south, as well as commercial development in the area, eliminated Segment 9 from the analysis. Other constraints included steep or undulating terrain, sensitive environmental or historic areas, and land use conflicts.

Scores and rankings for the top 20 routes are provided in Table 2-2. Information on all 92 potential routes is provided in Appendix I, Tables I-2 and I-3. Of all 92 routes considered, Alternative Route 22 was the best scoring option (25.82) and Alternative Route 60 was the worst scoring option (72.02).

Table 2-2. Top 20 Alternative Route Corridor Scores

Route Rank	Total Score Based on Criteria Analysis	Alternative Route Option
1	25.82	22
2	27.47	21
2	28.00	24
4	28.36	92
4	28.82	96
6	28.82	95
7	29.25	26
8	29.94	23
8	30.23	93
8	30.56	99
11	30.66	27
11	30.95	97
13	31.01	25
14	31.02	28
15	31.47	94
15	33.04	33
17	33.26	29
18	33.33	100
19	33.53	98
20	34.44	34

2.4. Comparison of Alternative Routes and Switching Station Sites

Based on 51 possible alternative transmission line segments TVA established and considered 92 alternative routes for this project, ranging between 19 and 23 miles in length. Each of these alternatives routes connects to one of three alternative switching station sites. . This section provides analysis of the route segments and their relation to alternative routes that scored within the top 20.

2.4.1. Alternative Transmission Line Segments as Related to Alternative Routes

To connect GAF to the proposed new Angeltown Switching Station, all of the proposed routes are primarily oriented in a north-south alignment. As described in Section 2.3.5, the switching station would be located near the midpoint of the Portland-Westmoreland 161-kV Transmission Line.

As described in Section 2.3.4, the analysis showed that existing transmission line ROWs north of the plant provided the most feasible route corridor. In fact, the northernmost corridor exiting GAF and the existing ROW, consisting of Segments 1, 2, 6, and (consequently) 10, were used in all of the top 20 routes. Routes that included Segments 3, 4, and 5 fell outside the top 20 best scoring routes due in part to the environmental and engineering impacts and concerns associated with the river crossing transmission line towers. These segments were also strongly opposed by the landowners in that area.

Furthermore, high scores resulting from existing commercial and industrial development conjoined with restrictions associated with the glide path of the airport made routes associated with Segments 7, 8, and 11 much less favorable than using Segment 6 to rebuild the existing Gallatin-Hartsville 69-kV Transmission Line to 161-kV double circuit. Visual and economic impacts would be especially high on Segments 8 and 11 due to the

need for shorter structures and shorter spans that would be required due to the nearby airport glide path restrictions. None of the top 20 routes utilized Segments 7, 8, or 11.

The analysis showed that optimal routes utilized the corridors provided by Segments 1, 2, 6, and 10. Once at this point, the options to proceed are therefore limited. Segments 11, 18, and 19 would be eliminated due to the optimal scoring routes. In addition to being isolated from the optimal route, Segment 11 contains 33 commercial parcels within 300 feet of the proposed route. Segment 18 is exposed to residential development in addition to being isolated from the optimal routes. Finally, Segment 19 was not only isolated from the optimal routes, but the terrain along 25 percent of this segment has a slope of 30 percent or greater. Thus constructability would have been a major concern along this segment.

This recognition in the analysis resulted in the middle and eastern corridors remaining viable. The middle corridor was preferable to the eastern corridor due to Segments 14 and 26 scoring poorly in the environmental and engineering categories because of floodplains and slope, respectively.

Scores for the middle corridor segments in this area were similar. Routes utilizing the western middle corridor consisting of Segments 12, 17, and 20 scored closely to routes using the eastern middle corridor consisting of Segments 13, 15, 22, 23, and 24. However, the overall analysis showed that the optimal route used Segments 12, 17, and 20.

As shown in Figure 1-3, from this point, Segment 27 remains as the only choice. Following Segment 27, the optimal route utilized Segment 29, which also allowed all three switching station sites to remain in consideration. Segments 28 and 35 would affect more residential development than Segment 29. Moreover, if Segment 28 were used, access to switching station Site 3 would be impractical.

The route then utilized Segment 34 and in consequence, Segment 38, to avoid the steeper slope of Segment 50. This choice resulted in the elimination of switching station Site 3 in addition to multiple segments.

Finally, while Segment 46 (ending at switching station Site 2) offered no discernible advantage over Segments 47 and 48 (ending at switching station Site 1) from a transmission line routing standpoint, the independent analysis performed on the switching station site selection supported the use of switching station Site 2 (as described in Section 2.4.2 and Appendix I, Table I-5).

2.4.2. Alternative Switching Station Sites

In addition to the new transmission line route connection from GAF that would terminate into the proposed Angeltown Switching Station, the existing Portland-Westmoreland 161-kV Transmission Line would need to be rerouted or “looped” into the proposed switching station. The new 161-kV transmission line loops from the Portland Switching Station and the Westmoreland Substation, along with the new line from GAF, would provide three line terminations at the new Angeltown Switching Station, with provisions proposed for future line connections and capacitor bank installation.

Following the open house and public comment period, TVA performed a study of the three alternative switching station sites described in Section 2.3.5 independent of the transmission line analysis. The three alternative sites were evaluated using the updated

constraint model and information obtained during public scoping. Land use was the most important concern in the comments submitted in the scoping process. The criteria used in the analysis include terrain, environmental, accessibility, visibility, and land use (Appendix I, Table I-5). Each individual criterion was ranked from 1 to 5, with the lower number indicating a better score.

Site 1 provides the appropriate site characteristics necessary for a switching station as described in Section 2.3.3.2. Additionally, because the parcel contains the existing transmission line, no additional ROW would be required to connect to the Portland-Westmoreland 161-kV Transmission Line. Access would be limited to one paved highway. Site 1 scored 21 in the analysis.

Site 2 met all criteria for a switching station site, including close proximity (within 500 feet) to the transmission facilities to be connected, open undeveloped land, and easy access (at an intersection of two paved highways) for construction and maintenance. Minimal additional ROW would be required to provide the loop line into the Portland-Westmoreland Transmission Line. Site 2 scored 11 in the analysis.

Site 3 provides the appropriate site characteristics necessary for a switching station as described in Section 2.3.3.2. Additionally, because the parcel contains the existing transmission line, no ROW would be required to connect to the Portland-Westmoreland 161-kV Transmission Line. Accessibility to Site 3 would be via one paved highway. Site 3 scored 19 in the analysis.

The terrain for Site 1 was more rolling than on Sites 2 and 3, making it less desirable from a constructability standpoint. Sites 2 and 3 are closer to the road and thus would be more visible than Site 1. Housing density was highest at Site 3, thus presenting more constraints for transmission line connections into this site. Furthermore, the owner of Site 2 was more willing to sell 10 acres to TVA for the switching station than the other two owners were. The owner of Site 1 had plans to build a large home on the property and thus was very reluctant to sell it. Similarly, Site 3 is located on an approximate 40-acre tract, and the owner had plans to develop the site into several residential lots. Consequently, Site 2 provided the best choice for land use.

Overall, Site 1 scored worse than Site 2 in five of the nine categories, and Site 3 scored worse than Site 2 in three categories. For these reasons, based on the switching station analysis, Site 2 was the best site (Appendix I, Table I-5).

The results of the switching station selection analysis were then factored into the overall transmission line routing analysis. Following the choice of the best route showing switching station Site 2 as the optimal choice, a detailed evaluation was performed to determine the site's suitability. The preliminary data from soil borings and site inspections found no obstacles to a detailed design of a site plan.

2.4.3. Identification of Preferred Transmission Line Route and Switching Station

TVA's preferred switching station site is Alternative Site 2 (Figure 2-1). This site, located near the intersection of Buck Perry Road and West Mount Vernon Road in Angeltown, is approximately 10 acres in size. Further, based on the analysis, TVA's preferred transmission line route for the proposed Action Alternative is Alternative Route Option 22 consisting of Alternative Segments 1, 2, 6, 10, 12, 17, 20, 27, 29, 34, 38, and 46.

After the preferred transmission line route and switching station site were identified, affected property owners were mailed information showing the location of the preferred route or site 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. Approximately 24 minor adjustments were made to the route before and during field surveys (Appendix I, Table I-1). After property owners reviewed the changes, the sections were resurveyed to identify the final routes.

These segments were adjusted based on public and property owner input as well as environmental data to lessen overall impacts. Examples include following parcel boundaries to lessen the impact on future uses of the property and to reduce the proximity to sensitive areas and species as well as cultural/historical features.

2.4.4. Modifications at Existing TVA Facilities

In addition to the new 161-kV transmission lines and switching station, TVA would need to implement minor modifications at some existing TVA facilities. TVA would need to install a new 161-kV breaker and associated relay equipment at the GAF switchyard. Site grading would be required to install the foundations for this equipment. Adjustments to each switching station entrance road and gate may also be required. TVA would follow appropriate environmental quality protection measures during construction activities at these switching station locations (Appendices E and G).

Communication and control equipment would be installed at the Wilson 500-kV Substation and the South Nashville 161-kV Substation. Relays would be replaced at the Portland 161-kV Switching Station and Lafayette 161-kV Substation. This work would consist of changes or additions of cable connections and would occur inside the substation facility.

TVA would also retire 2.5 miles of the existing Gallatin-Hartsville 69-kV Transmission Line and rebuild it as 161-kV double circuit with the proposed new transmission line. All of the retired structures, associated materials, and equipment would be removed and handled through approved TVA Environmental Protection Procedures, whether recycled, disposed of, or retained for reuse.

The TVA system's mapboard at the SOC and ROC in Chattanooga would be modified to include the names and numbers of the new transmission lines and switching station.

TVA would need to remove two barns. One barn is located along Segment 46 within the proposed ROW where the line turns east into the switching station site, just south of Buck Perry Road. The second barn is located just north of the existing transmission line loop on the proposed switching station property. Before TVA removes a barn, a survey of the property is performed to identify any environmental hazards. TVA is required to submit an Asbestos Notification to the state for all building demolitions whether or not asbestos-containing materials are present. A survey of these barns was completed June 28, 2010, and indicated that no hazardous materials were present. Material from the barns would be reused, recycled, or disposed of according to TVA's Environmental Protection Procedures.

2.5. The Preferred Alternative

The Action Alternative, i.e., Construct and Operate New 161-kV Transmission Lines and a New Switching Station and Modify Various Existing TVA Facilities, is TVA's preferred alternative for this proposed project. TVA would build a 161-kV transmission line from GAF to a new Angeltown Switching Station. TVA's preferred transmission line route for the Action Alternative is Alternative Route Option 22. This route is composed of Alternative Route Segments 1, 2, 6, 10, 12, 17, 20, 27, 29, 34, 38, and 46, and would terminate into switching station Site 2, TVA's preferred switching station site. The transmission line route would be approximately 19.6 miles in length.

CHAPTER 3

3.0 AFFECTED ENVIRONMENT

Based on preliminary evaluations of the proposed route and switching station site, TVA concluded that certain resources would not be affected by the proposed action. Potential effects related to air quality, hazardous and nonhazardous wastes, and health and safety have been considered, but because of the nature of the action, did not require detailed evaluation. Additionally, TVA concluded that the modifications to existing TVA facilities as described in Section 2.4.4 did not require detailed evaluation due to the nature of the action and because they would comply with the appropriate environmental protection procedures.

Various environmental resources that could be affected by the implementation of the alternatives described in Chapter 2 have been given further consideration. This chapter describes the status of these potentially affected environmental resources and include the following: groundwater and geology, surface water, aquatic ecology, vegetation, wildlife, endangered and threatened species, wetlands, floodplains, prime farmland, visual and aesthetic quality, recreation, parks, and natural areas, historical and archaeological resources, and environmental justice. Section 2.3.1 defines the project study area for the proposed transmission line and switching station. Areas of potential effect (APEs) for individual resources that differ are identified within these resources areas. The affected environment descriptions below are based on field surveys conducted in 2009 and 2010, on published and unpublished reports, and on personal communications with resource experts. This information establishes the baseline conditions against which the decision maker and the public can compare the potential effects of the alternatives under consideration.

3.1. Groundwater and Geology

The project area is underlain by Ordovician-, Silurian-, and Devonian-aged rocks in the Interior Low Plateaus Physiographic Province. These carbonate rocks, which are primarily limestone with some dolostone, are the principal aquifers in large areas of Central Tennessee and are part of the Central Basin aquifer system. The carbonate rock aquifers consist of almost pure limestone and minor dolostone and are interlayered with confining units of shale and shaly limestone. The middle Ordovician Stones River Group contains the most important carbonate-rock aquifers in the project area. The calcareous siltstones of the middle Ordovician Nashville Group yields small volumes of water, but these units are not considered principal aquifers. The lower Ordovician Knox Group is a major aquifer where dolostone contains freshwater. In a large area in Central Tennessee, the upper parts of these aquifers contain freshwater and underlie a thin layer of Mississippian limestone and/or the Chattanooga Shale of Mississippian and Devonian age (Lloyd and Lyke 1995).

Precipitation is the primary source of recharge in the Interior Low Plateaus Physiographic Province. Most of the precipitation becomes overland runoff to streams, but some percolates downward through soil to the underlying bedrock. In the consolidated rocks, however, most of the water moves through and is discharged from secondary openings, such as joints, fractures, bedding planes, and solution openings. As a result, groundwater discharge from springs is common throughout this physiographic province. However, the volume of solution openings in the Ordovician limestones is estimated to be less than 0.5 percent of the total rock volume (Lloyd and Lyke 1995).

The quality of the water in the carbonate aquifers in the Ordovician rocks is considered hard and contains high concentrations of dissolved solids, chlorine, and iron. These concentrations are, however, equal to or less than USEPA's secondary maximum contaminant levels for drinking water. The quality of the water generally is adequate for domestic use, or it can be treated and made adequate for most uses. Contaminated and turbid waters are common problems for the users of water from the carbonate aquifers in Ordovician rocks. The thin soil and residuum and the presence of solution features, such as sinkholes, swallow holes, and solution-enlarged fractures, allow water from the land surface to recharge the aquifer directly and rapidly. Contaminated and sediment-laden waters can then spread through a system of interconnected solution openings, which can eventually reach wells and springs (Lloyd and Lyke 1995).

Karst systems are readily susceptible to contamination as the waters can travel long distances through conduits with no chance for natural filtering processes of soil or bacterial action to diminish the contamination. In unconfined conditions, karst aquifers have very high flow and contaminant transport rates under rapid recharge conditions such as storm events (Tennessee Department of Environment and Conservation [TDEC] 2002). Consequently, the groundwater sources in karst aquifers considered most vulnerable to contamination are those that are under the direct influence of surface water.

Public water for Sumner County is supplied by surface water sources (USEPA 2009). The proposed project area is not within a state designated source water protection area. Residential wells may occur near the project area.

3.2. Surface Water

Precipitation in the project area averages about 52 inches per year. The wettest month is March, with 5.4 inches of precipitation, and the driest month is October, with 3.2 inches of rainfall. The average annual air temperature is 57 degrees Fahrenheit (°F). Temperatures range from a monthly average of 34°F in January to 78°F in July. Stream flow varies with rainfall and averages about 21 inches of runoff per year. This equates to approximately 1.5 cubic feet per second per square mile of drainage area.

The project area drains to the Cumberland River (at Old Hickory Reservoir) and its tributaries, including Bledsoe Creek and its tributaries Deshea Creek, Dry Creek (and its tributary Pryor Branch), and Brushy Fork Creek. The northern end of the project area drains to Caney Fork Creek of West Fork Drakes Creek, which flows into Kentucky to Drakes Creek of the Barren River of the Green River in the Ohio River Basin. All of the streams in the project vicinity are classified for fish and aquatic life, recreation, livestock watering, and irrigation (TDEC 2007). Portions of Bledsoe Creek in Bledsoe Creek State Park, Old Hickory WMA, and Cragfont State Historic Area are designated by the state as Tier 2 (high quality) streams (TDEC 2010a). One unnamed tributary to Old Hickory Reservoir is on the state 303(d) list as impaired (i.e., not fully supporting its designated uses) due to loss of biological integrity because of siltation from discharges from a municipal separate storm sewer system area (TDEC 2008; TDEC 2010b).

3.3. Aquatic Ecology

Portions of the proposed project area are located within either the Outer Nashville Basin or the Eastern Highland Rim level IV ecoregions (Griffith et al. 1998). Although the majority of

the proposed project lies within the Cumberland River watershed, the northern end of the proposed transmission line ROW and the proposed switching station lie within the watershed of the Green River, a major tributary to the Ohio River. Additional information regarding the streams affected can be found in Section 3.2. Aquatic communities in the project area would vary depending on water quality, width and depth, and habitat conditions both within and along the watercourses. No aquatic life field surveys were performed; however, aquatic communities are expected to be similar to those previously described in the region (Etnier and Starnes 1993; Parmalee and Bogan 1998).

Watersheds that are in the Nashville Basin ecoregion are characterized by low to moderate gradient and are virtually paved in some areas with expanses of limestone bedrock interspersed with rock rubble riffle areas, silty basins, and some sand and gravel reaches (Etnier and Starnes 1993). Many streams in this vicinity are dry and reduced to isolated pools or are subterranean during the late summer and fall (TDEC 2003). The limestone freely leaches nutrients; consequently, waters are very productive, and algae and rooted vegetation are abundant in streams.

North of the Nashville Basin ecoregion lie the headwaters of the Barren River system that drain the northward-sloping portion of Tennessee's Highland Rim before flowing into Kentucky to join the Green River. Streams in the Highland Rim ecoregion are characterized by course chert gravel and sand substrates interspersed with bedrock areas, moderate gradients, clear waters, and moderate to low productivity, and thus little aquatic vegetation except near spring sources (Etnier and Starnes 1993).

A total of 124 watercourses, including 25 perennial, 28 intermittent, 61 wet-weather conveyances, and 10 ponds occur along the proposed transmission line route. The location of each of these was recorded using a global positioning system and a listing of stream crossings, excluding wet-weather conveyances, is provided in Appendix J. Watercourses documented during the field survey were typical of those found in the Outer Nashville Basin or the Eastern Highland Rim ecoregions.

Because transmission line construction and maintenance activities mainly affect riparian conditions and in-stream habitat, TVA evaluated the condition of both of these at each stream crossing along the proposed route and along access roads. A habitat assessment form was also completed for each watercourse during field surveys that occurred in November 2009 and March 2010. Subsequently, the riparian condition was assigned to one of three classes to indicate the current condition of streamside vegetation across the length of the proposed transmission line and access roads (Table 3-1). The assigned classes are as follows:

- 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 - Sparse trees and/or scrub-shrub vegetation is present within a band of riparian vegetation 20 to 60 feet wide. Disturbance of the riparian zone is apparent.

- Nonforested - No or few trees are present within the riparian zone. Significant vegetation clearing has occurred, usually associated with pasture or cropland.

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

Riparian Condition	Number of Perennial Streams	Number of Intermittent Streams	Total
Forested	9	11	20
Partially forested	9	8	17
Nonforested	8	8	16
Total	**26**	**27**	**53**

TVA then assigns appropriate categories of protection levels, SMZs, and best management practices (BMPs) based upon these evaluations and other considerations [such as 303(d) status and the presence of endangered or threatened aquatic species]. Implementation of these BMPs minimizes the potential for impacts to water quality and in-stream habitat for aquatic organisms.

3.4. Vegetation

As previously mentioned, the proposed project area is located in the Eastern Highland Rim and Outer Nashville Basin level IV ecoregions (Griffith et al. 1998). Most of the project area (greater than 90 percent) occurs in the Outer Nashville Basin, which is located in the southern portion of Sumner County. In the Outer Nashville Basin, pasture, cropland, and deciduous forest are the dominant land cover. Ordovician-aged limestone bedrock is common in the lower portions of the region, but the higher, more rugged areas are underlain by Mississippian and Devonian-aged chert and shale more indicative of the Highland Rim. The northern portion of the Sumner County project area lies is the Eastern Highland Rim ecoregion. Landforms of the Eastern Highland Rim are characterized as tablelands of moderate relief and irregular plains. Natural vegetation in this region is an intermediate type between the oak-hickory forests found to the west and the mixed mesophytic forests found farther east in Appalachia.

The two main types of vegetation found in the proposed transmission line ROW, access roads, and switching station site are herbaceous vegetation (68 percent) and forested vegetation (32 percent). 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 predominate in the project area. Early successional habitat (found along existing transmission line ROW areas) and pasture are the most common types of herbaceous vegetation found along the proposed transmission line ROW routes and switching station site. Common species include cocklebur, foxtail, orchard grass, sericea lespedeza, tall fescue, white clover, and yellowdicks.

The forested vegetation occurring in the project area is comprised of deciduous and mixed evergreen-deciduous forests. Deciduous forests are the most prevalent forest, accounting for about 90 percent of total forest cover.

Deciduous forest is characterized by trees with overlapping crowns where deciduous species account for more than 75 percent of the canopy cover. Dominant are varieties of tree species including black oak, black walnut, blackgum, chinquapin oak, sugar maple, and

shagbark hickory that range from 12 to 24 inches diameter at breast height (DBH). Young deciduous forest along the proposed ROW had pole-sized hackberry, red mulberry, white ash, and yellow-poplar trees in the overstory. Though the project area was surveyed in November when many herbaceous species are not visible above ground, much of the forested area was grazed and likely exhibits low species richness. Herbaceous species commonly observed include clearweed, downy wild rye, ebony spleenwort, Virginian wild rye, Indian pink, and white snakeroot.

Mixed evergreen-deciduous forest has more than 25 percent canopy cover of both evergreen and deciduous trees and accounts for about 10 percent of total forest cover in the project area. These forest stands are early successional and many are grazed. Common overstory tree species are less than 12 inches DBH and include black walnut, eastern red cedar, Osage orange, and white ash. The herbaceous vegetation in these areas lacks variety likely due to intensive grazing by cattle.

Invasive species are nonnative species that can degrade natural areas and displace native species, generally by outcompeting or hybridizing with native species or by altering ecological communities or ecosystem processes (Morse et al. 2004). EO 13112 for 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 invasive species potentially cause. TVA has compiled a list of invasive species considered high priority because of their potential to spread rapidly, displace native vegetation, and occur in dense stands of numerous individuals (Appendix K). During field surveys, invasive plants were observed in both forest and herbaceous vegetation types, but herbaceous areas generally contained both greater numbers and cover of nonnative, invasive plant species. This likely reflects the frequency and magnitude of disturbance present in areas of herbaceous vegetation. Disturbances associated with mowing, grazing, and ROW maintenance prevent tree species from becoming established, but can also encourage invasion and establishment of weedy species. No plants identified on the Federal Noxious Weed List (United States Department of Agriculture [USDA], 2010) were observed; however, there were eight nonnative plant species (Table 3-2) considered a severe threat to native plant communities in Tennessee identified in the project area (Tennessee Exotic Plant Pest Council 2009).

Table 3-2. Invasive Plant Species Observed Within the Proposed 161-kV Transmission Line Right-of-Way and on the Switching Station Site

Common Name	Scientific Name
Autumn olive	*Elaeagnus umbellata* var. *pariflora*
Chinese privet	*Ligustrum sinense*
Johnson grass	*Sorghum halepense*
Multiflora rose	*Rosa multiflora*
Japanese Stiltgrass	*Microstegium vimineum*
Princess tree	*Paulownia tomentosa*
Sericea lespedeza	*Lespedeza cuneata*
Tree of heaven	*Ailanthus altissima*

3.5. Wildlife

Habitat assessments along the proposed transmission line corridor and switching station site were conducted in November 2009 and along access roads in March 2010. The project area occurs in a landscape disturbed and shaped by previous agricultural and development practices (existing roads, residential and industrial buildings). As described in Section 3.4, terrestrial habitat observed along the proposed transmission line route, associated access roads, and switching station site is characterized by two main types—herbaceous vegetation and forested vegetation. Some fragmented forested areas occur on the southern end of the project area, but the majority of forested habitat is located in the northern half of the project area between US 31E and the northern terminus of the proposed project. Features occurring within both habitat types included a variety of karst features, such as sinkholes and outcrops, and aquatic features, including an embayment, farm ponds, streams, springs, and wet-weather conveyances.

Herbaceous wildlife habitat included existing transmission line ROW, cattle pastures, residential lawns, and fields. Pastures and other areas composed primarily of herbaceous vegetation provide habitat for early successional bird species such as Carolina wren, eastern bluebird, American robin, brown thrasher, white-eyed vireo, yellow-breasted chat, prairie warbler, indigo bunting, northern cardinal, blue grosbeak, field sparrow, song sparrow, and orchard oriole. Birds found in early successional habitats with a dominant grass component include dickcissel, grasshopper sparrow, savannah sparrow, northern bobwhite, eastern meadowlark and white-throated sparrow. Small mammals such as eastern mole, white-footed mouse, and prairie vole, and larger mammals such as eastern cottontail, woodchuck, common raccoon, and white-tailed deer can be abundant in early successional habitats. Predators that hunt small mammals in these areas include red fox, coyote, snakes, and raptors such as American kestrel and red-tailed hawk. Reptiles often found in early successional habitats include black racer, black rat snake, milk snake, and common garter snake. Wetlands and streams occurring within areas dominated by herbaceous vegetation provide habitat for amphibians including American and Fowler's toads, green frog, northern cricket frog, southeastern chorus frog, and red-spotted newt.

Forested wildlife habitat included deciduous forest and mixed evergreen-deciduous forest. These forested areas provide habitat for wild turkey, downy woodpecker, pileated woodpecker, white-breasted nuthatch, and American crow, as well as numerous Neotropical migrant birds such as wood thrush, red-eyed vireo, ovenbird, hooded warbler, black-and-white warbler, and yellow-rumped warbler. White-tailed deer and eastern gray squirrel are mammals frequently found in deciduous forests, and scattered rock outcrops within these forests provide habitat for woodrats and other small mammals. Eastern zigzag and slimy salamanders were observed during field surveys, and common reptiles include eastern box turtle, ring-necked snake, black rat snake, and copperhead. Wetlands and streams within deciduous woodlands provide habitat for amphibians such as American and Fowler's toads, northern cricket frog, spotted salamander, red salamander, and red-spotted newt.

Five caves and two heron colonies are known from within 3 miles of the proposed actions. No other unique habitats have been reported from the project area. During field investigations, unique and important terrestrial habitats were sought out. Several small sinkholes were observed near the proposed route, but no previously undocumented caves, heronries, or other unique habitats were observed during the field surveys.

3.6. Endangered and Threatened Species

Six species federally listed under the ESA and 13 state-listed species are known from Sumner County or within the vicinity of the proposed transmission line or switching station. No federally designated critical habitat occurs in the proposed project area.

3.6.1. Aquatic Animals

Two federally listed and ten state-listed aquatic species are known to occur in Sumner County (Table 3-3) and/or within a 10-mile radius of the proposed project. However, the federally listed Appalachian monkeyface and the state-listed flame chub and ornate rocksnail are historical records and likely no longer occur within the area due to habitat loss.

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

Common Name	Scientific Name	Status[1]	
		Federal	State (Rank[2])
Fish			
Bedrock shiner	*Notropis rupestris*	-	NMGT (S2)
Blackfin sucker	*Thoburnia atripinnis*	-	NMGT (S1)
Flame chub[3]	*Hemitremia flammea*	-	NMGT (S3)
Frecklebelly darter	*Percina stictogaster*	-	NMGT (S1)
Lake sturgeon	*Acipenser fulvescens*	-	END (S1)
Orangefin darter	*Etheostoma bellum*	-	NMGT (S3)
Slenderhead darter	*Percina phoxocephala*	-	NMGT (S3)
Splendid darter	*Etheostoma barrenense*	-	NMGT (S3)
Teardrop darter	*Etheostoma barbouri*	-	NMGT (S2)
Mussels			
Appalachian monkeyface[3]	*Quadrula sparsa*	END	END (S1)
Pink mucket	*Lampsilis abrupta*	END	END (S2)
Snail			
Ornate rocksnail[3]	*Lithasia geniculata*	-	TRKD (S3)

Source: TVA Natural Heritage database December 2009
[1]Status Codes: END = Listed endangered; TRKD = Tracked as sensitive but has no legal status; NMGT = Listed in need of management
[2]State Ranks: S1 = Extremely rare and critically imperiled in the state with five or fewer occurrences, or very few remaining individuals, or because of some special condition, where the species of some factor(s) make it vulnerable to extinction; S2 = Very rare and imperiled within the state, six to 20 occurrences; S3 = Rare or uncommon with 21 to 100 occurrences
[3]Historical Record = There is a lack of recent field information verifying the continued existence of the species, and species is considered to be possibly extirpated due to general habitat loss.

A brief description of species found within the affected watersheds, with the exception of historical records, can be found below. Habitat requirements are as described in Etnier and Starnes (1993) for fish and Parmalee and Bogan (1998) for mussels.

The bedrock shiner is state-listed because its range is restricted to the Nashville Basin in Tennessee. It is abundant in some low-gradient streams and prefers bedrock pools in the Stones, lower Caney Fork river systems, and direct Cumberland River tributaries between these watersheds in Cannon, Rutherford, Smith, and Wilson counties. Spawning is thought to occur from late May through June, but June through September data are lacking.

The blackfin sucker is endemic to the headwaters of the Barren River system in Kentucky and Tennessee (Etnier and Starnes 1993). Although not under immediate threat, the blackfin sucker is state-listed because of its restrictive geographical range in Tennessee. The species can typically be found in gentle flowing pools with slab rocks and undercut banks in large creeks. Juveniles sometimes occur in smaller tributaries.

The frecklebelly darter occurs in small rivers and larger creeks with frequent pool areas and moderate current with vegetation cover. In Tennessee, the species is restricted to the Barren River system (Etnier and Starnes 1993). The frecklebelly darter is state listed due to the peripheral nature of its distribution rather than any identifiable threats.

The lake sturgeon prefers large lakes and rivers where it feeds on crayfishes, mollusks, and insect larvae. Sturgeon species are well accepted as food, but the species is better known as a principal source of caviar. The lake sturgeon is state listed because it has been drastically reduced or eliminated throughout much of its native range (Etnier and Starnes 1993).

The orangefin darter occurs in gravel riffles with swift current in creeks to small rivers. Spawning takes place in late June to early July. This species is endemic to the headwaters of the Barren and Green river systems where it is common (Etnier and Starnes 1993). Although not under immediate threat, the orangefin darter is state listed because of its restrictive geographical range in Tennessee.

In recent years, the slenderhead darter has been collected primarily from the Duck, Stones, Harpeth, and Red River drainages, with sporadic specimens taken from main stems of the Tennessee and Cumberland rivers. The slenderhead darter is commonly found in gravel shoal areas of small to large rivers with moderate to swift current.

The splendid darter prefers riffles and pools with rocky substrates in small to medium streams. This species is endemic in the Barren River portion of upper Green River system (Ohio River drainage) of Kentucky and Tennessee, where it is common (Etnier and Starnes 1993). The splendid darter is state listed because of its restrictive geographical range in Tennessee.

The teardrop darter prefers sandy pool areas in small to medium streams with small flat stone substrate. This species is confined to the Barren River system and upper portion of the Green River system where it is moderately common (Etnier and Starnes 1993). Although not under immediate threat, the teardrop darter is state listed because of its restrictive geographical range in Tennessee.

The pink mucket is typically a big river species, but occasionally individuals become established in small to medium-sized tributaries of large rivers (Parmalee and Bogan 1998). It inhabits rocky bottoms with swift current usually in less than 3 feet of water.

3.6.2. Plants

Two federally listed and one state-listed plant species are known from Sumner County or are known to occur within a 5-mile vicinity of the project area (Table 3-4). No designated critical habitat for plant species occurs in the project area.

Field surveys of the project area occurred in November (2009) when these three listed plant species would not likely be visible above ground (Table 3-4). However, each of these three species has distinct habitat requirements that can be observed during any season (U.S. Fish and Wildlife Service [USFWS] 2006; McKerrow and Shea 1993; USFWS 1991). No habitat appropriate for any of the three plant species was observed in the project area.

Table 3-4. Federally and State-Listed Species Known From Sumner County, Tennessee, and/or Within a 5-Mile Radius of the Proposed Project Area

Common Name	Scientific Name	Status[1]	
		Federal	State (Rank[2])
Leafy prairie-clover[3]	*Dalea foliosa*	END	END (S2S3)
Spring Creek bladderpod	*Lesquerella perforata*	END	END (S1)
Water stitchwort	*Stellaria fontinalis*	-	THR (S3)

Source: TVA Natural Heritage database November 2009

[1]Status Codes: END = Endangered; THR = Threatened

[2]State Ranks: S1 = Extremely rare and critically imperiled in the state with five or fewer occurrences, or very few remaining individuals, or because of some special condition where the species is particularly vulnerable to extirpation; S2 = Very rare and imperiled within the state, six to 20 occurrences; S3 = Rare or uncommon with 21 to 100 occurrences; S#S# = Denotes a range of ranks because the exact rarity of the element is uncertain (e.g., S1S2)

[3]Federally listed species occurring within the county, but not within 5 miles of the project area

3.6.3. Terrestrial Animals

Two federally and two state-listed terrestrial animal species are known from Sumner County or within 3 miles of the proposed project area (Table 3-5). No federally or state-listed terrestrial animal species were observed during field surveys conducted in November 2009 or March 2010; however, habitat suitable for summer roosting of the federally listed endangered Indiana bat (*Myotis sodalis*) was found within the proposed ROW. This species is not known from the project vicinity but is considered because it is known from nearby counties in Kentucky.

Table 3-5. Federally and State-Listed Terrestrial Animal Species From Sumner County, Tennessee, and/or Within a 3-Mile Radius of the Proposed Project Area

Common Name	Scientific Name	Status[1]	
		Federal	State (Rank[2])
Bird			
Bald eagle	*Haliaeetus leucocephalus*	DM	END (S2)
Mammals			
Gray bat	*Myotis grisescens*	END	END (S2)
Southeastern shrew	*Sorex longirostris*	-	NMGT (S4)
Allegheny woodrat	*Neotoma magister*	-	NMGT (S3)

Source: TVA Natural Heritage database October 2009

[1]Status Codes: END = Endangered; DM = Recovered, delisted, and being monitored; NMGT = In need of management

[2]State Ranks: S2 = Very rare and imperiled within the state, six to 20 occurrences, or few remaining individuals, or because of some factor(s) making it vulnerable to extinction; S3 = Rare or uncommon in the state, from 21-100 occurrences; S4 = Widespread, abundant, and apparently secure within the state, but with cause for long-term concern

Bald eagles were removed from the endangered species list, but remain protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Both acts prohibit harm to eagles or their nests. Bald eagles nest in forested areas near large bodies of water, such as rivers and reservoirs, where they forage (Bryan et al. 2005; Thompson et al. 2005). Two active pairs have been reported within Sumner County near GAF along the Cumberland River and Old Hickory Reservoir. The closest active nest is 770 feet southeast of the proposed ROW. Suitable habitat does exist for the bald eagle along the proposed transmission line route.

Gray bats roost in caves year-round and typically forage over streams, rivers, and reservoirs (Tuttle 1976). Gray bats have been reported from one cave in Sumner County that is located 0.8 mile from the proposed transmission line ROW. A cove located adjacent to the Cumberland River and several streams provide foraging habitat along the proposed route.

Approximately 0.25 mile of the proposed ROW was identified as having habitat potentially suitable for summer roosting by Indiana bats. The Indiana bat is not known to occur within a 10-mile radius of the proposed project area. However, given the proximity of the proposed project area to locations in several counties in Kentucky from where the Indiana bat has been reported, the potential for summer roosting at this location is possible.

Southeastern shrews are found primarily in bogs, swamps, among dense ground cover in wooded areas, and occasionally in upland fields some distance from water. They live underground, and come above ground after a rain or on humid nights. Suitable habitat for this species is available in the project area.

Allegheny woodrats occur in rocky bluffs, caves, and other rocky habitats (Whitaker and Hamilton 1998). Small rock outcrops within the project area could provide suitable habitat for this species.

3.7. Wetlands

Wetlands are those areas inundated by surface water or groundwater such that vegetation adapted to saturated soil conditions is prevalent. Examples include swamps, marshes, bogs, and wet meadows. Wetland fringe areas also are found along the edges of most watercourses and impounded waters (both natural and man-made). Field surveys were conducted in November 2009 to delineate wetland areas within the proposed transmission line ROW, the associated access roads, and the switching station site.

Wetland determinations were performed according to the USACE standards, which require documentation of hydrophytic (i.e., wet-site) vegetation, hydric soil, and wetland hydrology (Environmental Laboratory 1987; Reed 1997; U.S. 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. Using a TVA-developed modification of the Ohio Rapid Assessment Method (Mack 2001) specific to the TVA region (Tennessee Valley Authority Rapid Assessment Method [TVARAM]), wetlands were categorized 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/statewide concern, such as wetlands that provide habitat for threatened or endangered species.

The southern portion of the proposed transmission line corridor traverses a flat to rolling landscape dominated by agricultural fields, crossed by roadways and riparian corridors, and containing scattered residential developments. The landscape crossed by the northern portion of the line is hilly, with large tracts of upland forest. Three wetlands, totaling 0.27 acre, were identified within the proposed transmission line ROW. One additional wetland was identified adjacent to an existing access road (Table 3-6).

Table 3-6. Wetlands Within the Proposed Gallatin-Angeltown 161-kV Transmission Line Right-of-Way and Along Proposed Access Roads

Wetland Identifier	Type[1]	Wetland Acreage	Estimated Forested Wetland Acreage in Proposed Right-of-Way	TVARAM Category (score)
W001	PEM/PSS1E	0.02	--	1 (28)
W002	PEM/PSS1E	0.03	--	1 (25)
W003	PEM/PFO1E	0.22	0.11	2 (42)
W004[2]	PEM1E	0.03	--	1 (28.5)
Total Acres		**0.30**	**0.11**	

[1]Classification codes as defined in Cowardin et al. (1979): PEM1 = Palustrine emergent, persistent vegetation; PSS1 = Palustrine scrub-shrub, broadleaf deciduous; PFO1 = Palustrine forested, broadleaf deciduous; E = Seasonally flooded/saturated

[2]Located adjacent to Access Road 10

W001 is a small emergent/scrub-shrub wetland within an open, mowed field south between GAF and the Cumberland River. This wetland totals 0.03 acre in size; however, only 0.02 acre is located within the ROW. W001 exhibits hydric soils and drains into an unnamed intermittent stream tributary to the Cumberland River. W001 is dominated by wetlands vegetation that includes black-willow saplings, giant reed, and serrate eupatorium.

W002 is a small emergent/scrub-shrub wetland within a recently clear-cut and partially graded tract. This wetland totals an estimated 0.25 acre in size; however, only 0.03 acre is located within the ROW. W002 exhibits hydric soils and drains into an unnamed intermittent stream to the West Prong of Caney Fork. W002 is dominated by wetlands vegetation that includes black-willow saplings, sycamore saplings, knotweed, and flat sedge.

W003 is an approximate 0.5-acre emergent/forested wetland located at the north end of proposed ROW along a roadside. Of this 0.5-acre, only 0.22 acre is located within the ROW, and only half of this is forested. This wetland exhibits hydric soils and drains into an unnamed tributary of Caney Fork Creek. W003 is dominated by wetlands vegetation that includes sweet gum, cattails, beggars tick, knotweed, and a wetland aster.

W004 is a 0.03-acre emergent wetland located adjacent to Access Road 10. This wetland receives drainage from a spring located on the east side of the access road that drains across the road and into the wetland. The wetland delivers water into a pond that drains into an unnamed tributary of Pryor Branch. This wetland exhibits hydric soils and is vegetated predominantly by cattails and buttercups.

3.8. 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 transmission line route and access roads cross several floodplain areas in Sumner County associated with streams listed in Section 3.2. The proposed 161-kV switching station would not be located within the 100-year floodplain.

3.9. Prime Farmland

Prime farmland soils, as defined by the USDA, are those soils with 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. Prime farmland does not include land that is already in or committed to urban development (through, for example, zoning) or to water storage.

This project involves the construction of about 19.6 miles of new transmission lines and a 161-kV switching station. Switching station construction would alter approximately 6 acres of the proposed 10-acre site. The construction of transmission lines and their support structures would not render farmland unusable because transmission line ROWs can still be farmed. Only the land occupied by the switching station would be converted to nonfarm use. Consequently, this prime farmland evaluation is restricted to the switching station site.

The proposed switching station would be located on a 10-acre site adjacent to the existing Portland-Westmoreland 161-kV Transmission Line ROW in Sumner County. The site is currently maintained in early successional vegetation and pasture. The USDA Soil Survey for Sumner County indicates that the proposed switching station site property contains four different soil types (Appendix L).

Dickson Silt Loam (DkB2) soils comprise about 7 acres or 70 percent of the proposed site. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA 2008), DkB2 is considered prime farmland. Other soils on the proposed site consist of Guthrie Silt Loam (Gu), Sugargrove Gravelly Silt Loam (SgD2), and Sulphura Channery Silt (SuD). These are not considered as soils composing prime farmland areas.

3.10. Aesthetics

3.10.1. 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 4.10.

All of the proposed work as defined under this EA is located within GAF, along existing transmission lines coming into the plant switchyard, or tapping existing transmission lines located outside of the plant site for new construction. GAF is located 5 miles southeast of Gallatin on a peninsula on the north bank of the Cumberland River. Completed in 1959, Gallatin is a relatively large fossil site with extensive ash ponds and wooded rolling hills. The switchyard area that will be used for new ROW is a broadly horizontal industrial feature with numerous steel-pole structures that are seen in foreground distances from numerous locations inside the plant site area.

Along Steam Plant Road, the existing Gallatin-Hoeganaes 161-kV Transmission Line can be seen mainly in the foreground by motorists. There are few homes along the road, particularly within several miles of the plant site. Terrain ranges from slightly rolling to mainly flat within the road ROW. Road ROW is cleared and maintained and transitions to a natural, heavily vegetated wood line outside its boundaries along each side.

The existing Gallatin-Hartsville-Westmoreland 69-kV Transmission Line crosses predominately open land northwest of the GAF. The wood-pole structures can be seen in the foreground and middleground by area residents and motorists. The existing line is visually similar to other service poles and structures seen along local roadways.

The new Gallatin-Angeltown 161-kV Transmission Line, structures, and ROW would traverse a variety of Middle Tennessee countryside. The proposed transmission line would begin at the Gallatin-Hartsville-Westmoreland 69-kV Transmission Line north of the Cumberland River, approximately 4.4 miles northeast of the GAF, and just east of Cairo Road. The line would be routed over mainly agriculture land along this portion, crossing SR 25 to the north and continuing across open fields before crossing US 31E. Farther north, the line would disappear into heavily vegetated rolling topography. Steep peaks along this section of the line become focal points in the landscape and contrast with gently sloping open land to the east. Scenic attractiveness is common. Scenic integrity is moderate to low.

The proposed transmission line would cross Fork Creek Road farther north, a minor road used mainly for local residential traffic. The line would quickly disappear into heavy vegetation and continue north along steep slopes. There are few homes along this section

of the route and few road crossings. The line would cross Smith Thompson Road and Buck Perry Road to the north before terminating at the proposed Angeltown Switching Station. The existing Westmoreland-Portland 161-kV Transmission Line and steel-pole structures can be seen in the foreground by one resident to the south. Scenic attractiveness is common. Scenic integrity is moderate.

3.10.2. 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) used 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 3-7). 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 3-7. Estimated Annoyance From Background Noise

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

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 higher-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.

Sources of noise expected during the transmission line construction would include equipment used for clearing the ROW, for transporting structures and conductors to the site, construction of the transmission line, and revegetation of the ROW. These sources would generate noise above ambient levels in areas that are undergoing clearing and construction. Similarly, noise related to periodic line and vegetation maintenance is also expected to occur for short durations during the operation of the transmission line. In residential areas, the need for periodic ROW vegetation maintenance, i.e., mowing, would be limited or nonexistent.

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. This noise is

generated by the corona resulting from the dissipation of energy and heat as high voltage is applied to a small area. Under normal conditions, corona-generated noise is not audible. The noise may be audible under some wet conditions, but the resulting noise level away from the ROW would be well below the levels that can produce interference with hearing.

Both the USEPA and the United States 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.

3.10.3. Odors

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

3.11. Recreation, Parks, and Natural Areas

Informal outdoor recreation activities such as target practice, hunting, nature observation, and off-road vehicle activity may occur on some of the lands within the path of the proposed transmission line.

The project site crosses or abuts the boundaries of three natural areas, including two state WMAs and a USACE reservoir reservation. A state park and a wildlife observation area are within 0.5 mile of the project site. A protection planning site including a cave, a heronry, and one Nationwide Rivers Inventory (NRI) listed stream is within a mile of the project site.

The GAF WMA is managed by TWRA for big game hunting using only archery equipment. This 1,500-acre tract of land is located on TVA property in Sumner County on Odoms Bend. The existing Gallatin-Hoeganaes 161-kV Transmission Line crosses or abuts the eastern boundary of this WMA.

Old Hickory WMA, Units I-III, consists of 6,000 land acres along the shoreline and 21,700 water acres of Old Hickory Reservoir in Sumner, Wilson, and Trousdale counties. The unit of interest for this assessment is Unit I, which extends from SR 109 upstream to Cumberland River Mile (CRM) 267, excluding Lock 5 Refuge. The WMA, on USACE land and water, is managed by TWRA primarily for waterfowl hunting, although big game and small game hunting is allowed. The existing Gallatin-Hartsville-Westmoreland 69-kV Transmission Line crosses the northern tip of a small creek embayment on the Old Hickory Reservoir.

Old Hickory Reservoir Reservation is located on 26,386 land acres in Sumner and Davidson counties, and includes a lock, a dam, and a power plant on the Cumberland River at CRM 216.2. The Old Hickory Reservoir covers 22,500 water acres and 440 miles of shoreline. The reservoir is owned and managed by USACE for hydropower production, retention and regulation of floodwaters, river navigation, environmental stewardship, and recreational uses. The existing Gallatin-Hartsville-Westmoreland 69-kV Transmission Line crosses the northern tip of a small creek embayment on the Old Hickory Reservoir.

Bledsoe Creek State Park, approximately 0.3 mile east of the proposed new ROW, is managed by TDEC. This state park is on a 164-acre tract located on the Bledsoe Creek embayment of Old Hickory Reservoir at approximately CRM 248.5. Park activities include boating, camping, fishing, and hiking. Extensive renovations were made in 2009 to the 1960s campground to provide spaces suitable for recreational-vehicle camping and to improve facilities and services. This park is a state-designated Wildlife Observation Area.

GAF Protection Planning Site includes two disjunct areas: a cave, approximately 0.8 mile southwest of the project site and a heronry, approximately 1.7 miles northwest of the project site. The cave, which is across the Cumberland River from GAF, provides habitat for gray bats. The heronry, approximately a mile northwest of the cave, is inactive.

Bledsoe Creek, NRI-listed stream, is located in Sumner County approximately 0.7 mile east of the proposed new ROW. Between River Mile 0 at Old Hickory Reservoir, and River Mile 14 at Bethpage, the National Park Service recognizes Bledsoe Creek for its outstanding scenic, recreational, geologic, fish, wildlife, historic, and cultural values.

3.12. Historical and Archaeological Resources

The northern Highland Rim and Nashville Basin ecoregions of Middle Tennessee have been an area of human occupation for the last 12,000 years. Human occupation of the area is generally described in five broad cultural periods: Paleo-Indian (11,000 to 8000 B.C.), Archaic (8000 to 1600 B.C.), Woodland (1600 B.C. to A.D. 1000), Mississippian (A.D. 1000 to 1700), and Historic (A.D. 1700 to present). Prehistoric land use and settlement patterns vary during each period, but short- and long-term habitation sites are generally located on floodplains 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 Sumner County began in the 17th and 18th centuries associated with the fur trading industry (Lester 1998). In 1799, the city of Cairo was established by two merchants as a trading town. Cairo was an important river port during the Civil War. The first part of the 19th century was a time of growth and development. Better transportation through improved roads, a stagecoach line, river trade, and ferry services brought about the establishment of about 30 communities. The early 20th century was focused on agriculture production. When TVA built Old Hickory Dam and a steam electric generating plant at Gallatin, new jobs were brought to the county. The largest city in the county is Hendersonville, which became a tourist center for country music fans.

The APE for archaeological resources consists of all areas in which land-disturbing activities would take place. The APE includes 6.5 miles of existing 100-foot-wide transmission line ROW, approximately 13.5 miles of proposed 100-foot-wide ROW, and approximately 10 acres proposed for a switching station. The APE for historic/architectural resources includes any historic structures within a 0.5-mile radius surrounding the proposed

transmission line corridor and switching station site, as well as any areas where the project would alter existing topography or vegetation in view of a historic resource.

Prior to the survey, a records search was conducted, and one previously recorded archaeological resource (40SU192) was identified within the APE. Site 40SU192 is a 19th century agricultural and possible industrial site that consists of complex stone wall features. The APE crosses the center of 40SU192, but is considered ineligible for listing in the NRHP due to a lack of research potential and intact archaeological deposits.

The records search also identified 51 previously recorded architectural resources within the APE (Barrett 2009; Appendix A). Of these, the Womack House is eligible for the NRHP, Oakland House is listed in the NRHP, 14 have been destroyed since their initial recordation, 15 are located outside the visual line-of-sight to the project corridor, and 20 are considered ineligible for the NRHP due to lack of architectural distinction and loss of integrity.

The archaeological survey conducted in October through December 2009, identified five previously unrecorded archaeological resources (Barrett 2009; Appendix A). Four of these consist of prehistoric open habitations that are considered ineligible for the NRHP due to the lack of research potential and intact archaeological deposits. The fifth consists of a prehistoric open habitation and 19th/20th-century scatter that is considered ineligible for the NRHP due to the lack of research potential and intact archaeological deposits. The architectural survey identified 10 previously unrecorded architectural resources (Barrett 2009; Appendix A). These resources are considered ineligible for the NRHP due to lack of architectural distinction and loss of integrity.

3.13. Socioeconomics

The proposed transmission line and switching station would be located in Sumner County, which is northeast of Nashville. Sumner County adjoins the northeast boundary of Davidson County and is part of the Nashville-Davidson-Murfreesboro-Franklin Metropolitan Statistical Area (MSA). The estimated population of Sumner County in 2009 was 158,759, an increase of 21.7 percent since 2000 (U.S. Census Bureau 2009). This increase is slightly faster than the estimated 20.6 percent increase in population of the MSA. If recent population growth rates continue, the population of Sumner County will increase to well over 200,000 during the next 20 years. The economy of Sumner County is closely tied to Nashville-Davidson County. According to U.S. Bureau of the Census data for the year 2000, over 26,000 Sumner County residents commuted to Davidson County to work while almost 32,000 worked in Sumner County (U.S. Census Bureau 2000a). Per capita personal income in Sumner County in 2008 was $34,768, 99.8 percent of the state average and 86.6 percent of the national average.

The proposed transmission line would run north from GAF, located in Census Tract (CT) 209.01, continuing through CT 206 and into CT 201 where the proposed Angeltown 161-kV Switching Station would be located. All construction activity in CT 209.01 would be on existing ROW, alongside existing transmission lines. Under the Action Alternative, five census block groups in these CTs would be impacted by the construction of the transmission line. Population of these block groups ranges from 900 to 1,609. Table 3-8 provides the most current population data for the block groups and CTs that would be impacted under the preferred alternative.

Table 3-8. Population of Census Tracts and Block Groups Along Proposed Route, 2000

Area	Total Population
Census Tract 201	7,297
Block Group 4	1,363
Census Tract 206	8,178
Block Group 1	900
Block Group 5	1,609
Block Group 6	1,091
Census Tract 209.01	1,467
Block Group 1	1,467
Sumner County	130,449
Tennessee	5,689,283
United States	281,421,906

Source: U.S. Census Bureau 2000b

3.14. Environmental Justice

As indicated in Section 3.13, the proposed transmission line would run from CT 209.01 through CT 206 and into CT 201 (U.S. Census Bureau 2000b). All construction activity in CT 209.01 would be on existing ROW, alongside existing transmission lines. New contruction would occur along CT 206 and 201. The most current data on disadvantaged populations for the block groups that would be impacted under the proposed Action Alternative are provided in Table 3-9.

Table 3-9. Minority and Low-income Populations, 2000

Area	Total Population	Percent Minority	Percent Below Poverty Level
Census Tract 201	7,297	1.7	12.3
Block Group 4	1,363	1.5	12.0
Census Tract 206	8,178	6.2	5.8
Block Group 1	900	4.3	5.5
Block Group 5	1,609	6.4	2.4
Block Group 6	1,091	12.8	10.3
Census Tract 209.01	1,467	11.2	5.6
Block Group 1	1,467	11.2	5.6
Sumner County	130,449	9.4	8.1
Tennessee	5,689,283	20.8	13.5
United States	281,421,906	30.9	12.4

Source: U.S. Census Bureau 2000b

CHAPTER 4

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter contains a discussion of the potential environmental effects of implementing the two alternatives under consideration. The discussion of the potential effects to each resource is presented in the same order as the previous chapter.

4.1. Groundwater and Geology

4.1.1. No Action Alternative

Under the No Action Alternative, there would be no direct effects to groundwater or geological resources because the proposed transmission line and switching station would not be built. The existing transmission line would remain in operation, and periodic and routine maintenance of these ROW easement sections would continue. Thus, there would be no project-related direct, indirect, or cumulative effects to groundwater or geological resources under the No Action Alternative.

4.1.2. Action Alternative

The project area is located within karst terrain, which can allow groundwater systems to be easily contaminated. Although no state designated source water protection areas were identified along the proposed ROW, TVA would implement BMPs to avoid contamination of groundwater in the project area. BMPs (Muncy 1999) would be used during construction to minimize potential sediment infiltration from storm water runoff. Additionally, during revegetation and maintenance activities, fertilizers and herbicides would be applied with caution and in accordance with the manufacturers' label directions. With the use of BMPs, direct, indirect, and cumulative impacts to groundwater as a result of the proposed action would be insignificant.

4.2. Surface Water

4.2.1. No Action Alternative

Under the No Action Alternative, the proposed 161-kV transmission line and associated switching station would not be constructed. Thus, there would be no project-related effects to surface water or to surface water quality along the proposed ROW or switching station site under the No Action Alternative.

4.2.2. Action Alternative

Soil disturbances associated with access roads or other construction activities can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog small streams and can threaten aquatic life. Removal of the tree canopy along stream crossings can increase water temperatures and algal growth, deplete dissolved oxygen, and cause 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, operation, and maintenance of its transmission line projects to minimize these potential impacts (Appendices B, C, D, E, G, H, and Muncy 1999). Permanent stream crossings that could not be avoided would be

designed not to 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). Transmission line conductors would span stream crossings, and canopies in all SMZs would be left undisturbed unless there were no practicable 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 designed in part to restrict applications near receiving waters and to prevent unacceptable aquatic impacts. Under the Action Alternative, proper implementation of these controls is expected to result in minor and temporary direct and indirect impacts to surface waters. No cumulative impacts are anticipated.

4.3. Aquatic Ecology

4.3.1. No Action Alternative

Under the No Action Alternative, the construction of the proposed transmission line, access roads, and switching station would not be implemented, and no changes to aquatic resources within these areas would occur. Therefore, there would be no direct, indirect, or cumulative impacts to aquatic ecology under the No Action Alternative.

4.3.2. Action Alternative

Aquatic life could be affected by the proposed Action Alternative either directly by the alteration of habitat conditions within the stream or indirectly from modification of the riparian zone and storm water runoff resulting from construction and maintenance activities along the transmission line corridor. Potential impacts from the removal of streamside vegetation within the riparian zone include increased erosion and siltation, loss of in-stream habitat, and increased stream temperatures. Other potential construction and maintenance impacts include alteration of stream banks and stream bottoms by heavy equipment and runoff of herbicides into streams.

The proposed action may cause a temporary increase in sedimentation that could have an effect on 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). Mussel species adapted to a sand and gravel bottom environment cannot survive long in one composed of fine sediment and are quickly destroyed by silt that clogs the gills, smothering the animal (Parmalee and Bogan 1998).

In order to minimize potential impacts to aquatic life, BMPs as outlined in Muncy (1999) would be applied to all construction and maintenance activities.

A total of 61 watercourses that convey only surface water during storm events (i.e., wet-weather conveyances) and that could be affected by the proposed transmission line route and access roads 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. Wet-weather conveyances are included on transmission line design drawings, and protection of these areas is addressed through the storm water permitting process.

As identified in Appendix J, the 10 ponds and each of the 28 intermittent streams along the proposed transmission line would be protected by Standard Stream Protection (Category A) measures as defined in Muncy (1999) and Appendix D. In addition, Category A protection measures would apply to all perennial streams crossed by the proposed transmission line and access roads with the exception of the perennial streams identified as 010, 007AR, 008AR, and 049 (Appendix J). This category is TVA's standard (basic) level of protection for streams and the habitats around them. The purpose of this measure is to minimize the amount and length of disturbance to the water bodies without adversely impacting the construction work (Appendix D). Furthermore, a 50-foot SMZ buffer would be established as defined in Muncy (1999) on each side of the watercourses protected by Category A measures except for Stream 007 (Appendix J). Instead, due to the slope of lands surrounding Stream 007, a 75-foot SMZ buffer would be implemented on each side of this stream. The width of the SMZ is determined by the type of watercourse, primary use of the water resource, topography, or other physical barriers (Muncy 1999).

For the streams that are identified as 010, 007AR, 008AR, and 049 (Appendix J), Protection of Important Permanent Streams (Category B) would be applied as defined in Muncy (1999) and *TVA's Transmission Construction Guidelines Near Streams* (Appendix D). As perennial springs with aquatic life present, each of these water bodies is considered a sensitive aquatic resource that supports aquatic life and requires protection beyond that provided by Category A protection or standard BMPs. A 100-foot SMZ buffer would be implemented on these Category B streams. The purpose of the Category B guidelines is to minimize the disturbance of the banks and water in the flowing stream(s) where this level of protection is required.

With the implementation of appropriate BMPs and additional protection measures during construction, operation, and maintenance of the proposed transmission line and switching station, the direct, indirect, or cumulative impacts to aquatic animals resulting from the proposed action are expected to be minor and insignificant.

4.4. Vegetation

4.4.1. No Action Alternative

Under the No Action Alternative, the area within the proposed ROW and switching station site would remain in its current condition. Thus, adoption of the No Action Alternative would not affect plant life in the area of the proposed ROW because no project-related work would occur. 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. All invasive species found in the project area are common throughout the region and would likely remain because no project-related work would take place.

4.4.2. Action Alternative

Adoption of the Action Alternative would not significantly affect the vegetative terrestrial ecology of the region. Adoption of this alternative would require clearing of approximately 70 acres of forest. However, these forested communities are common and well represented throughout the region. Project-related work would temporarily affect local herbaceous plant communities, but these communities would likely recover to their preproject condition in less than one year. Any impact to vegetative terrestrial ecology is expected to be minor and insignificant.

Much of the project area currently has a large component of invasive terrestrial plants, and adoption of the Action Alternative would not significantly affect the extent or abundance of these at the county, regional, or state level. Some areas of mature deciduous forest have low concentrations of invasive plants, and invasive species could become more prevalent in certain areas of newly constructed ROW. The use of TVA standard operating procedure of revegetating with noninvasive species (Muncy 1999) would help prevent introduction and spread of invasive species within the affected project area.

Environmental effects resulting from the proposed actions are expected to include the loss of and conversion of forested communities to early successional plant communities and increased fragmentation of remaining adjacent forests within the proposed project area. The impact of converting forestland to managed ROW for construction of the proposed transmission line would be long-term in duration, but insignificant. As of 2007, there was at least 437,000 acres of forestland in Sumner and the adjacent Tennessee counties (United States Forest Service [USFS] 2009). Cumulatively, project-related effects to forest resources would be negligible when compared to the total of forestland that occurs in the project area.

4.5. Wildlife

4.5.1. No Action Alternative

Under the No Action Alternative, the proposed new transmission line, access roads, and switching station would not be constructed, and the project area would remain in its current condition. Wildlife and wildlife habitats would not be affected by any project-related actions. Therefore, there would be no direct, indirect, or cumulative impacts to wildlife under the No Action Alternative.

4.5.2. Action Alternative

Under the Action Alternative, construction of the proposed transmission line ROW and switching station would result in a change in the composition of wildlife habitats in the project area. Approximately 69.6 acres of forested habitats and other woody vegetation would be initially removed from the proposed ROW, and would then be converted and maintained as early successional habitat. As described in Section 2.2.2, vegetation would be removed and the property would be leveled for the switching station site. Further, the switchyard would be graveled and routine vegetation maintenance would reduce encroachment of any vegetation into the switchyard. The initial clearing of the proposed ROW and switching station site 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 edge and early successional habitat would occupy the proposed ROW, changing the overall species composition of the area to species more closely associated with early successional or scrub-shrub habitat and less species associated with forested habitat. Most species that would be affected by these changes are common locally and regionally.

Areas of the proposed project that would utilize existing ROW would continue to be maintained as early successional habitat. Small animals occupying the area could be initially affected by the transmission line upgrades and periodically affected by the routine

mowing and clearing activities; however, the species composition along these sections of ROW would not change under the proposed Action Alternative.

Environmental effects resulting from the proposed actions are expected to include the loss of and conversion of forested habitat to early successional and edge habitat and increased fragmentation of remaining adjacent forests within the proposed project area. This change would benefit early successional species and species that tolerate disturbance well. The loss of forested habitat in the proposed project area and further fragmentation of adjacent forested areas would impact species favoring forested habitats while benefiting other species.

Middle Tennessee is one of the faster-growing areas in the United States. This level of population growth is associated with large-scale development that converts natural areas to other land uses, including the transmission of electricity to areas with new growth. The majority of this area is highly disturbed and modified from previous human alterations of the landscape, and the changes from the proposed project would not be regionally significant. In general, clearing of forested habitat along the route would convert approximately 70 acres to early successional habitat and result in minimal habitat fragmentation, slightly increasing the percentage of forest edge. Overall, the forest conversion would be locally insignificant due to the high amount of habitat fragmentation that already exists along the proposed route. Most species that would be affected by these changes are locally and regionally common. The proposed new transmission line is not expected to result in significant direct, indirect, or cumulative impacts to terrestrial wildlife or their habitats.

4.6. Endangered and Threatened Species

The ESA requires federal agencies to conserve endangered and threatened species and to determine the effects of their proposed actions on endangered and threatened species and their critical habitat. Endangered species are those determined to be in danger of extinction throughout all or a significant portion of their range. Threatened species are those determined to be likely to become endangered within the foreseeable future. Section 7 of the ESA requires Federal agencies to consult with the USFWS when their proposed actions may affect endangered or threatened species and their critical habitats.

The State of Tennessee provides legal protection for species considered threatened, endangered, or deemed in need of management within the state other than those federally listed under the ESA. The legal listing is handled by the TWRA; however, TDEC's Natural Heritage Inventory Program and TVA both maintain databases of plant and animal species that are considered threatened, endangered, or of special concern in Tennessee. These species, as well as species listed under the ESA, are discussed in this section.

4.6.1. No Action Alternative

Under the No Action Alternative, TVA would not construct the proposed transmission line, access roads, or switching station and the resulting potential for impacts to endangered and threatened species would not occur. The status and conservation of the potentially affected listed species would continue to be determined by the actions of others. Changes to the area would nonetheless occur over time, as 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. Therefore, there would be no direct, indirect,

or cumulative impacts on endangered and threatened species and their critical habitats under the No Action Alternative.

4.6.2. Action Alternative

Six federally listed species are known to occur in Sumner County. Habitat does not occur within the project area for three of these species. The remaining three species, pink mucket, gray bat, and bald eagle are discussed in Section 3.6. Because habitat for the Indiana bat, known from an adjacent county, was found within the proposed project area, additional consideration for this species is included. Of the 13 state-listed species known from within a 10-mile radius of the proposed project, no habitat occurs within the proposed project area for three of these. No federally designated critical habitat occurs in the proposed project area.

4.6.2.1. Aquatic Animals

Two federally listed endangered mussels and ten state-listed aquatic species are known to occur in Sumner County (Table 3-3) and/or within a 10-mile radius of the proposed Gallatin-Angeltown 161-kV Transmission Line, access roads, and switching station. Three of these, the federally listed Appalachian monkeyface and the state-listed flame chub and ornate rocksnail, are historical records and likely no longer occur within the area due to habitat loss. The proposed project would have no effect on the federally listed pink mucket because the project would not affect the riverine habitats where this species occurs.

The remaining seven state-listed species potentially could be directly or indirectly affected by increased sedimentation as a result of riparian vegetation clearing or soil disturbances associated with transmission line construction or maintenance activities. However, in addition to standard BMPs that would be applied to all watercourses during construction and maintenance activities, all perennial and intermittent streams would be protected by measures defined in either Standard Stream Protection (Category A) or Protection of Important Permanent Streams (Category B) as described in Muncy (1999) and Appendix D (see Section 4.3.2). Furthermore, SMZ buffer zones would be established on each side of the watercourses as defined in Muncy (1999). These BMPs and additional protection measures 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 measures of additional stream protection as described in Section 4.3.2 would be implemented during construction, operation, and maintenance of the proposed transmission line, access roads, and switching station, any direct, indirect, or cumulative impacts that may occur to these state-listed aquatic species would be short term and insignificant.

4.6.2.2. Plants

Adoption of the Action Alternative would not impact the federally or state-listed plant species known from the proposed project area, because no habitat capable of supporting these three plant species (Table 3-4) was observed during field surveys of the project area. Additionally, no habitat capable of supporting other federally or state-listed plant species was observed. Therefore, no direct, indirect, or cumulative impacts on endangered and threatened species and their critical habitats are anticipated as a result of implementing the Action Alternative.

4.6.2.3. Terrestrial Animals

Suitable bald eagle habitat exists along the proposed transmission line route; however, the transmission line and ROW are preexisting in these areas. The proposed Action Alternative would add another transmission line conductor to the existing structures and no suitable nesting trees would be impacted. The closest bald eagle nest is located 770 feet from the proposed transmission line in the GAF area. This nest is greater than 660 feet from the proposed actions and, therefore, no restrictions would be placed around this nest as recommended by the National Bald Eagle Management Guidelines (USFWS 2007). Implementation of the proposed Action Alternative would not affect this species.

Suitable habitat for the state-listed Allegheny woodrat is present among outcrops, cliffs, talus slopes, crevices, sinkholes, caves, and karst. Impacts to outcrop habitat would be limited to new and existing ROW. The state-listed southeastern shrew is found primarily in bogs, swamps, among dense ground cover in wooded areas, and occasionally in upland fields some distance from water. Implementation of standard BMPs would limit impacts to any aquatic features within the ROW. Since southeastern shrews are known to use a variety of habitats, conversion to early-successional habitat may result in habitat suitable for this species.

The nearest known gray bat cave occurs 0.8 mile away from the proposed new transmission line route. Because this cave and others in the region are greater than 200 feet from the proposed actions, no impacts would occur to any cave habitat occupied by this species as a result of the proposed actions. A large cove located adjacent to the Cumberland River and several streams that cross the proposed transmission line ROW provide marginal foraging habitat for the federally listed gray bat. Impacts to foraging habitat could occur as a result of disturbance associated with heavy equipment crossing streams or soil disturbance adjacent to watercourses within the project area. SMZs would be established, and BMPs would be properly implemented during construction and maintenance activities. As indicated in Section 4.2.2, these measures are designed to minimize and avoid disturbance in or around watercourses in the project area.

Approximately 0.25 mile of potentially suitable Indiana bat summer roosting habitat was identified along the proposed route. Although the federally listed Indiana bat is not known from Sumner County or within a 10-mile radius of the proposed project, it is known to occur in the adjacent county (Allen County, Kentucky). TVA, as a precautionary measure would implement the following commitment:

- During construction, the removal of trees located within or adjacent to this identified 0.25-mile area of the proposed ROW would be seasonally restricted to prevent directly impacting the Indiana bat. The removal of trees within this section of proposed ROW would occur during a time period between November 15 and March 31. However, should it become necessary to remove a tree outside of this time frame, TVA would conduct a bat mist-net survey and acoustic survey between June 1 through August 15 and prior to the removal of any trees within this 0.25-mile area. Documentation of Indiana bat use of this area following this survey would require additional consultation with the USFWS.

In a letter dated September 16, 2010, the USFWS concurred with TVA's determination that the proposed undertaking would not adversely affect the Indiana bat or gray bat (Appendix A) and that TVA's requirements under Section 7 of the ESA have been fulfilled.

4.7. 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 EO 11990.

4.7.1. No Action Alternative

Under the No Action Alternative, no disturbance to wetlands within the proposed switching station site, transmission line ROW, and the associated access roads would occur. Therefore, no wetlands would be affected. Changes to wetlands 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.

4.7.2. Action Alternative

Under the Action Alternative, the proposed transmission line and switching station would be constructed. Wetland areas located on proposed access roads would be traversed either during the dry season, by using mats, or with low ground-pressure equipment. Some wetlands located within the proposed ROW areas would be spanned by the transmission line, thus allowing emergent and scrub-shrub wetlands to continue functioning in the same capacity as current conditions. However, as described in Section 2.2.1.1, to obtain adequate clearance between tall vegetation and transmission line conductors, some trees within the proposed ROW would have to be cleared. As a result, the proposed Action Alternative would result in the clearing and subsequent conversion of 0.11 acre of moderate quality forested wetlands to emergent or scrub-shrub wetland areas (Table 3-6). Because all wetlands located within the proposed ROW boundaries would be subject to a periodic ROW vegetation management, these areas would continue to be maintained as emergent or scrub-shrub wetland areas.

Cumulative impact analysis of wetland effects takes into account wetland loss and conversion at a watershed-level scale, in this case within the West Fork Drakes Creek and Bledsoe Creek/Cumberland River watersheds. According to the National Wetlands Inventory (NWI) data, 7 percent of these watershed areas were mapped as wetland or open water. Open water ponds were the dominant water retention system, comprising 94 percent of the mapped NWI acreage in these watersheds. Forested wetlands comprised less than 3 percent of mapped NWI acreage. However, clearing 0.11 acre of moderate-quality forested wetland would not significantly reduce the area or percentage of forested wetland within the watershed. Therefore, no significant reduction in wetland functions within the surrounding watersheds is anticipated as a result of clearing such a nominal area.

As evidenced in the discussion of the project siting process in Section 2.3, there is no practicable alternative to avoiding some impacts to wetlands in the project area. However,

consistent with EO 11990, TVA would minimize these impacts through proper vegetation management and the use of BMPs. TVA would also comply with USACE regulations regarding any required permits for any structures placed within these wetlands (Table 3-6). Potential impacts to all other wetland areas resulting from possible access across these wetlands during the proposed transmission line construction and maintenance would be reduced by the use of standard BMPs (Muncy 1999). With the implementation of these measures, the proposed project would have insignificant direct, indirect, and cumulative impacts to wetland areas and the associated wetland functions and values provided within the project area and general watershed.

4.8. 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 practicable alternative.

4.8.1. No Action Alternative

Under the No Action Alternative, the proposed transmission line, access roads, and switching station would not be constructed. Therefore, there would be no direct, indirect, or cumulative impacts to floodplains because there would be no physical changes to the current conditions found within the local floodplains.

4.8.2. Action Alternative

The proposed transmission line route and access roads cross several floodplain areas in Sumner County. Consistent with EO 11988, the construction of an overhead transmission line and related support structures and roads is considered a repetitive action in the 100-year floodplain. The construction of the support structures for the power line is not expected to result in any increase in flood hazard either as a result of increased flood elevations or changes in 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 C.

To ensure that construction or modifications to access roads would not adversely affect floodplains and flood control, the following mitigation measure would be included as a condition in the appropriate construction contract for work undertaken on the proposed project:

- Any road construction in the 100-year floodplain must be done in a manner that does not increase upstream flood elevations.

The proposed switching station would not be located within the 100-year floodplain, which would be consistent with EO 11988.

4.9. Prime Farmland

The Farmland Protection Policy Act of 1981 directs federal agencies to evaluate land use prior to converting an area permanently to a nonagricultural land use and to minimize the extent to which federal actions contribute to the unnecessary conversion of farmland to nonagricultural uses.

4.9.1. No Action Alternative

Under the No Action Alternative, TVA would not build the transmission line or switching station, and areas considered as prime farmland would not be affected. 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.

4.9.2. Action Alternative

Under the Action Alternative, a switching station would be constructed in Sumner County on a 10-acre site that would be graded and graveled to accommodate the placement of switching station facilities (described in more detail in Section 2.2.2). This action would permanently convert this land to nonfarm use.

Soils on about 7 acres of the 10-acre site are classified as prime farmland soils. In order to determine if prime farmland should be protected under the Farmland Protection Policy Act, a Farmland Conversion Impact Rating is normally completed using a Form AD 1006. A score of 160 or better out of a maximum 260 points prompts a federal agency to consider means avoidable to protect or minimize impacts to farmland.

The NRCS completed an assessment of the proposed switching station site (Appendix L). A rating of 5 out of a possible maximum of 100 was assigned for the relative value of the prime farmland soils in the project area. Based on the NRCS input and additional assessment criteria that focused on the remoteness of the site and the lack of impacts to nearby farming and agricultural support services, the TVA prime farmland staff calculated a total site assessment score of 66 for the 7.0-acre site. The sum of these two scores yields a total impact rating of 71, which falls below the score of 160 that warrants consideration of other alternatives (Appendix L). As a result, direct, indirect, and cumulative effects to prime farmland because of the proposed project are expected to be insignificant. Farmland preservation, therefore, would not be considered a viable reason to alter TVA's actions associated with the construction of the proposed switching station.

4.10. Aesthetics

4.10.1. No Action Alternative

Under the No Action Alternative, TVA would not build the transmission line or switching station. Aesthetic features including visual resources, noise, and air quality would not be affected. The existing scenic attractiveness would remain common to the area, and the scenic integrity would remain moderate to low. 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.

4.10.2. Action Alternative

4.10.2.1. 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 (Appendix M). 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 3.10.

The new ROW and associated lines and structures associated with the switchyard at GAF would be visually similar to other broadly horizontal industrial elements seen in the area now. New upgrades would be seen mainly by plant employees and visitors to the plant. Views of these improvements within the new ROW are expected to be visually insignificant.

Along Steam Plant Road, TVA proposes to string the vacant side of the existing Gallatin-Hoeganaes 161-kV Transmission Line. The line would be visible mainly to motorists, particularly closer to the plant area. The proposed transmission line would be visually similar to the conductor (line) seen on the existing structures now. There may be some minor visual discord during the construction period due to an increase in personnel and equipment. This would be temporary, lasting until all activities have been completed.

Visual effects as a result of upgrading the existing Gallatin-Hartsville-Westmoreland 69-kV Transmission Line would be similar to those described in Section 3.10 for the Gallatin-Hoeganaes 161-kV Transmission Line. During construction, activities would likely be seen by area residents as well as motorists along local roads. As previously stated, these minor visual intrusions would be temporary, lasting until all activities have been completed.

The proposed Gallatin-Angeltown 161-kV Transmission Line and 100-foot ROW would be visually similar to lines and structures at the existing Gallatin-Westmoreland 69-kV Transmission Line (to be upgraded to 161-kV). The new line may be seen briefly by motorists along Cairo Road to the west and by a few residents in foreground distances to the north. New structures and lines would add to the number of discordantly contrasting elements seen in the landscape. However, due to topographic variations and the presence of vegetative masses that provide sporadic screening, it is expected that the landscape would have the ability to absorb minor visual changes.

At SR 25, the proposed transmission line would be in the viewshed of several area residents and motorists. For motorists, the longer duration of views of the line and structures would be from the west, while views from the east would be much shorter as a result of existing road alignment. For residents, views would be up to middleground distances to the north. While these views of new transmission line elements would contribute to reduced visual integrity, it is not expected that the existing scenic class would be reduced two or more levels, the threshold of significance (Appendix M). This is mainly a factor of existing development along the roadway, to include numerous wood service poles and associated lines.

Continuing north, the proposed transmission line would cross US 31E, a major thoroughfare between Gallatin and Glasgow, Kentucky, to the north. Views of the new line from the roadway would be brief for motorists as a result of dense vegetation outside the road ROW. A few area residents could have foreground views, particularly in the winter during leaf-drop. These views are not expected to be significant when viewing structures and lines in context with existing development along the roadway and the roadway itself.

North of US 31E, the transmission line would traverse steep topography, crossing prominent peaks in the landscape and several minor roads. At the minor road crossings, the line would disappear quickly to the north and south. Area residents and motorists would have minor and insignificant views of lines and structures due to dense vegetation and variations in topographic conditions.

At the proposed switching station, the new line and structures would be seen in the foreground by a single resident to the south and by motorists. New structures and lines would be seen mainly to the north near the roadway. Scenic integrity would likely be reduced with the addition of these elements. This reduction would likely be minor and insignificant as these views would be in context with the existing transmission line and structures. New switching station lighting would comply with the TVA Substation Lighting Guidelines (Appendix F).

Operation, construction, and post-construction maintenance activities such as ROW clearing and line maintenance for the proposed transmission line upgrades and new lines and structures would be visually insignificant. There may be some minor visual discord during the construction and subsequent post-construction maintenance 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, lasting until the existing ROW, proposed 100-foot ROW, and laydown areas have been restored through the use of TVA standard BMPs (Muncy 1999). Therefore, there are no significant direct, indirect, or cumulative visual impacts anticipated as a result of the construction and operation of the proposed transmission line and switching station.

4.10.2.2. Noise

Construction Noise

Under the Action Alternative, 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 transmission line and switching station construction activities are described in Section 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 existing noise levels 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 line and switching station are expected to be temporary and insignificant because of the short construction period. In the more densely populated areas along the ROW and switching station site, construction techniques would be used to limit noise as much as possible.

These techniques include limiting construction activities 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 line 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. The duration of the construction of the switching station would be approximately one year.

Operational Noise

Transmission lines can produce audible noise by corona on high-voltage transmission lines that is different from other noise sources (e.g., traffic). 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 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 35-45 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 line would be well below the recommended maximums of the USEPA DNL sound levels (Dezé Energy Corporation 2008). Corona is not associated with any adverse health effects in humans or livestock.

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, however, would be of very short duration and very infrequent occurrence and therefore expected to be insignificant.

4.10.2.3. Odors

Vehicles and equipment used during construction and operation of the proposed transmission line and switching station 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 B, C, and G contain procedures to address objectionable odors caused by smoke or fumes that could result during the construction and operation of the proposed transmission line and switching station. Construction and operation of the transmission line and switching station are not expected to produce any other noticeable odors.

4.11. Recreation, Parks, and Natural Areas

4.11.1. No Action Alternative

Under this alternative, the proposed actions identified for this EA would not be implemented, and the stated need for the proposed actions—to relieve overloading of existing equipment and to improve reliability of power service in the Sumner County area—would not be met. Depending on the degree of unreliability that the power service is allowed to reach because of no action, recreational services and facilities that require electricity at the state park and on the reservoir could be directly impacted. Severely unreliable power service, i.e., frequent or long-term outages, also would impact users of these natural areas, with impacts ranging from inconvenience to safety and health concerns. However, it is unlikely that no action would be taken given the highly reliable service goals of TVA. Further, no environmental impacts to the natural areas in the vicinity of the project site would be anticipated because of no action.

4.11.2. Action Alternative

The presence of the proposed transmission line could cause some minor shifts in informal recreation use patterns, but any impacts should be minor and insignificant. The transmission line would be well removed from Bledsoe State Park and should have no impact on the recreational character or use of the park.

Several factors are considered when determining environmental impacts on natural areas from a proposed action. For this assessment, these include the distance from and the frequency or duration of the proposed action; the percentage of the natural area affected; the nature of the proposed action; and the degree to which the proposed action would affect the uniqueness of the natural area.

Because the proposed project area crosses or abuts only a very small percentage of Old Hickory Reservoir Reservation and WMA and the GAF WMA and because the proposed actions at these locations would be on an existing transmission line ROW, only minor and temporary impacts are anticipated during the construction phase of the proposed action. Because the proposed action could potentially conflict with scheduled hunts on the WMAs, To avoid affecting these hunts and to ensure that construction personnel are not at risk due to any scheduled hunts, TVA contacted TWRA. In August 2010, TWRA confirmed there were no scheduled hunts in either WMA that would be affected by the proposed action.

No impacts as a result of the proposed action are anticipated for the following natural areas because the distance from the project site to these features is sufficient: Bledsoe Creek State Park, Bledsoe Creek Wildlife Observation Area, GAF Protection Planning Site, and Bledsoe Creek (NRI-listed stream).

No cumulative impacts to these natural areas are foreseeable under the time and scope bounds of this project.

4.12. Historical and Archaeological Resources

Historic and cultural resources, including archaeological resources, are protected under various federal laws, including: ARPA, NAGPRA, and NHPA. Section 106 of the NHPA requires federal agencies to consult with the respective State Historic Preservation Officer (SHPO) when proposed federal actions could affect these resources.

4.12.1. No Action Alternative

There would be no project-related effects to historic or archaeological resources under this alternative. Likewise, no direct, indirect, or cumulative effects to these resources are expected along the proposed line route or switching station site.

4.12.2. Action Alternative

A cultural resources survey identified one previously recorded archaeological resource and 51 previously recorded architectural resources within the APE (Barrett 2009). With the exception of the Womack House and Oakland House, all of these previously recorded resources are considered ineligible for the NRHP. Additionally, the archaeological survey identified five previously unrecorded archaeological resources and the architectural survey identified 10 previously unrecorded architectural resources (Barrett 2009). All of these previously unrecorded resources are considered ineligible for the NRHP.

The Oakland House is listed in the NRHP. The proposed project would have a visual effect on the Oakland House, but the effect would not be adverse due to the existing modern development within view of the property. The Womack House is eligible for the NRHP. The proposed project would have a visual effect on the Womack House; however, that effect would not be adverse. Although the current viewshed of the Womack House has already been compromised by an existing transmission line and other modern developments, the proposed project would not contribute to the cumulative effects because none of the proposed transmission line structures would be in line-of-sight of this historic property.

Pursuant to regulations (36 CFR Part 800) implementing Section 106 of the NHPA, TVA consulted with the Tennessee SHPO to assess potential impacts to historic properties. In a letter dated February 16, 2010, the Tennessee SHPO concurred with TVA's determination that the proposed undertaking would not adversely affect any historic properties that are potentially eligible or currently listed in the NRHP (Appendix A).

Pursuant to 36 CFR § 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b), TVA also consulted with federally recognized Indian tribes regarding properties within the proposed project's APE that may be of religious and cultural significance to them and eligible for the NRHP (Section 1.5). TVA received comments from the Chickasaw Nation and the Shawnee Tribe that there would be no effect to religious or cultural properties of these tribes (Appendix A).

4.13. Socioeconomics

4.13.1. No Action Alternative

Under the No Action Alternative, TVA would not build the proposed switching station or transmission line. However, due to the growing demand for electric power in the Middle Tennessee area, transmission lines serving the Gallatin, Portland, and Lafayette areas are

at risk to overload by summer 2011 (see Chapter 1). New transmission capacity and a switching station would be necessary to meet this increased demand. Failure to provide the needed capacity would add instability to electrical supplies and increase the likelihood of both planned and unplanned power outages (brownouts/blackouts) in the area as demand continues to grow. This could result in significant losses to businesses and industries in the area. Individuals living or working in the area could suffer income losses as a result. Loss of electrical supply, especially during extreme weather conditions such as very hot or very cold temperatures, could impact and threaten human health and life depending on the duration and circumstances. Such impacts would be significant.

4.13.2. Action Alternative

Under the Action Alternative, TVA would construct a transmission line and switching station. This action would have no effect on population in the area; it is instead a response to growth already occurring and projected to continue in the Middle Tennessee area. Construction would involve a relatively small crew of workers for a few months. Due to the nature of the project, most workers probably would either move in temporarily or commute from their current homes, especially if they live within 50 or 60 miles. Consequently, there would be little or no change in employment of local workers. Little impact on housing is anticipated since many of the construction workers who move temporarily into the area likely would rent motel rooms or provide their own lodging using campers or trailers.

Some local business income and local government revenues would be generated during the construction period from purchases of items such as meals and from lodging or campground rental fees. The impacts of this additional revenue would be small. Some construction materials could be purchased locally, but due to their nature, most of the purchases would likely be outside the area. The increase in local tax revenues generally would not be noticeable.

While TVA, as a federal agency, does not pay local property taxes, it does make in lieu of tax payments to the state, much of which is redistributed to local governments. These payments are based, in part, on the value of TVA-owned assets in a county. Therefore, the completion of the proposed switching station and transmission lines would result in a small increase in these payments to Sumner County.

The proposed section of transmission line that would extend north from GAF and then northeast past Cairo Road would be on existing ROW, alongside existing transmission lines. The new transmission line on new ROW would then extend northward to the proposed Angeltown 161-kV Switching Station. The proposed transmission line route and switching station site would generally be located in less densely populated areas of the county, thereby minimizing both construction and operation effects to residents of the area. Any construction impacts would be of short duration. Therefore, no significant negative social or economic impacts due to construction or operation of the transmission line or switching station are expected.

4.14. Environmental Justice

4.14.1. No Action Alternative

Under the No Action Alternative, TVA would not build the proposed switching station or transmission line. As discussed in 4.13.1, failure to provide the needed capacity would add

instability to electrical supplies and increase the likelihood of both planned and unplanned power outages in the area as demand continues to grow. The resulting impacts on businesses, industries, and residences in the area, however, could occur anywhere in the area and are not likely to affect minority or low-income populations disproportionately. Therefore, no direct, indirect, or cumulative disproportionate environmental justice impacts would occur.

4.14.2. Action Alternative

Under the Action Alternative, the southern end of the proposed new transmission line in the area near GAF would be in Census Block 1023, CT 209.01. The line would follow existing ROW through CT 209.01 and then northeast into CT 206. The route would then turn northward continuing through CT 206 and into CT 201. The line would end in CT 201 at the proposed Angeltown 161-kV Switching Station. The block groups within each of the affected CTs are shown in Table 3-9. Poverty data are not available at the individual block level. However, a review of minority population data for individual blocks found that minority populations in this area tend to be small and scattered, rather than concentrated (U.S. Census Bureau 2000b). No significant clusters of minorities were identified in the affected area.

The affected project area within Sumner County as a whole and all census tracts and block groups have lower poverty levels and smaller minority population shares than the state and the nation. No significant concentrations of minority or low-income populations have been identified in the area. Therefore, no disproportionate impacts to disadvantaged populations are expected by the construction of the proposed transmission line and switching station.

4.15. Post-Construction Effects

4.15.1. Electric and Magnetic Fields

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 (i.e., 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: (1) the strength of the electric or magnetic field, (2) the size and shape of the conducting object, and (3) 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 line, like other transmission lines, has 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 power line 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 (i.e., those beyond five 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 (*Journal of the 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 an 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.

TVA transmission lines are built with overhead ground wires that would lead a lightning strike into the ground for dissipation. Thus, a safety zone is created under the ground wires at the top of structures and along a line for at least the width of the ROW. The NESC standards are strictly followed when installing, repairing, or upgrading TVA lines, substations, or equipment.

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 power line 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 (e.g., 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 recent 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 transmission 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).

EMFs would be produced along the length of the proposed transmission line. The strength of the fields within and near the ROW would vary with the electric load on the line as well as with the terrain. Public exposure to EMFs would be determined by final routing decisions and would change over time after the line is completed as adjacent land uses change. As described above, TVA would minimize public exposure to EMFs through engineering features and line routing decisions.

Although no federal standards exist for maximum EMF strengths for transmission lines, two states (New York and Florida) have regulations addressing EMF strengths. Florida's regulation is the more restrictive of the two, with field levels being limited to 150 milligaus 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 line is not anticipated to cause any significant impacts related to EMFs.

4.15.2. 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 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.

4.15.3. Transmission Structure Stability

The pole structures (Figures 2-2, 2-3, and 2-4) that would be used on the proposed 161-kV transmission line 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 to their low cross-section in the wind.

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

4.15.4. Other Impacts

No significant impacts to resources such as air quality and solid waste are expected to result from the relatively short-term activities of construction. Appendices B, C, E, and G contain procedures for dealing with these issues.

4.16. Unavoidable Adverse Impacts

Construction and operation of the proposed transmission line and switching station have the potential to cause unavoidable adverse effects to several environmental resources. Adverse effects could include the loss of forest area and changes in associated wildlife populations; increased forest fragmentation; removal of the tree canopy at stream crossings; restrictions on future land use within the ROW; and changes to the visual character within the local area. TVA has reduced the potential for such adverse effects during the planning process. In addition, TVA would implement mitigation measures (Section 4.16) to reduce potential adverse effects to certain environmental resources.

4.17. Relationship of Short-Term Uses and Long-Term Productivity

The construction and operation of the proposed transmission line and switching station would maintain and improve the reliability of electric service in the Middle Tennessee areas near Gallatin, Portland, and Lafayette. This would help support the economic and population growth that is presently occurring in the proposed project area and the quality of life that depends on adequate and reliable supplies of electric energy. This would be accomplished by a localized shift of a small amount of land to use for electric power transmission. If, during the useful life of the transmission line, it is no longer needed or technology renders it obsolete, it can be removed with relatively little difficulty. The land encumbered by the ROW could be returned to its previous use or used for other purposes.

The proposed action would result in both short-term and long-term effects on vegetation, especially in forested areas where potential forest productivity, including timber and associated wildlife production, would be lost from within the ROW and switching station site where these resources now exist.

The principal change in short-term use of transmission line ROW and switching station site would be the exclusion of trees and permanent structures. The amount of forest being lost would be approximately 70 acres within the ROW. A minor amount of agricultural productivity would be lost for the life of the transmission line due to the placement of poles, but most agricultural activities could continue within the transmission line ROW. Approximately 10 acres would be devoted to the switching station site, and this use would

preclude other uses for the life of this facility. These minimal constraints on other uses would be outweighed by the social and economic benefits of the project.

There would be long-term effects on land use within the ROW due to restrictions on building construction. The ROW cannot support building construction for the life of the project, but the social and economic benefits of the project should outweigh this small loss. Additional long-term effects would occur on scenery in the project area near the new sections of transmission line ROW and switching station due to the visual intrusions of the transmission structures and conductors. These short-term and long-term effects have been, to the extent possible, minimized during project planning.

4.18. Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources cannot be replaced, except perhaps in the extreme long term. For example, mining of ore is an irreversible commitment of a resource; once the ore is removed and used, it cannot be restored. Irretrievable commitments are those in which a resource is lost for a finite period—even a long period of time. For example, the construction of a road through a forest would be an irretrievable commitment of the productivity of timber within the road ROW as long as the road remains.

The materials used for construction of the proposed transmission line and switching station would be committed for the life of the line, a period of 50 years or more. Some materials, such as ceramic insulators may be irrevocably committed. However, metals in conductors, structures, and other equipment could be recycled.

Constructing the proposed transmission line would result in the irretrievable loss of 70 acres of forest. Similarly, the ROW used for the proposed transmission line would be committed irretrievably, but the approximately 238 acres of ROW could be returned to other uses upon retirement of the line. In the meantime, compatible uses of the ROW such as farming and the provision of open-land wildlife habitat could continue. However, the provision of forest products, forest wildlife habitat, and other forest-dependent amenities on those forested sections of the proposed ROW would be lost for the life of the transmission line.

Constructing the proposed switching station would result in an irretrievable loss of 10 acres of land that would be converted to nonfarm use, including about 7 acres classified as prime farmland soils. The site would be committed irretrievably, but could be returned to other uses upon the retirement of the switching station.

4.19. Summary of TVA Commitments and Proposed Mitigation Measures

Under the Action Alternative, TVA would undertake the following routine measures to reduce the potential for adverse environmental effects.

- Appropriate BMPs would be implemented as defined in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (Muncy 1999) during construction and maintenance activities.
- During construction and operation of the proposed transmission line, the environmental quality protection specifications as described in Appendices B, C, D, E, and G of this document would be implemented.

- To minimize adverse impacts on natural and beneficial floodplain values following construction activities, the ROW would be revegetated where natural vegetation is removed, and the removal of unique vegetation would be avoided.

To ensure that construction or modifications to access roads would not adversely affect floodplains and flood control, the following mitigation measures would be included as a condition in the appropriate construction contract for work undertaken on the proposed project:

- Any road construction in the 100-year floodplain must be conducted in a manner that does not increase upstream flood elevations.

The following nonroutine measures would be applied during construction of the proposed transmission line to reduce the potential for adverse environmental effects.

Although the Indiana bat is not known from Sumner County or within a 10-mile radius of the proposed project, it is known to occur in the adjacent county (Allen County, Kentucky). To avoid potential impacts to the federally listed Indiana bat, TVA, as a precautionary measure would implement the following commitment:

- During construction, the removal of trees located within or adjacent to this identified 0.25-mile area of the proposed ROW would be seasonally restricted to prevent directly impacting the Indiana bat. The removal of trees within this section of proposed ROW would occur during a time period between November 15 and March 31. However, should it become necessary to remove a tree outside of this time frame, TVA would conduct a bat mist-net survey and acoustic survey between June 1 through August 15 and prior to the removal of any trees within this 0.25-mile area. Documentation of Indiana bat use of this area following this survey would require additional consultation with the USFWS.

CHAPTER 5

5.0 LIST OF PREPARERS

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CHAPTER 6

6.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES ARE SENT

Federal Agencies

U.S. Fish and Wildlife Service

State Agencies

Tennessee Department of Environment and Conservation, Tennessee Historical Commission

Tribes

Chickasaw Nation
Shawnee Tribe

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CHAPTER 7

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