CHAPTER 2

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1. Introduction

Chapter 2: Alternatives Including the Proposed Action is the *heart* of this Environmental Assessment. This chapter has the following six major sections:

- Description of Alternatives
- Description of Construction, Operation, and Maintenance of the Proposed 161-kV Transmission Line
- Project and Siting Alternatives
- Identification of the Preferred Alternative
- Summary of Mitigation Measures

2.2. Description of Alternatives

2.2.1. Alternative 1 – Do Not Provide an Interconnection to Calpine's Morgan Energy Center (No Action)

Under this alternative, TVA would not connect its transmission system to Calpine's Morgan Energy Center. However, TVA is required to connect to the Calpine facility by the Federal Power Act. If TVA and Calpine are unable to agree on interconnecting the Calpine facility, Section 210 of the Federal Power Act provides that the Federal Energy Regulatory Commission may issue an order that would require TVA to interconnect TVA's transmission system with those of the generator. Therefore, TVA does not have the discretion to take no action in this situation, and the No Action Alternative was deemed unreasonable. It is not discussed further within this document.

2.2.2. Alternative 2 – Construct a Transmission Line from Calpine's Morgan Energy Center to General Motors Substation

TVA would construct 15.8 miles of new 161-kV transmission line from Calpine's Morgan Energy Center to GM Substation. The proposed transmission line would be constructed using 12 miles of existing right-of-way and 3.8 miles of new right-of-way 100 feet wide. Most of the proposed transmission line would be constructed using the vacant side of existing towers and new H-frame steel pole structures (Figure 2-1). Nine existing structures within the transmission right-of-way would be removed, relocated, or replaced for the new transmission line. TVA would take ownership of three oil-filled breakers and associated equipment at the GM Substation. The oil-filled breakers would be replaced with sulphur hexafluoride-6 breakers. Existing foundations would be used. An additional breaker and associated isolating switches would be added in the substation. At the GM Substation, the following communication equipment would be replaced: coupled capacitor voltage transformers, carrier set, wave trap, and the line-tuning unit. Supervisory Control and Data Acquisition and Global Positioning System equipment would also be installed in the GM Substation. At Morgan Energy Center, carrier set and wave trap would be installed. Map board upgrades would occur at TVA's Power Business Center and Power System Control Center in Chattanooga, Tennessee.

2.2.3. Alternative 3 – Rebuild and Upgrade Existing TVA Transmission Lines

TVA would destruct and rebuild three 161-kV transmission lines totaling approximately 28.4 miles and uprate six 161-kV transmission lines and one 500-kV transmission line totaling 138.2 miles. Transmission line uprates consist of resagging the conductor by increasing conductor tension, adding structures within the transmission line, and/or replacing existing structures. Although this alternative would utilize existing right-of-way, because more land disturbance would be required for destructing and rebuilding 23.8 miles of three different transmission lines and uprating ten different transmission lines, the environmental impacts would potentially be the same or much greater than for Alternative 2. Transmission system impacts would also be greater than for Alternative 2, because this alternative would require more scheduled outages at the many different locations. In addition, the cost of this plan is twice as high as Alternative 2. Based on these reasons, Alternative 3 was rejected as TVA's preferred alternative and is not discussed further within this document.

2.3. Description of Construction, Operation, and Maintenance of the Proposed 161-kV Transmission Line

2.3.1. Transmission Line Construction

2.3.1.1. Structures and Conductors

The proposed transmission line would be constructed using the vacant side of existing structures and mostly H-frame steel pole structures (Figure 2-1). Structure height would vary according to the terrain and existing transmission line crossings. With the exception of the existing tower structures at the Tennessee River crossing, which are 235 feet tall to meet navigation requirements, structures would range from 50 to 130 feet to meet the clearance requirements.

Figure 2-1. H-Frame Type 161-kV Transmission Structure

Three conductors (the cables that carry the electrical current) are required to make up a circuit in alternating current transmission lines. For 161-kV transmission lines, each conductor is made up of a single cable. The conductors are attached to fiberglass or ceramic insulators suspended from the structure cross arms. A smaller overhead ground wire is attached to the top of the structures. This ground wire may contain fiber optic communication cables.

Poles at angles in the line may require supporting guys. Some structures for larger angles could require two or three poles. Most poles would be directly imbedded in holes augured into the ground to a depth equal to 10 percent of the pole's length plus an additional 2 feet. The holes would normally be backfilled with the excavated material. In some cases, gravel or a cement and gravel mixture might be used. Some structures may be self-supporting (non-guyed) poles fastened to a concrete foundation that is formed and poured into an excavated hole.

Equipment used during the construction phase would include trucks, truck-mounted augers and drills, as well as tracked cranes and bulldozers. Low ground pressure equipment would be used in specified locations to reduce environmental impacts.

2.3.1.2. Right-of-Way Acquisition and Clearing

Existing and new right-of-way would be needed for the transmission line. The transmission line on existing right-of-way would parallel 6 miles of existing transmission lines and share towers on another 6 miles. The existing right-of-way width varies depending upon the size of the transmission line being paralleled, but no additional right-of-way would be needed for the existing structures. The section of new right-of-way would be 100 feet wide and occupy about 41 acres.

TVA would purchase easements from landowners for the new right-of-way on private land. These easements and land give TVA the right to construct, operate, and maintain the transmission line as well as remove danger trees off the right-of-way. Fee title for the land within the right-of-way would normally remain with the landowner, and a number of activities could be continued on the property by the landowner. The easement would prohibit certain activities such as the construction of buildings and any other activities within the right-of-way that could interfere with the transmission line or create a hazardous situation.

Because of the need to maintain adequate clearance between tall vegetation and transmission line conductors, as well as to provide access for construction equipment, most trees and shrubs would be initially removed from the entire width of the right-of-way. Equipment used during this right-of-way clearing would include chain saws, skidders, bulldozers, and/or low ground pressure feller-bunchers. Marketable timber would be salvaged where feasible; otherwise, woody debris and other vegetation would be piled and burned, chipped, or taken off site. In some instances, vegetation may be windrowed along the edge of the right-of-way 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's Right-of-way Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, and Transmission Construction Guidelines Near Streams are included in Appendixes II, III, and IV.

Any trees located off the right-of-way which are tall enough to pass within 6 feet of a conductor or structure (if it were to fall toward the line) are designated "danger trees" and would be removed.

Subsequent to clearing and construction, the right-of-way would be restored as much as is possible to its state prior to construction. Pasture areas would be reseeded with suitable grasses. Wooded areas would be restored using native grasses and other low-growing species. Erosion controls would remain in place until the plant communities were fully established. Streamside areas would be revegetated as described in Section 2.6, "Summary of TVA Commitments and Proposed Mitigation Measures," of this document.

2.3.1.3. Access Roads

Permanent access roads would be needed to allow vehicle access to each structure and other points along the right-of-way. TVA would obtain the necessary rights for these access roads from landowners. Existing roads including farm and field roads, some of which may need upgrading, would be used where possible. New access roads would be located on the right-of-way wherever possible and designed to avoid severe slope conditions and minimize stream crossings. New access roads would be about 20 feet wide and surfaced with dirt or gravel. Culverts and other drainage devices, fences, and gates would be installed as necessary. Culverts installed in any permanent streams would be removed following construction; however, in wet-weather conveyances, they would be left or removed dependent upon the wishes of the landowner or any permit conditions that might apply. New temporary access roads would be restored to previous conditions. If graveled, the gravel would be removed and the area planted with approved seed mixtures following construction. Additional applicable environmental quality protection specifications are listed in Appendixes II and III.

The actual locations of access roads cannot be determined until a preferred corridor route and specific alignments have been chosen and individual structure locations are known. The locations of access roads would be closely coordinated with potentially affected landowners.

2.3.1.4. Construction Assembly Areas

One or more construction assembly areas would be required for worker assembly, vehicle parking, and material storage. These areas may be on existing substation property or leased from a private landowner for the duration of the construction period. These areas are typically 5 to 10 acres in size, relatively flat, previously cleared, and located adjacent to an existing paved road near the transmission line. Depending on site conditions, some minor grading and installation of drainage structures may be required. The areas would be graveled and fenced, and trailers used for material storage and office space would be parked on the areas. Following the completion of construction activities, all trailers, unused materials, and construction debris would be removed from the site. Removal of the fence and restoration would be at the discretion of the landowner.

2.3.1.5. Conductor and Ground Wire Installation

Reels of conductor and ground wire would be delivered to various staging areas along the right-of-way, and temporary clearance poles would be installed at road and railroad 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.

2.3.2. Operation and Maintenance

2.3.2.1. Inspection

Periodic inspections of 161-kV transmission lines are performed from the ground and by aerial surveillance using a helicopter. These inspections, which occur on approximately five-year cycles after operation begins, are conducted to locate damaged conductors, insulators, or structures, and report any abnormal conditions that could hamper the normal operation of the transmission line or adversely impact the surrounding area. During these inspections, the condition of vegetation within the right-of-way, as well as immediately adjoining the right-of-way, is noted. These observations are then used to plan corrective maintenance or routine vegetation management.

2.3.2.2. Vegetation Management

Management of vegetation along the right-of-way would be necessary to ensure access to structures and to maintain an adequate distance between transmission line conductors and vegetation. For 161-kV transmission lines, National Electric Safety Code standards require a minimum clearance of 24 feet.

Management of vegetation along the right-of-way would consist of two different activities: felling of danger trees adjacent to the cleared right-of-way and control of vegetation within the cleared right-of-way.

Management of vegetation within the cleared right-of-way 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 right-of-way and mechanical mowing is not practical. Herbicides would be selectively applied from the ground with backpack sprayers or vehicle-mounted sprayers. Given the land use in the area of this project, right-of-way maintenance is expected to be minimal.

Any herbicides used would be applied in accordance with applicable state and Federal laws and regulations and the commitments listed in this document. Only herbicides registered with the U.S. Environmental Protection Agency (USEPA) would be used. Appendix V contains a list of the herbicides and adjuvants (ingredients added to the herbicide solution to increase its effectiveness) currently used by TVA in right-of-way management. This list may change over time as new herbicides are developed or new information on presently approved herbicides becomes available.

Other than vegetation management, little other maintenance work would normally be required. The transmission line structures and other components typically last several decades. In the event that a structure must be replaced, the structure would normally be lifted out of the ground by crane-like equipment and the replacement structure 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 releveling the area surrounding replaced structures but there would be little, if any, additional disturbance compared to the initial installation of the structure.

2.4. Project and Siting Alternatives

The process of siting the proposed transmission line followed the basic steps used by TVA to identify acceptable transmission line routes:

- Determine the potential sources to interconnect Calpine's generation with TVA's transmission system.
- Define the study area.
- Collect data to minimize potential impacts to cultural and natural features.
- Develop general route options and potential routes.
- Delimit one or more alternative transmission line routes within the option(s).
- Gather public input.
- Incorporate public input into the final identification of the preferred transmission line route.

2.4.1. Definition of Study Area

The first task in defining the study area was to identify the alternatives that could interconnect Calpine's generation with TVA's transmission system. TVA performed an ISIS evaluating only the impacts of interconnecting Calpine's Morgan Energy Center to the TVA transmission system. The ISIS does not address the ability of the TVA transmission system to transfer power from the facility to any specified load either on the TVA system or off system.

The study area was defined based on the location of Calpine's Morgan Energy Center and the practical routes for interconnection, which would be the GM Substation. Calpine's Morgan Energy Center and GM Substation are located on opposite sides of the Tennessee River. For this study, the regional study area included portions of northern Morgan and southern Limestone Counties (Figure 1-1).

Relatively flat, open agricultural fields along with sparse forests dominate the study area north of the Tennessee River. A small portion in the southeast corner is industrial. The Tennessee River and Reservation and Swan Creek Management Area are the dominant features. The study area south of the Tennessee River is more congested with industrial development.

2.4.2. Collect Data

Geographic data, such as topography, land use, transportation, environmental features, cultural resources, near-term future development, and land conservation information were collected for the entire study area. Analysis of the data was aided by using a geographic information system (GIS). This system allowed the multitude of factors of the large study area to be examined simultaneously to develop and evaluate numerous options and scenarios to identify the route or routes that would best meet project objectives.

Maps were created to show regional opportunities and constraints clearly. Sources included 1 inch = 500 feet aerial photography, county tax maps/property boundaries, U.S. Geological Survey digital line graphs, National Wetland Inventory, and cultural resource data, among others. Aerial photography was 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 analyzed both manually and with GIS. Manual calculations from aerial photographs, tax maps, and other sources included the number of road crossings, stream crossings, and property parcels.

The siting team used GIS to analyze multiple factors when defining and comparing alternative routes. GIS displays and analyzes multiple layers of information simultaneously using geographically referenced digital information.

For this project, GIS data analyses included land cover, land use, and other data. A 1:100,000 GIS database was developed and used for regional opportunity and constraint analysis, while a 1:24,000 database was developed for more complex computations, such as acreage of wetlands.

2.4.3. Route Network Development

The main step in developing a route was to identify a network of feasible routes from Calpine's Morgan Energy Center to GM Substation. A major routing issue was crossing the Tennessee River. Within the study area, an existing transmission line crossing the Tennessee River was identified approximately 4300 feet west of Calpine's Morgan Energy Center. The existing transmission line had sufficient right-of-way for a new transmission line. This existing transmission line also had towers with vacant sides that could be used for the new transmission line. Therefore, with this opportunity, the new transmission line route would head south out of Calpine's Morgan Energy Center approximately 1737 feet to an angle structure. The route would then head west approximately 4373 feet along the railroad right-of-way to an angle structure. At this point, the route would turn north and parallel TVA's existing transmission lines on existing right-of-way for approximately 29,800 feet, crossing the Tennessee River. The route would then head east approximately 31,000 feet following TVA's existing transmission lines on existing right-of-way. At this point two routes were identified to connect to GM Substation. Route 1 would be about 17,400 feet in length and would head south from the existing TVA transmission lines on the west side of the railroad to the south side of Swan Creek. The route would then head southeast crossing the railroad and Pryor Creek to Thomas L. Hammon Road where the route would head south on the east side of Sandy Road to the GM Substation. Route 2 would be about 16,400 feet in length and would head south from the existing TVA transmission lines about midway between the railroad and Highway 31 to the south side of Pryor Branch. The route would then head southwest to Thomas L. Hammon Road where the route would head south on the east side of Sandy Road to the GM Substation.

2.4.4. Establish and Apply Siting Criteria

TVA has long employed a set of evaluation criteria that represent opportunities and constraints for development of transmission routes. One of the major requirements for this project was establishing a river crossing. The criteria are oriented toward 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 right-of-way acquisition cost being the most important elements. In addition, the scenic and historic resources in this study area required special consideration. Information gathered and comments made at public meetings were taken into account while refining criteria to be specific to the study area.

Each of the routes was evaluated according to these criteria relating to engineering, environmental, land use, and cultural concerns. Specific criteria are described below; for each category described, a higher score means a bigger constraint. For example, a greater number of streams crossed, a longer route length, or a greater number of historic resources affected would give an alternative route a worse score.

- *Engineering Criteria:* total length of the transmission route, length of new right-of-way and rebuilt right-of-way, primary and secondary road crossings, pipeline and transmission line crossings, and total line cost
- *Environmental Criteria:* slopes greater than 30 percent (steeper slopes mean more potential for erosion and potential water quality impacts), slopes between 20 and 30 percent, visual aesthetics, forested acres, open water crossings, sensitive stream (those supporting endangered or threatened species) crossings, perennial and intermittent stream crossings, wetlands, rare species habitat, caves, natural area crossings, and wildlife management areas
- *Land Use Criteria:* the number of fragmented property parcels, schools, houses, commercial or industrial buildings, barns, and parkland crossings
- *Cultural Criteria:* archaeological and historic sites, churches, and cemeteries

Scores for each of the alternatives were calculated by adding individual criterion values for each route. The resulting sum values were evaluated using standard statistical techniques and were assigned a ranking from 1 to 4 for each route in each subcategory (engineering, environmental, land use, and cultural).

A weighted score was produced for each route in each subcategory. This made it possible to understand which routes would have the lowest and highest impacts on engineering, environmental, land use, and cultural resources. Finally, to determine total impacts, the scores from each category were combined for an overall score.

2.4.5. Route Evaluation and Selection

Following the public open house, each route was evaluated using the updated constraint model along with the modified routing criteria obtained during the open house.

Based on public comments, Route 1 would be more favorable than Route 2. Route 1 would be approximately 1000 feet longer and have two more angles than Route 2, but it would not impact as many property owners. Route 1 would parallel the railroad right-of-way about 7400 feet, while Route 2 would split agricultural fields. Both routes would have similar impacts on natural areas.

Each of the route segments, shown in Figure 1-1 were analyzed using the numerical criteria discussed above. Based on the results, Route 1 was selected as TVA's preferred route for Alternative 2 (Figure 2-2). The preferred route was marked on the ground by survey teams and field reviewed by resource specialists. These resource teams were made up of individuals with expertise in wetland and aquatic ecology, historic and archaeological resources, wildlife, botany, and visual aesthetics.

Figure 2-2. Calpine's Morgan 161-kV Transmission Line - TVA's Preferred Route Alternative

2.5. Identification of the Preferred Alternative

Alternative 2: Construct a Transmission Line from Calpine's Morgan Energy Center to GM Substation is TVA's preferred alternative. A selected alternative will be chosen after a thorough internal TVA review.

2.6. Summary of TVA Commitments and Proposed Mitigation Measures

The following measures identified in this EA would be applied during construction and operation of the proposed transmission line.

1. Best Management Practices (BMPs) as described in Muncy (1999).
2. Environmental quality protection specifications as described in Appendixes II-V.

In addition, the following measures would be implemented at the National Register of Historic Places (NRHP)-eligible site 1LI568 (see Section 3.2.13).

Preconstruction:

1. Detailed recordation of all features that comprise Site 1LI568 including the portion of the historic Athens-Decatur roadbed that would be affected as well as the abandoned portion of the Louisville and Nashville Railroad and another unidentified railroad bed. Recordation would be conducted using a total station to map characteristics of the feature at close intervals, the result of which would be to produce a detailed map of all features within the site.
2. Photographs to document the site's condition before clearing and construction.
3. Additional historical research to document the sequence of railroad construction in the area as well as railroad history.

Clearing and Construction:

1. Clearing of the vegetation on the site within the right-of-way would be conducted with a low-pressure tired feller-buncher during dry soil conditions.
2. No heavy equipment, including the feller-buncher, would be allowed to traverse the feature or be positioned on it.
3. Construction of transmission line structures 98-100 would be regulated to produce minimal impact to the feature and its contours.
4. Photographs would be taken after right-of-way clearing that would document both the feature without its vegetative cover and any effects that may have occurred as a result of clearing. Additional photographs would be taken post construction to document the effects of structure placement.

Maintenance:

1. The boundaries of the feature within the right-of-way would be depicted on the final Plan and Profile sheets, which are used as reference throughout the line's use life.

2. Conditions would be placed in the right-of-way easement as well as the final Plan and Profile sheets that would govern future maintenance of the line. These conditions would include no traversing of the site with heavy equipment and hand clearing of vegetation within its boundaries.

3. Any action involving maintenance or replacement of the transmission line structures would be reviewed by TVA's Cultural Resources staff.