to the current three units, which they do not now have. The FGD systems would require additional water. Therefore, in 2004 AECI conducted an in-depth study of water supply at its Thomas Hill facility to assess whether the current water supply source would be adequate during a severe drought, using various future use scenarios, including the addition of a 600-MW unit (AECI, 2004b).

The Thomas Hill plant was first constructed in 1966 with one net 180-MW generating unit. Unit 2 (303 MW net) was added in 1969 and Unit 3 (670 MW net) was installed in 1982 (AECI, 2006f). The Thomas Hill Reservoir was built as a water source for the plant, by damming the Middle Fork of the Little Chariton River (Figure 2-43).

Prior to December 1991 the reservoir covered 4,400 acres and the mean pool elevation was 710 ft mean sea level (MSL). Currently, the Thomas Hill Reservoir covers 4,950 acres at the current pool elevation of 712 ft MSL (MDC, 2001). During a drought that occurred between 1987 and 1990, the reservoir water level decreased to elevation 700.9 ft MSL, within 3 feet of the elevation 698 circulating water pump design minimum submergence depth. A much more severe drought had occurred during the 1950s, before the plant was constructed. The current three units have once-through cooling and no FGD system (AECI, 2004b).

2.2.10.1.1 Scenarios Evaluated

The study evaluated water needs in the event of a drought similar to the 1950s drought, for four scenarios related to the generating units:

- Scenario 1: Present configuration (Units 1-3 with no FGD).
- Scenario 2: Addition of FGD systems to Units 1-3.
- Scenario 3: Present configuration for Units 1-3, addition of Unit 4 at 600 MW.
- Scenario 4: Addition of FGD to Units 1-3, plus addition of Unit 4 at 600 MW.

Modeling and Results

To predict water needs, a model was developed using actual data for precipitation, weather conditions, reservoir levels, plant water usage and other variables. After benchmarking with known conditions, the model was

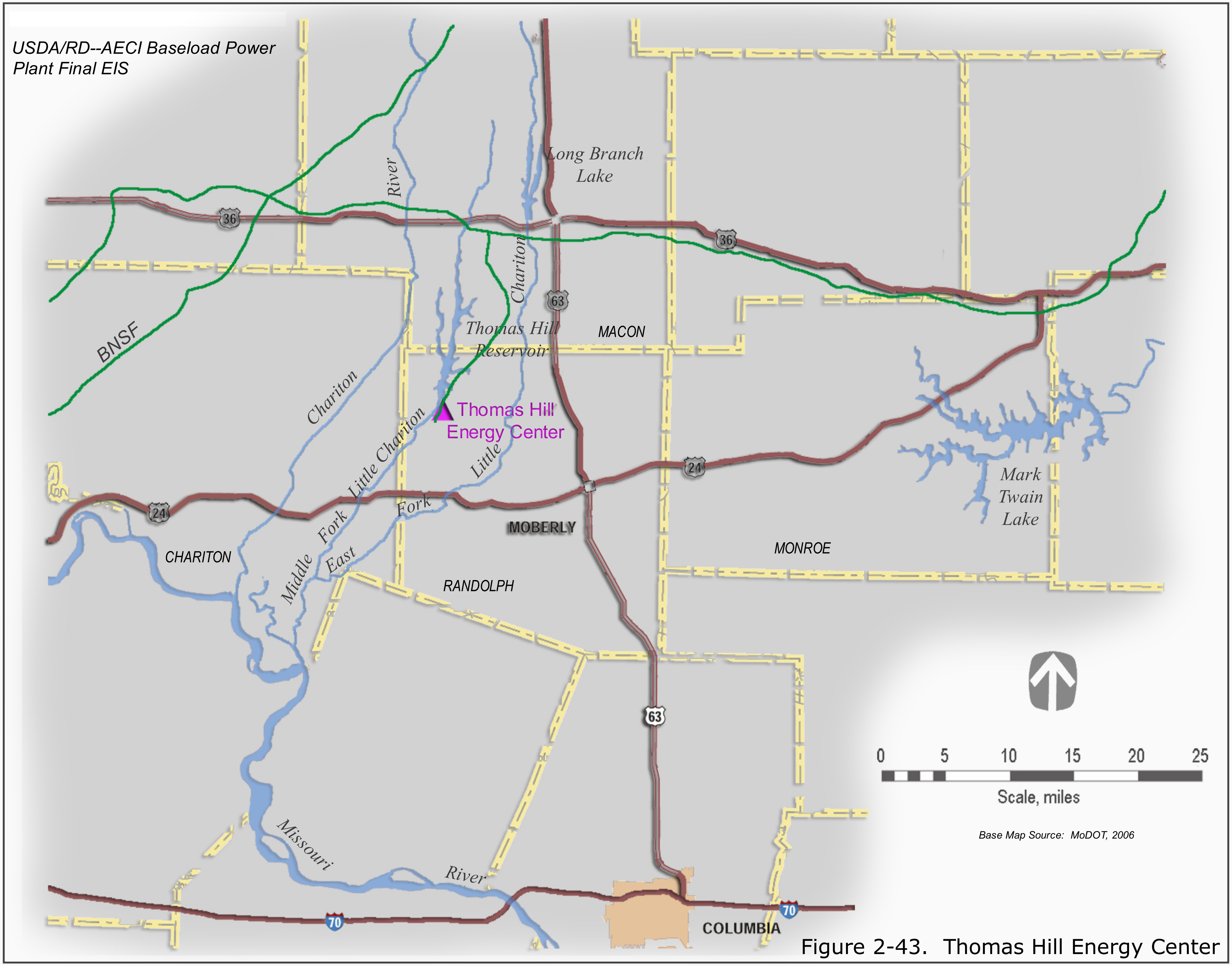

Figure 2-43. Thomas Hill Energy Center

used to predict reservoir levels for a drought similar to the 1950s drought. Estimate inflow rates for the time period before the reservoir was constructed were developed by rainfall and stream flow data for the reservoir watershed during the period 1948 to 2003.

The model results indicated that with the reservoir at the normal pool elevation of 712 ft MSL, water available through a 1950s-type drought would be insufficient for all four scenarios. The two plant configurations with the highest and lowest water requirements (Scenarios 1 and 4) were modeled to estimate how long the units would need to be removed from service during such a drought. For Scenario 1, the units would need to be removed from service for about 8 months; for Scenario 4, the units would need to be removed from service for about 2 years.

Further modeling was done to assess whether lowering the minimum reservoir elevation could alleviate the problem. As noted above, the minimum design reservoir elevation for operation of the intake pumps is 698 ft MSL. However, previous testing showed that the pumps perform satisfactorily at a water level of 696 ft MSL. Modifications to the pump intake area could potentially reduce the acceptable minimum level to 690 ft MSL. Assuming a minimum reservoir level of 690 ft MSL, the modeling showed that there would not be a water shortage for Scenario 1 (Units 1-3 with no FGD), but there would be shortages of 2, 13 and 15 cfs, respectively for Scenarios 2, 3, and 4(AECI, 2004b).

The potential water shortage could be alleviated by raising the reservoir level, or by providing makeup water from some other source. The study estimated makeup water requirements. The model assumed that whenever the reservoir level dropped to two feet below the normal pool elevation, makeup water would be supplied until the level was within 0.5 ft of normal pool elevation. The Missouri River aquifer, which is about 30 miles from the reservoir, could potentially provide a continuous supply of makeup water during a severe drought. The Chariton River, approximately 2 miles to the west of the reservoir, could also be a source of makeup water. However, during a drought, the flow in the Chariton River would be insufficient for makeup. Therefore, the pumping rate from the Chariton would need to be higher to compensate for the times when the flow was low and water could not be pumped. Table 2-13 summarizes the makeup requirements for the four scenarios for maintenance of the current minimum intake pump design elevation (698 ft MSL), and the lowest potential reservoir elevation if modifications are made to the intake system (690 ft MSL), using either the Missouri River aquifer or the Chariton River.

Table 2-13 Makeup Requirements to Maintain Thomas Hill Reservoir Level During a 1950s-Type Drought (AECI, 2004b)

	Makeup Requirements to Maintain Minimum Reservoir Elevation 698 ft MSL (cfs)		Makeup Requirements to Maintain Minimum Reservoir Elevation 690 ft MSL (cfs)	
	Missouri River	Chariton River	Missouri River	Chariton
Scenario 1	5	9	0	0
Scenario 2	8	14	2	4
Scenario 3	18	37	12	23
Scenario 4	21	42	15	29

The above requirements do not include an average of 11 cfs of blowdown from Units 1-2 bottom ash ponds.

2.2.10.1.2 Alternatives Evaluated

After the modeling was completed, alternatives in three categories were evaluated: 1) water conservation alternatives, 2) alternatives to increase available water storage, and 3) alternatives that provide additional water from other sources.

Water conservation alternatives were among the least costly, but could not alone provide adequate additional water supply. Options evaluated are summarized below.

Recycle Units 1 and 2 bottom ash sluice water. Units 1 and 2 have a once-through ash sluicing system and Unit 3 has a recirculating bottom ash system with dewatering bins. Bottom ash sluice water is discharged from Units 1 and 2 ponds to the Middle Fork of the Little Chariton River, with a discharge flow rate of 10.7 cfs. With a new pump and about a half-mile pipeline, this water could be returned to the reservoir. This option would require a new National Pollutant Discharge Elimination System (NPDES) permit. There may be some concern about discharging to the reservoir, though the discharge currently goes to the river.

Install Units 1 and 2 bottom ash dewatering systems. If the above recycling scenario cannot be permitted, dewatering systems could be installed for Units 1 and 2 bottom ash, same as Unit 3 currently has. This would result in a closed loop water system for the sluiced bottom ash.

Reduce minimum flow to Middle Fork. AECI has an agreement with the Missouri Department of Natural Resources (MDNR) and the Missouri Department of Conservation (MDC) to maintain a minimum 5 cfs flow to the Middle Fork of the Little Chariton River. This option would require changing that agreement to allow reduced flows during times of lower reservoir levels. Preliminary discussions with the agencies suggest this option may be acceptable. A minimum average flow reduction of 2 cfs was used in the study for this alternative.

Addition of flow-straightening devices. The addition of flow-straightening devices to the pump intake structures could result in a reduction of the minimum reservoir elevation from 698 ft MSL to 691.5 ft MSL, which would increase the reservoir capability by 12,000-acre-ft. This option is low risk, with minimal environmental impacts.

Pumping from the Chariton River. This option would require a pipeline approximately 2 miles long, and an intake structure in the river. (Water that could be obtained by wells from the aquifer would be insufficient.) This was the lowest cost option for providing additional water, but would require several permits from the USACE and from the MDNR. In addition, there is the possibility that AECI's rights to the water in the Chariton River could be challenged under the "reasonable use" doctrine (AECI, 2004b).

Pumping from the Missouri River aquifer. This option would require the construction of a 30-mile pipeline, making the cost considerably higher than pumping from the Chariton.

Other options. Dredging the reservoir to increase capacity and raising the reservoir level were both evaluated and were among the higher-cost alternatives. Purchasing water from Mark Twain Lake and Long Branch Lake (Figure 2-43), both operated by the USACE, were evaluated. The cost of the water plus conveyance costs were both considerably higher than pumping from the Chariton River. The possibility of purchasing water from the USACE's Rathbun Reservoir, located on the Chariton River in Iowa, about 90 miles north of Thomas Hill, was considered. The purchased water would be released into the river and could allow AECI to pump from the Chariton during drought conditions, thereby greatly reducing the required pumping rate from the Chariton River. However, the purchase costs of water from Rathbun would not have offset the cost of higher pumping rates, and this option was dropped.

Costs of various options are summarized in Table 2-14 (AECI, 2004b).

Table 2-14. Costs of Water Supply Alternatives

Option	cfs provided	Capital Cost ($1,000/cfs)	Relative Capital Cost
Reduce minimum flow to Middle Fork	2	25	1
Recycle Units 1-2 bottom ash sluice water	11	64	3
Units 1-3 flow straightening	6	125	5
Units 1-2 bottom ash dewatering system	11	273	11
Chariton River intake and makeup system	21	475	19
Raise Thomas Hill Reservoir to elev. 715	4	800	32
Add barge pumps for Units 1-3	6	1,167	47
Raise Thomas Hill Reservoir to elev. 725	21	1,500	60
Missouri River wells and makeup system	21	2,000	78
Addition of new reservoir SW of T. Hill	9	4,000	160
Unit 4 air cooled condenser	9	5,600	224
Dredge Thomas Hill Reservoir	4	52,000	2,080

Table 2-15 summarizes the required additional water needs for the various scenarios.

Table 2-15. Thomas Hill Water Needs

Scenario	Required Makeup or Conservation (cfs)	Required Volume (acre-ft)
1—Units 1-3 with no FGD	16	64,000
2—Units 1-3 with FGD	19	76,000
3—Units 1-4; no FGD Unit 1-3	29	116,000
4—Units 1-4 with FGD	32	128,000

The above requirements include an average of 11 cfs of blowdown from Units 1-2 bottom ash ponds

2.2.10.1.3 Study Recommendations

For all scenarios, the report recommended the following conservation measures:

- Reduce minimum flow to Middle Fork—conserves 2 cfs
- Recycle ash sluice water—conserves 11 cfs
- Intake flow straightening—conserves 6 cfs

The total conserved water is 19 cfs, at a cost of $1.5 million. These conservation options would cover the water requirements for Scenarios 1 and 2.

For Scenarios 3 and 4, the report recommended the above conservation measures, plus the Chariton River intake and makeup system: at a flow rate of 10 cfs for Scenario 3 and 13 cfs for Scenario 4. The total cost estimates were $8.5 million for Scenario 3 and $10 million for Scenario 4. There is some risk associated with pumping from the Chariton due to the uncertainty of permitting the intake structure, and the need to pump a large percent of the river's flow.

2.2.10.2 Conclusions Regarding Thomas Hill

Despite the potential benefits of adding a unit at Thomas Hill, after the water supply study was completed, AECI's Board decided not to pursue that option at this time, for the following reasons:

- The addition of a unit at Thomas Hill would result in a high percent of base load capacity at one location, stressing transmission system reliability.
- The high concentration of generation at one location would also subject a substantial portion of the system to a common failure, accident, or meteorological event.
- The site has the highest construction labor supply risk due to its distance from major metropolitan areas.
- As discussed above, the site has the highest water supply risk. The current water supply source is inadequate, and there is some risk and uncertainty associated with reasonable cost options for supplementing the water supply.

2.2.11 Rail Routing Alternatives

In AECI's 2005 assessment of alternative sites, the Norborne Site was identified as proposed, and the Big Lake (previously referred to as Forbes) Site as the alternate (AECI, 2005a). The site assessment included an evaluation of rail corridors. In a later study (AECI, 2006i), AECI narrowed the rail macro corridors for Norborne to quarter-mile wide route corridors and identified proposed corridors. This section summarizes the alternatives and briefly describes those that are not included in the detailed assessment in *Section 3, Affected Environment and Environmental Consequences*.

2.2.11.1 Big Lake Site

AECI's 2005 study included identification of one-mile wide rail corridors for coal delivery. The intent was to identify alternative routes to two different carriers to avoid complete dependence on one carrier. Railroads in the vicinity of the Big Lake Site are shown in Figure 2-44.

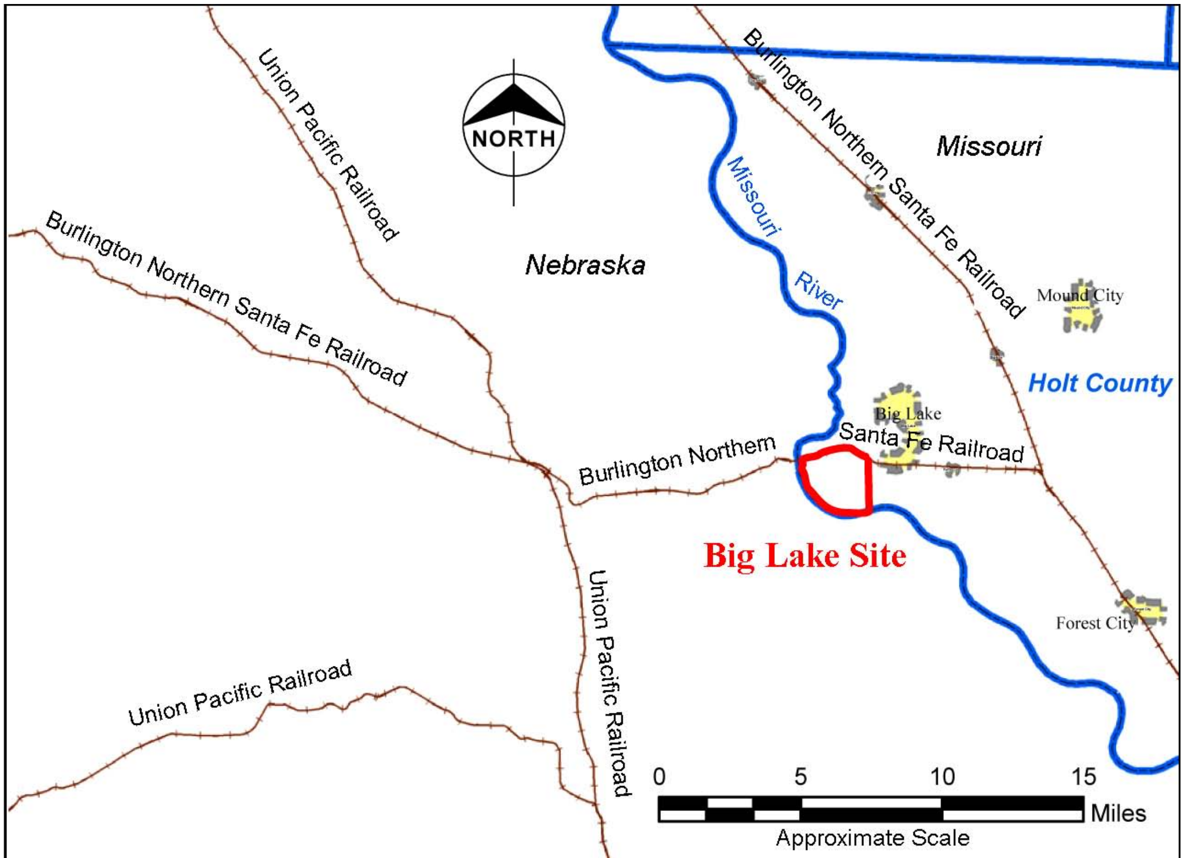

Figure 2-44. Mainline Railroads in Vicinity of Big Lake Site
Source: AECI, 2005a

As shown in the figure, there is a BNSF line very near the north side of the site. Approximately four miles of new rail connections and coal unloading loop would be required to connect the proposed generation facility to this

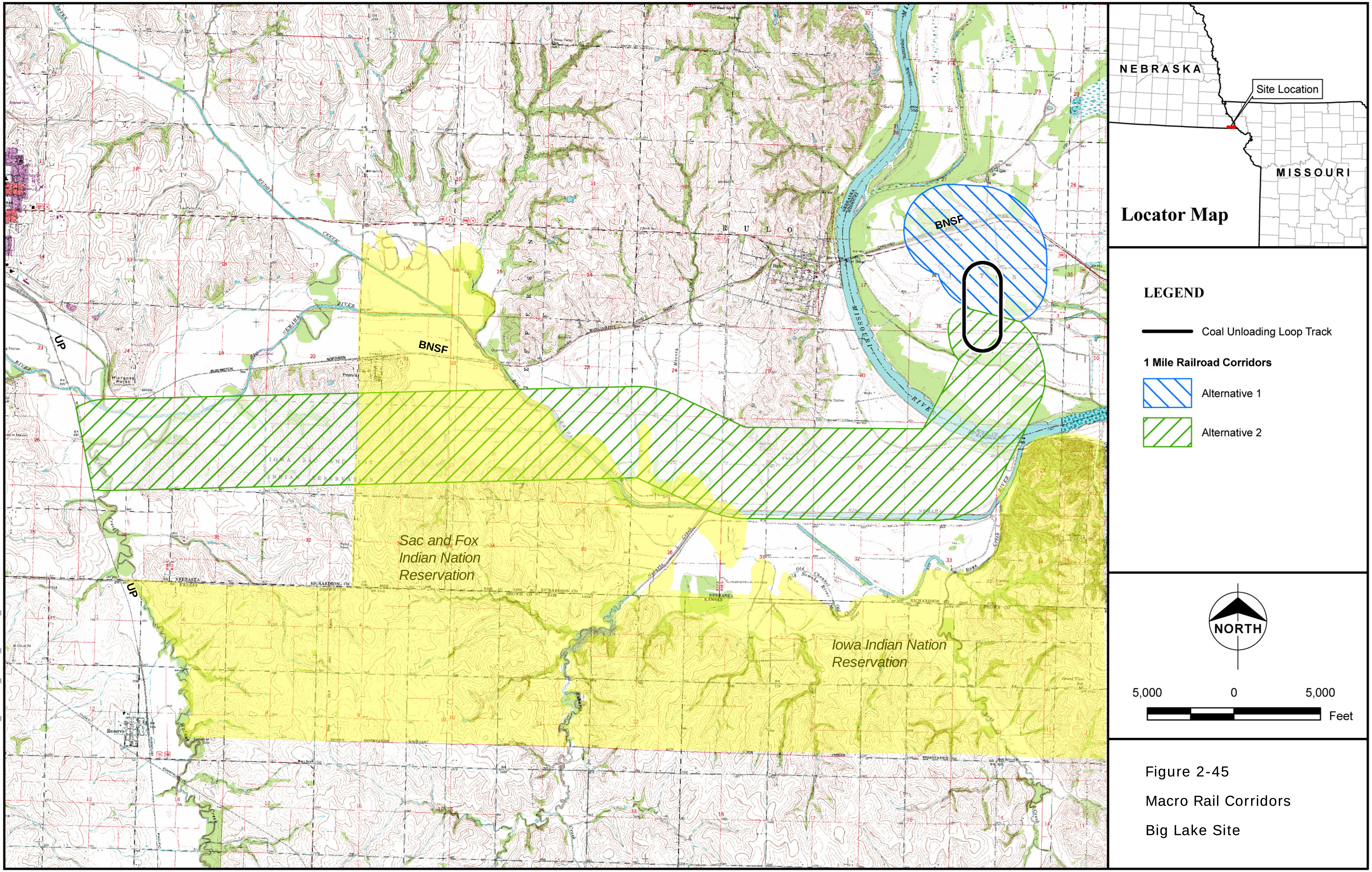

Figure 2-45
Macro Rail Corridors
Big Lake Site

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Source: USGS 1:24,000 Topographic Quadrangles: Falls City, Rulo, Big Lake, Reserve, Highland NW, White Cloud.

Sources: AECI, 2005a; NDOR, 2001; KDOT, 1991 existing BNSF line. The rail connector would require crossing U.S. Highway 159, which borders the site on the north. The one-mile-wide macro corridor for this route is shown in Figure 2-45 as Alternative 1. There is one residence within a quarter mile of the proposed mile-wide corridor. There would be no major stream crossings for this alternative. There are no parks, conservation areas (CAs), or refuges within the macro corridor. Within the Alternative 1 macro corridor the USFWS National Wetlands Inventory (NWI) map shows 86 acres of wetlands consisting of: emergent (28 acres), forested (21 acres), scrub-shrub (36 acres), and palustrine unconsolidated bottom (1 acre) (AECI, 2005a). The NWI wetlands mapped within the Alternative 1 macro corridor are shown in Figure 2-46. One transmission line (345 kV) crosses the macro-corridor and a crossing of the right-of-way of that transmission line would be unavoidable. Vertical clearances in accordance with the National Electric Safety Code (IEEE, 2006), would need to be provided at any crossing of a transmission line. In conclusion, there are few major constraints between the Big Lake site and the BNSF Railroad. (AECI, 2005a).

The only other railroad in the area besides BNSF is the UP line that lies across the Missouri River in Nebraska (Figure 2-44). AECI evaluated a one-mile wide macro corridor from the Big Lake Site to the UP line, shown in Figure 2-45 as Alternative 2. This route is about 15 miles long. There are no towns located in the corridor but there are 10 rural residences within the one-mile corridor. An effort was made to avoid residences; however, 7 are within one-quarter mile of the center line. Topography within the corridor is relatively flat, except for a narrow band with elevations ranging from 890 to 1000 feet. Elevations for the majority of the corridor are around 850 feet near the Missouri River and gradually slope up to around 880 feet near the railroad. The corridor would allow a direct route from the mainline railroad to the plant site with a gradual slope.

Major river crossings would present an obstacle to developing this corridor. As shown in Figure 2-45, there are two major rivers, the Missouri and Big Nemaha that would be crossed to connect with the UP railroad. In addition, several smaller perennial and intermittent streams would be crossed, including Walnut Creek and Snake Creek in Nebraska. Constructing a railroad bridge across the Missouri River may require consultation with USFWS under Section 7 of the Endangered Species Act. (AECI, 2005a).

It would also require permits from the Coast Guard and the USACE under the Rivers and Harbors Act, Sections 9 and 10, respectively. NWI maps show 148 acres of wetlands consisting of: emergent (52 acres), forested (37 acres), scrub-shrub (49 acres), and palustrine unconsolidated bottom (10 acres) within the macro-corridor (Figure 2-46) (AECI, 2005a).

There are no CAs, parks, and refuges located within the one-mile corridor. However, the corridor crosses part of the Sac and Fox Indian Nation Reservation, as shown in Figure 2-45 (NDOR, 2001; KDOT, 1991).

Although this reservation is currently crossed by the BNSF line to which the plant could be connected (Alternative 1), Tribal approval would be required for construction of a second rail line across the Reservation. AECI would be unable to acquire right-of-way for a rail line across the Reservation through eminent domain (AECI, 2005a). Because of the obstacles of the major river crossings and the Indian Reservation, AECI has not further pursued Alternative 2 for Big Lake.

A connection to the UP line that would avoid the reservation by going to the north would likely require at least one, if not two or more, crossings of the BNSF rail line. It is unlikely that the BNSF would agree to these crossings by a potential competitor. Such crossings could be forced through authorization from the Surface Transportation Board (formerly the Interstate Commerce Commission, the federal agency responsible for regulating rail construction and commerce activities). However, such authority is not guaranteed. If approved, crossings of the BNSF could either be at grade with the existing rail line but would more likely require the new rail line to go over the existing line, creating grade-separated overpasses of the existing line. The topography of the Nemaha River valley would require extensive earthwork to create suitable grades and approaches for these grade-separated crosses. (AECI, 2005a).

Should the Norborne Site prove infeasible and the alternate Big Lake Site becomes the proposed site, AECI will assess whether or not a competitive rail option is needed. Unless that happens, a rail connection to the UP line for the Big Lake Site will not be further evaluated. It is therefore eliminated from further consideration in this document. Only the Alternative 1 rail macro corridor is considered in the detailed analysis.

2.2.11.2 Norborne Site

Three railroads are located in proximity to the proposed Norborne site (Figure 2-47). In 2005, AECI identified three macro corridors, each about one mile

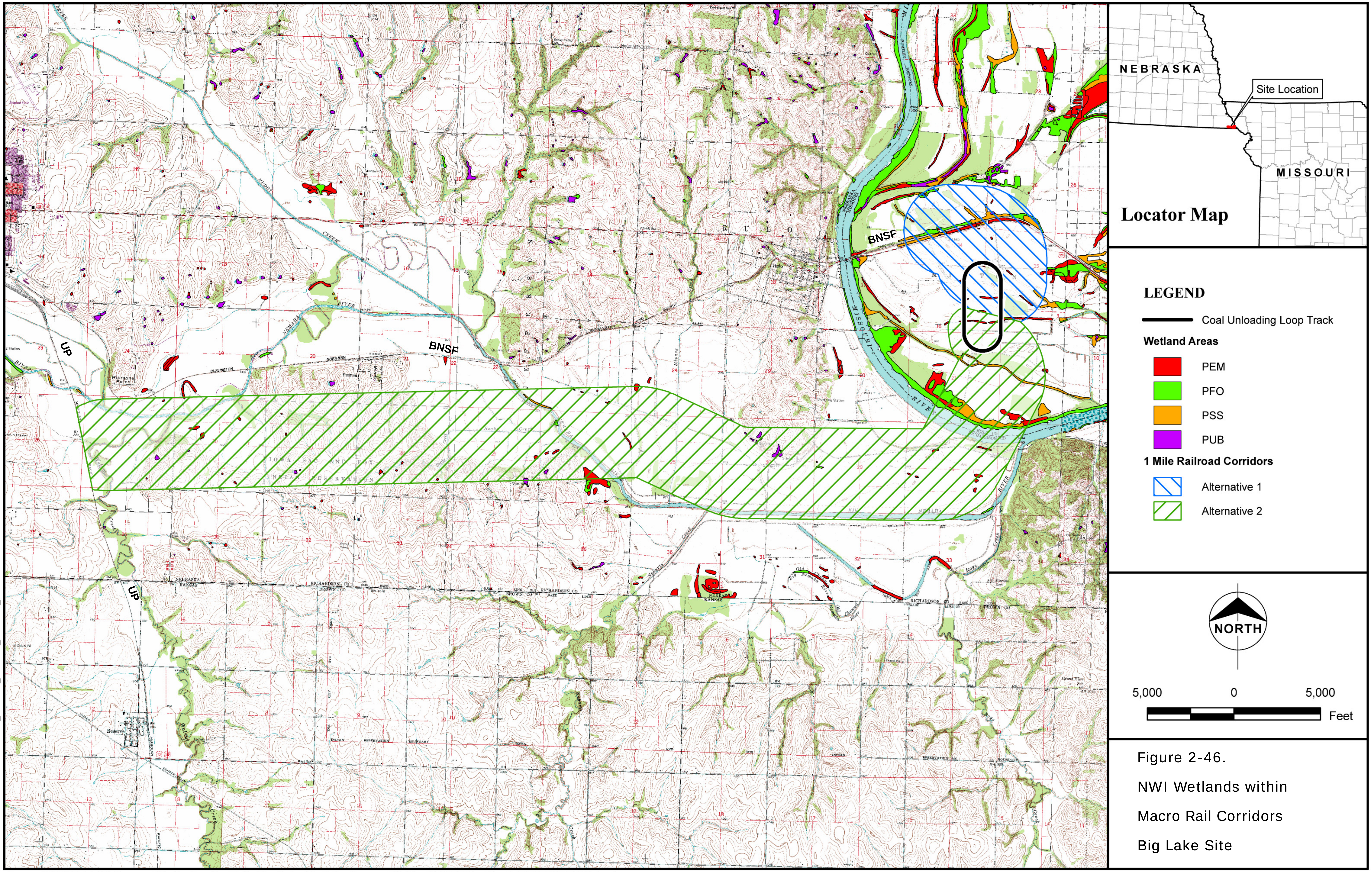

Figure 2-46.
NWI Wetlands within
Macro Rail Corridors
Big Lake Site

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Source: USGS 1:24,000 Topographic Quadrangles: Falls City, Rulo, Big Lake, Reserve, Highland NW, White Cloud; USFWS NWI Wetlands.

Source: AECI, 2005a

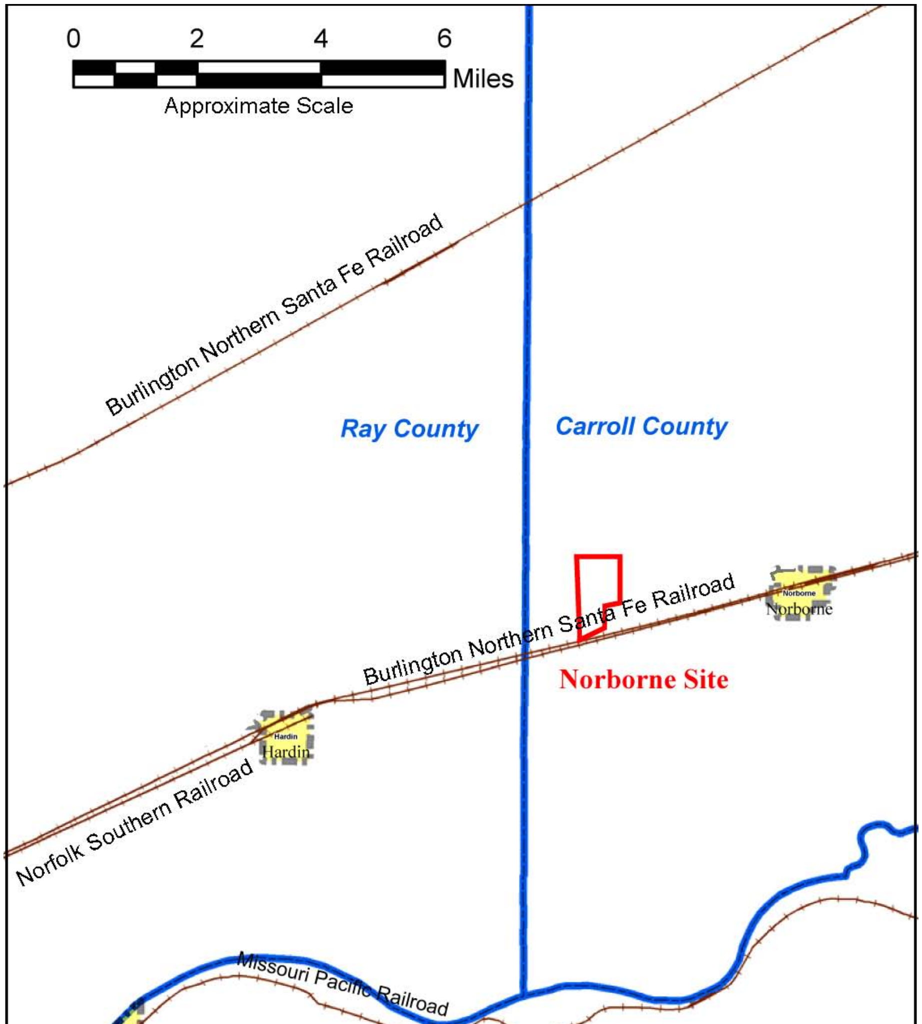

Figure 2-47. Mainline Railroads--Norborne Site Vicinity.
Source: AECI, 2005a

wide: Alternative 1, to connect to the BNSF and potentially also the NS railroad south of the site; and Alternatives 2 and 3, two different options to connect to the BNSF line north of the site (AECI, 2005a). Alternative 1 would likely be used to transport construction materials on the BNSF line to the south, and could potentially be used to transport coal from the NS line to the south. (The BNSF line to the south is an intermodal mainline for the railroad with high speed freight trains operating on that line. The railroad does not want to operate lower speed coal trains on this route and has told AECI that they will not deliver coal to the site from this rail line.) Alternatives 2 and 3 are options for coal transport from the BNSF line to the north. In 2006, AECI narrowed these corridors to about a quarter-mile in width, and identified Alternatives 1 and 2 as proposed. Only the narrowed corridors for Alternatives 1 and 2 are included in the Proposed Action and the detailed analysis in *Section 3, Affected Environment and Environmental Consequences*. The process of defining, then narrowing the corridors, then identifying the proposed corridors is summarized below.

Identification of Macro Corridors

The nearest rail access from the Norborne Site is the existing BNSF railroad located directly south of the proposed facility. Because of its use as a major high speed Intermodal/Automotive Business Units rail line it is not a feasible alternative for transporting coal (AECI, 2005a). However, the project would include a connection to the BNSF line for construction and heavy equipment deliveries (AECI, 2006i). The second nearest rail access is the Norfolk Southern (NS) Railroad to the south, which could be used for coal deliveries, but a line to the proposed Norborne plant would require crossing the BNSF line. Coal deliveries on the NS would originate on UP lines. UP is not taking on any new customers in the foreseeable future during a self-imposed embargo until capacity issues can be resolved. Nevertheless, a route to the proposed plant from the NS line was evaluated because it is expected to be a viable alternative in the future (AECI, 2006i). The corridor connecting to either or both of these southern lines is referred to as Alternative 1 (Figure 2-48). The other alternative for coal deliveries is a BNSF line about 6.5 miles north of the plant site that is currently used solely for coal trains. The BNSF has indicated this is the likely route if they transport coal to the proposed plant and AECI identified two macro corridors that would interconnect with this line (Alternative 2 and 3), as shown in Figure 2-48. Any of these connector lines and their interconnections with existing rail lines would require Surface Transportation Board approval. The regulatory approvals for connecting to the NS would likely be more rigorous and difficult than any of the others as this would require a grade or elevated crossing of the BNSF line (AECI, 2006i).

Alternative 1

The macro-corridor identified between the proposed Norborne site and the southern BNSF and NS lines is approximately 2.5 miles long (Figure 2-48).

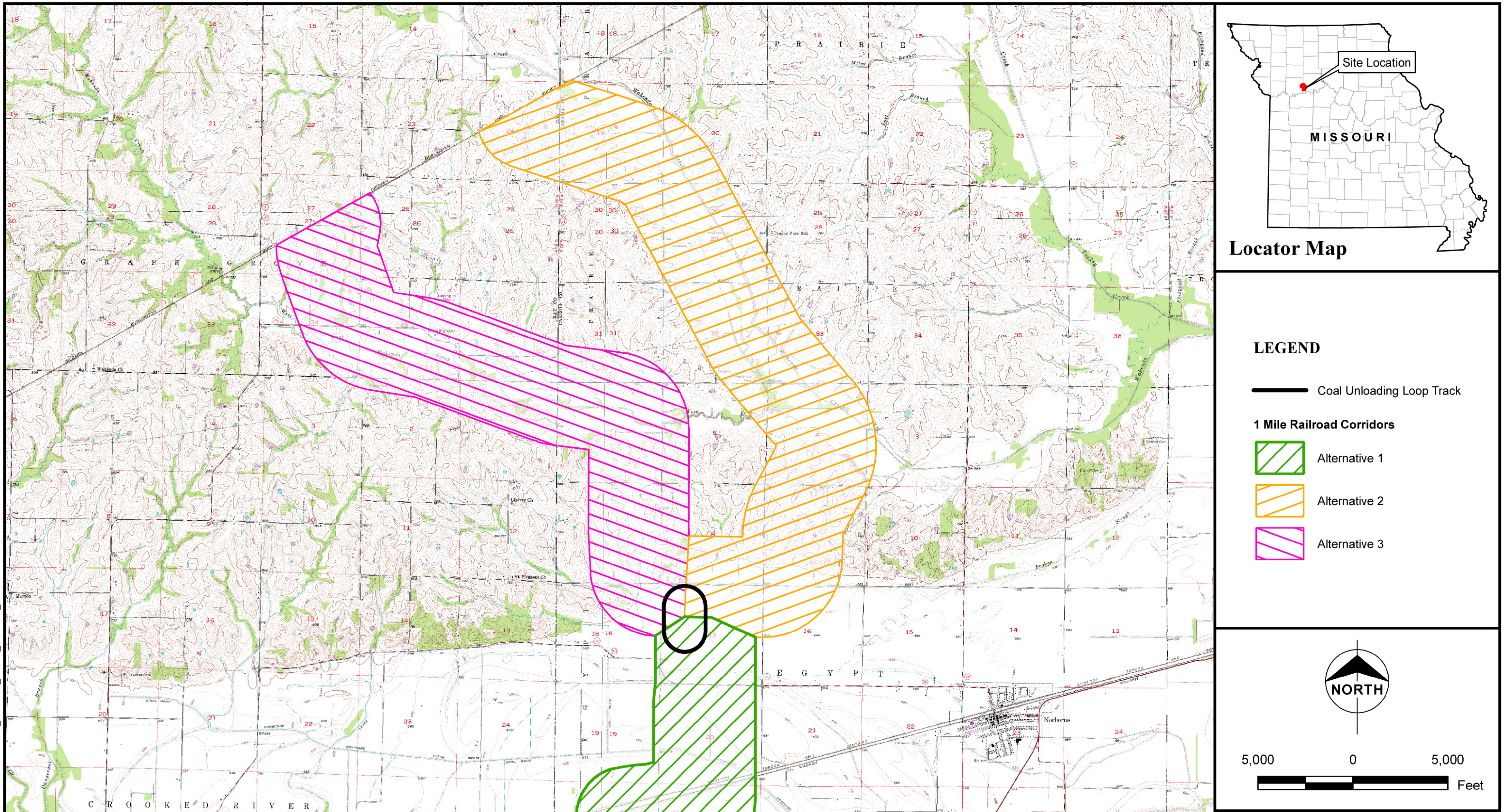

Figure 2-48

Macro Rail Corridors

Norborne Site

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Source: USGS 1:24,000 Topographic Quadrangles: Norborne, Hardin, Roads, Stet.

Source: AECI, 2005a

There are no residences located within the one-mile corridor. Topography within the corridor is flat, with elevations ranging from 675 feet to 685 feet. The corridor would allow a direct route from the BNSF mainline to the plant site with minimal slope. There are no CAs, parks, and refuges located within or near the one-mile corridor. No major river crossings are necessary to connect with the southern BNSF railroad. A few smaller drainages, the largest being the Norborne Drainage Ditch, would be crossed. The railroad spur connecting with the NS Railroad would require one extra mile of track and one 400-foot long bridge to cross both the existing NS Railroad track and the existing track southern BNSF Railroad track. There are no Interstate or U.S. highway crossings within the corridor. Missouri Route DD crosses the corridor, and an at-grade crossing would most likely be required. NWI maps show approximately 31 acres of wetlands (emergent (28 acres), forested (1 acre), scrub-shrub (1 acres), and palustrine unconsolidated bottom (1 acre) within the macro-corridor (Figure 2-49) (AECI, 2005a).

Alternative 2

The Alternative 2 macro-corridor is about seven miles long and would follow a route on the south side of Wakenda Creek (Figure 2-48). There are 26 rural residences but no towns located within the macro corridor. There are no CAs, parks, or refuges located within or near the one-mile corridor. NWI maps show about 166 acres of wetlands consisting of: emergent (23 acres), forested (110 acres), scrub-shrub (3 acres), and palustrine unconsolidated bottom (30 acres) within the macro-corridor (Figure 2-49).

Alternative 3

The Alternative 3 macro-corridor is about seven miles long and would follow the West Fork of Wakenda Creek (Figure 2-48). There are 34 residences within the macro corridor, most of them in the small community of Rockingham (AECI, 2005a). Crossings of six small streams would be required, the largest of which is the West Fork of the Wakenda Creek.

There would be one crossing of a transmission line. According to NWI maps there are approximately 102 acres of wetlands consisting of (emergent (21 acres), forested (57 acres), scrub-shrub (1 acres), and palustrine unconsolidated bottom (23 acres) within the macro-corridor (Figure 2-49) (AECI, 2005a).

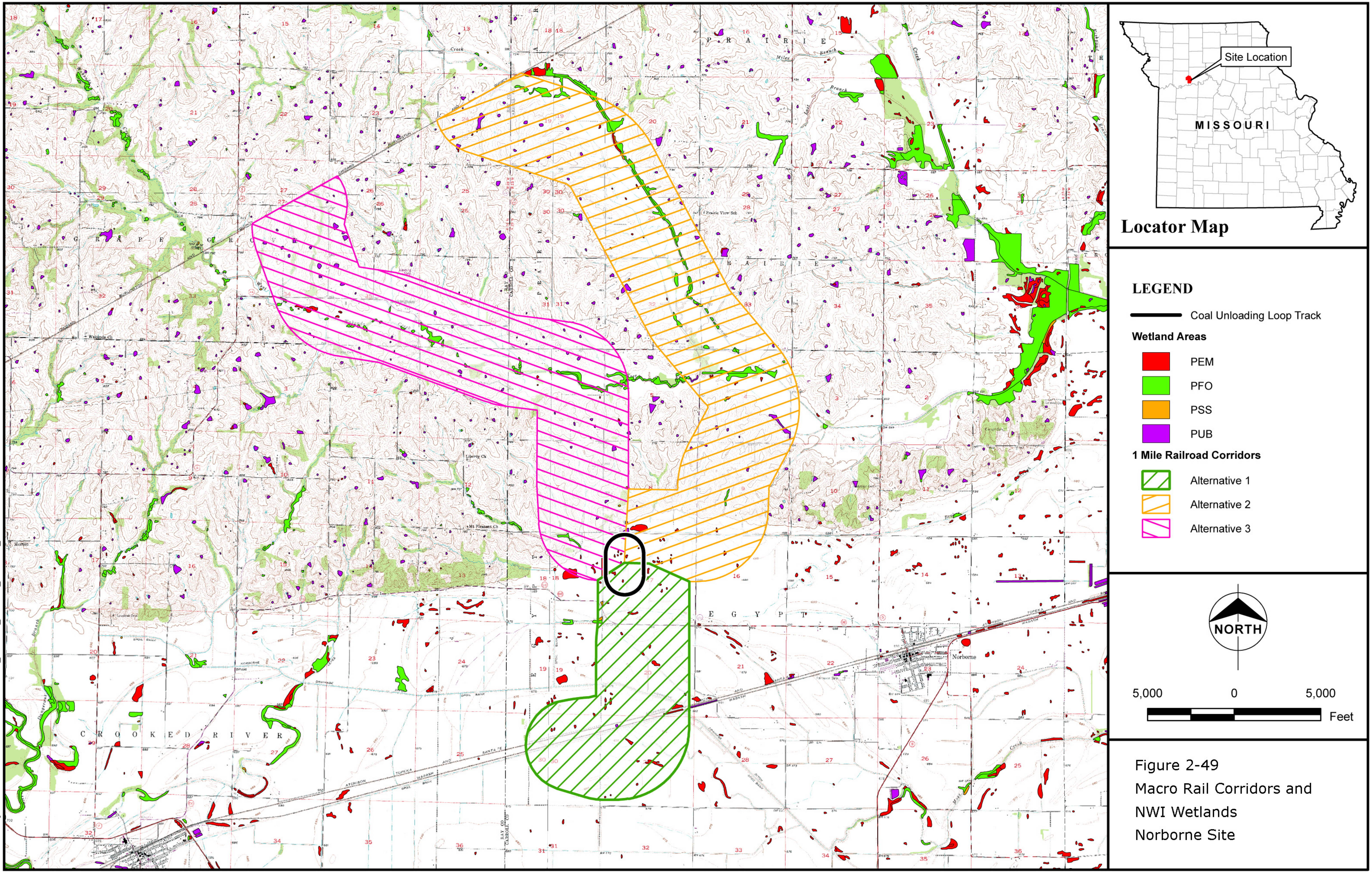

Figure 2-49
Macro Rail Corridors and NWI Wetlands Norborne Site

Source: USGS 1:24,000 Topographic Quadrangles: Norborne, Hardin, Roads, Stet; USFWS NWI Wetlands.

Source: AECI, 2005a

Refinement of Corridors

In 2006 AECI conducted another study, for the purpose of narrowing the macro corridors and identifying proposed routes (AECI, 2006i).

Alignments approximately 1,200 feet wide were established within each corridor to determine a potential centerline for the route corridor. The right-of-way width for a new rail line would be approximately 150 to 200 feet, depending on local conditions including cut and fill requirements. The following discusses each of these alignments, comparing potential for cut and fill, and environmental considerations.

Corridor Characteristics

The key considerations in the development of a rail line for heavy haul trains, such as unit coal trains, are grade and curvature. Inclines and declines acceptable for vehicle traffic can be many times steeper than those required for safe movement of the heavy coal trains, which may be a mile long. Even minimal inclines over distances of a mile or more can cause locomotives to be unable to continue to pull the weight of the train up the incline or loose wheel traction on the rails. Additionally, the weight of the train being pulled uphill may cause car couplers to fail (pull apart), resulting in separation of the train and derailments. Conversely, the weight of a train on a decline may also cause the couplers of cars at the bottom of the hill to fail as they are not strong enough to hold the weight pushing down the hill. As such, to reduce construction costs and environmental impacts associated with earthwork to create a suitable rail grade, it is desirable to locate rail lines for coal along level to nearly level topography to the extent practicable.

Trains in motion along a straight line exert extensive force to continue in a straight line when entering a curve. Therefore, it is highly desirable to minimize curves in rail line and maintain the straightest track possible. Rail track curves must be more open than road curves to prevent train derailments. Requirements for open, gentle curves greatly reduce the flexibility of where a rail line can be located and the ability to route around potential problems or concerns. To avoid any problem areas may require the alignment of a rail line for a mile or more in advance of the problem area in order to maintain suitable curve and grade for safe rail operations. Curves along a rail line incline result in forces on the train that magnify the actual grade slope, causing the train to experience a greater uphill grade than actually present (AECI, 2006i).

The following provides a discussion of the development of the location and characteristics for each rail route corridor based on the potential alignment. These characteristics include natural and human resources along the alignment, as well as discussion of the construction requirements.

Alternative 1 Route Corridor

This alternative includes a connection to the BNSF line and potentially also to the NS line. These two lines run parallel to one another south of the proposed Norborne Site. Adequate space appears to be available for construction and operation of both of these lines. As discussed earlier, connection to the NS line would likely require either an at-grade or elevated crossing of the BNSF. An at-grade crossing of the BNSF rail line would likely raise safety and operating issues related to unit coal trains blocking this line. An overhead crossing may raise similar concerns, particularly during construction and if BNSF has any plans for additional tracks or sidings through this area. BNSF has indicated it does not want regular movements of unit coal trains over this rail line for delivery to the plant (AECI, 2006i). Unit coal trains generally travel at slower speeds than the intermodal traffic currently moving over the BNSF line. Coal trains operating on this main line as well as slowing and switching onto the rail line to access the plant would create potential safety and operational conflicts with existing high-speed intermodal traffic. However, BNSF has indicated it may be possible to connect to this main line for deliveries of construction material. Delivery of construction material would include only a few short trains and would be limited to the short term of construction, as opposed to unit coal trains which would include several trains per week for the life of the plant.

The area of the southern corridor is relatively open and flat. The principal consideration in development of a route corridor is the track geometry required to elevate the connecting track over the BNSF line and then return to ground elevation to connect to the NS line. Alternative 1 (Figure 2-50) would extend from the plant site, crossing Missouri Route DD. While this may remain as an at-grade crossing, AECI is also evaluating the possibility of elevating Missouri Route DD over the proposed railroad line. South of Missouri Route DD, a connecting line to the NS would need to begin to gain elevation in order to maintain a suitable grade and still have sufficient

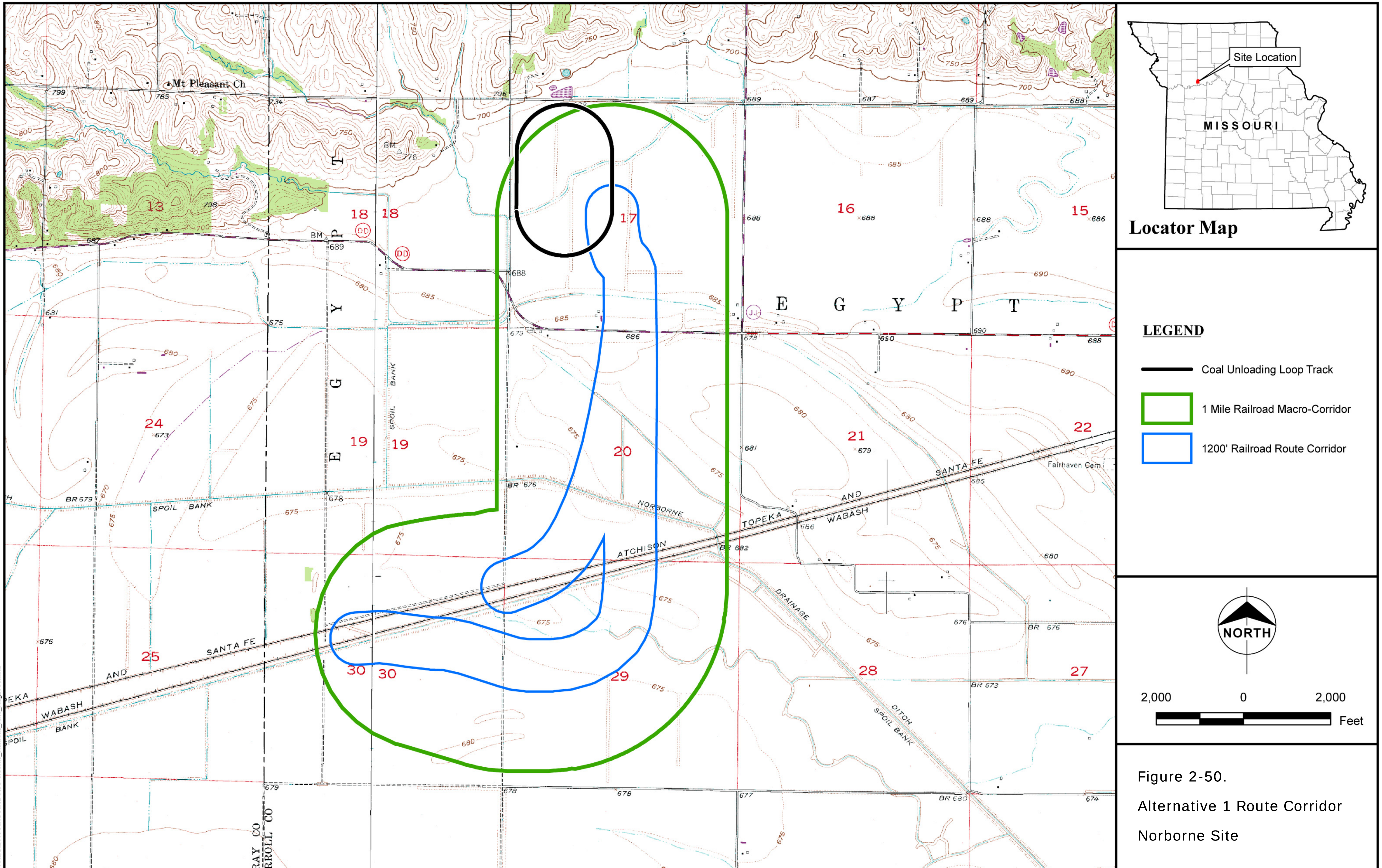

Figure 2-50.
Alternative 1 Route Corridor
Norborne Site

Source: USGS 1:24,000 Topographic Quadrangles: Norborne, Hardin.

Source: AECI, 2006i

clearance over the BNSF line. After crossing the BNSF, Alternative 1 would turn to the west, lowering in elevation until it could connect with the NS line.

The topography of Alternative 1 is generally flat. No areas of cut would likely be required for construction of this line. However, for a connection to the NS, it is likely that nearly two miles of the line (one mile on either side of the bridge over the BNSF) would be elevated on fill to bridge over the BNSF line and provide approximately 30 feet of clearance (sufficient clearance for double-stack intermodal train traffic). Maximum fill depth would be approximately 30 feet. However, as no areas of cut would be required for this connection, all fill material would need to be obtained from other areas or sources, requiring fill to be transported to the construction area. Alternative 1 would be approximately 2.8 miles long, crossing all cropland. Only one residence would be within 1,000 feet. One stream, one drainage ditch, and one road would be crossed, the road at-grade. The entire route is within the Missouri River floodplain. No woodland would be cleared. Most of the land for this route would be within AECI's plant property.

Good field access is available from local roads, also minimizing the fragmentation and isolation of small plots of acreage that could result from rail line construction. Aside from the amount of fill material required for the option of connecting to the NS line, the potential construction and environmental issues associated with Alternative 1 are minor. However, the regulatory issues associated with crossing the BNSF could be substantial. For this crossing, a railroad would need to make the crossing petition to the Surface Transportation Board for authority to construct and operate the crossing. The Board may require an evaluation of the potential environmental impacts associated with the crossing, including construction of the rest of the rail line. However, if these impacts are included in the project EIS, the Board could adopt the EIS and not do its own environmental review.

Should AECI decide to pursue an at-grade crossing of the BNSF, the same process would apply. Impacts for construction of a connection to the BNSF would be similar to those of the NS connection, without the requirement for fill to cross over the BNSF line. Environmental impacts would not be substantially different if two rail lines are constructed than for the single BNSF connection, except for the fill requirements for the NS line. A second grade crossing of Missouri Route DD would also be required but the two tracks could likely be aligned to cross the road at the same location.

Alternative 2 Route Corridor

Generally, this corridor takes advantage of the Wakenda Creek Valley where the topography is relatively flat minimizing grade changes and cut and fill requirements. The refined corridor was placed in the most likely location in the creek valley (Figure 2-51). In crossing over the ridge from the Wakenda Creek Valley to the proposed plant site, the route was placed along drainageways along both sides, at a location where the dividing ridge is fairly narrow, to reduce earthwork cutting requirements. The route was widened at this location: the most advantageous cut through the ridge comes in close proximity to a residence. The widening was included to allow more flexibility in this area. If the rail line would begin to rise from the floodplain east of the plant site, it is likely that the grade of Missouri Route JJ would need to be raised due to the rail line crossing this road above the existing grade but not at sufficient elevation to facilitate the clearances necessary for a grade separated crossing, with the rail line passing over the road. Missouri Route JJ would need to be raised to provide a level crossing area at the road, as opposed to a hump in the road at the crossing location. Changes to Missouri Routes would be coordinated with the Missouri Department of Transportation (MoDOT).

At the top of the ridge, the rail line would be 15 feet or more below the grade of the road, potentially requiring the road to be raised (depending on the final depth of cut) and a bridge constructed over the rail line.

Once in the Wakenda Creek Valley, Alternative 2 would best be located along the west side of the valley. This location provides a section of land several hundred feet wide that is relatively flat within which the line could be located. Such flexibility is not available if the east side of the valley is followed as Wakenda Creek is located at the bottom of the valley slope in many areas. Following the east side of the creek would require the rail line to be located up-slope from the creek (increasing cut and fill), have several crossings of Wakenda Creek, or require realignment of the creek to provide space for the rail line.

During final design, the exact location of the rail line along the west side of Wakenda Creek Valley would be determined. This location would focus on development of an alignment that would result in equal amounts of cut and fill material. It is anticipated that the alignment would be cut into the side slope on the west side of the creek valley in order to generate fill material.

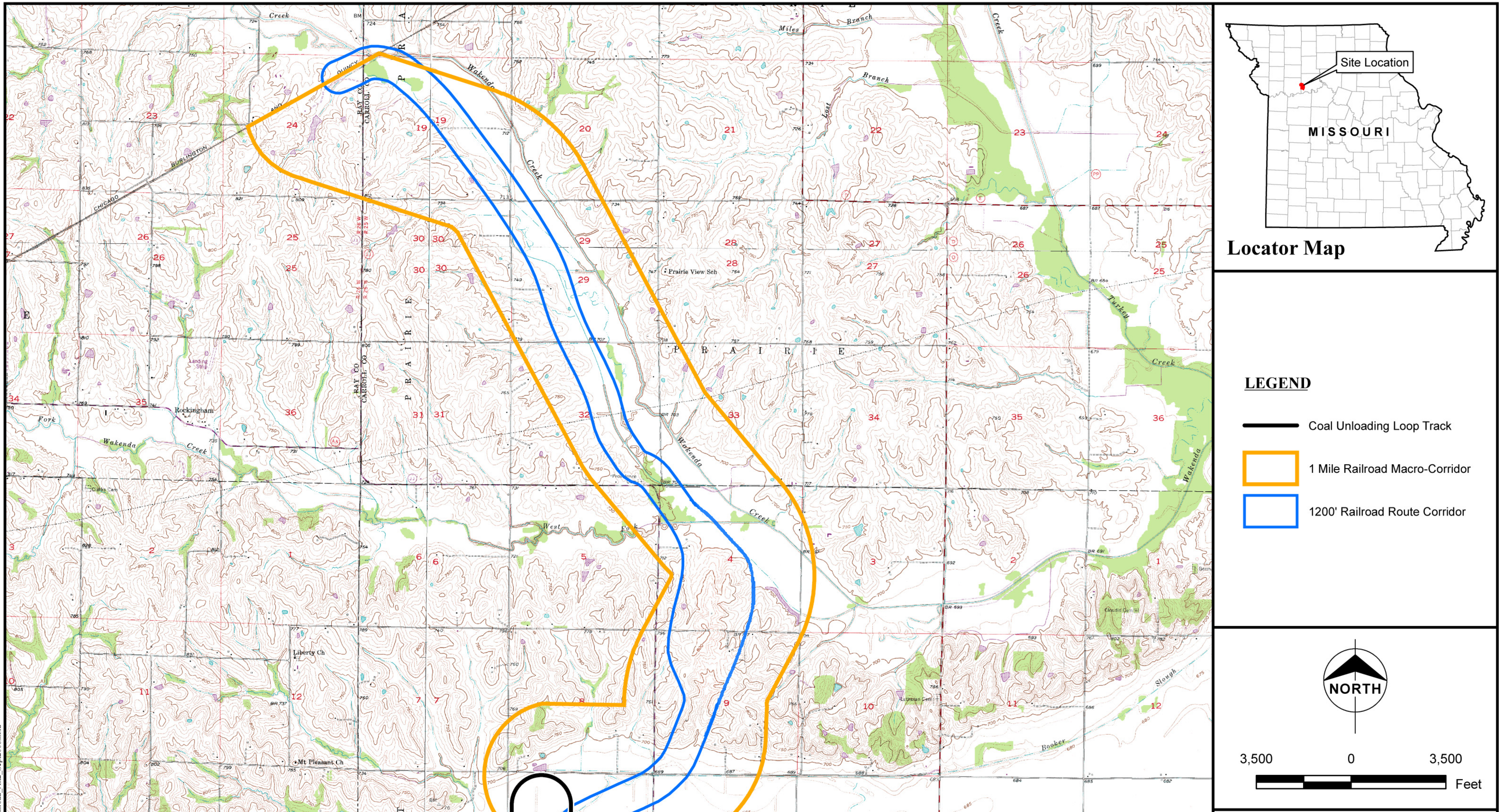

Figure 2-51

Alternative 2 Route Corridor

Norborne Site

Source: USGS 1:24,000 Topographic Quadrangles: Norborne, Hardin, Roads, Stet.

Source: AECI, 2006i

Substantial fill material would be generated crossing the ridge between the Wakenda Creek Valley and the proposed plant site, as discussed above. However, fill material would be needed to construct an elevated rail bed for drainage as well as to connect with the BNSF main line as discussed below.

Alternative 2 would generally follow the bottom of the west slope of Wakenda Creek northward to the BNSF line. The BNSF line currently bridges over Missouri Route JJ just south of Wakenda Creek. In order to take advantage of the existing bridge and eliminate the need to construct a second bridge with a switch to connect to the mainline, Alternative 2 would connect to the BNSF line east of Missouri Route JJ, curving southward from the BNSF line into the Wakenda Creek Valley. The BNSF line is currently approximately 26 feet above the elevation of the Wakenda Creek Valley. This difference in elevation would necessitate Alternative 2 rising from the creek valley to the same elevation as the existing line. Approximately 3,500 feet of fill, a maximum of approximately 25 feet in height, would be required for this connection.

Alternative 2 would be approximately 34,500 feet in length (6.5 miles). It would cross undeveloped land, consisting of cropland (30,500 feet) and pasture (4,000 feet). Of concern to landowners would be fragmentation of fields by the rail line, making them more difficult to farm, decreasing field size and isolating lands from access. In pasture, fencing would be necessary to keep livestock off the line. Similar issues would arise where the line crosses pasture as for cropland, however, these would not likely be as significant as for cropland.

Three homes or farmsteads and several out-buildings would be within 1,000 feet of Alternative 2. Alternative 2 would cross Missouri Route JJ and up to six county roads at grade. AECI is evaluating the potential of elevating Missouri Route JJ over the railroad crossing rather than remaining at grade. It would have 3-5 stream/drainage crossings, depending on the final alignment. These stream crossings would generally be small and could easily be accommodated with concrete box or steel pipe culverts.

Although approximately 1,600 feet of woodland would be cleared, many wooded areas would remain undisturbed, providing some screening of the rail line from the viewsheds of area residences. As aligned, Alternative 2 would pass under an existing 169-kV transmission line. However, the location of the intersection of the electric line and the rail line is near a tower structure, maximizing the clearance over the rail line. It is not expected that modification to the transmission line would be required to maintain required clearance between the rail line and the electric line. Wetlands along the rail line occur as streams/drainages and farm ponds. Only narrow bands of wetlands at stream crossing locations would be affected.

Alternative 3 Route Corridor

Alternative 3 follows the West Fork (WF) of Wakenda Creek. The refined corridor was placed in the stream valley to take advantage of the relatively flat topography (Figure 2-52). The refined corridor also takes advantage of the relatively flat topography along an un-named intermittent tributary that extends north from the plant site and climbs out of the Missouri River floodplain. It would cut through the top of the ridge at a relatively narrow location, approximately 300 feet wide and therefore minimizing the length of cut, and then drop into the Wakenda Creek Valley using a drainage swale flowing north into the creek valley.

Routing along the intermittent tributary and the drainage swale would help minimize the overall depth and length of cut required to maintain suitable grade for the rail line as it extends north from the plant site. As with Alternative 2, Alternative 3 would likely be located along the side slope of the valley, requiring areas of cut and fill, using the excavated material to generate fill material to elevate the rail bed, getting over the ridge into the valley and generating fill material for the connection to the BNSF. Unlike the Wakenda Creek which runs along the east side of a several hundred foot wide valley, the West Fork meanders back and forth along a narrower valley. Cuts into the valley side slopes would be necessary to keep the rail line away from the creek and minimize stream crossings. Even as such, it appears that two crossings of WF Wakenda Creek would be necessary, as would crossings of numerous tributaries connecting to it.

Final design of Alternative 3, if selected would determine the exact location of the rail line, focusing on development of an alignment that would balance cut and fill quantities and minimize stream crossings to help minimize cost and environmental impacts.

As shown in Figure 2-52, Alternative 3 has two options for connection to the BNSF. The first connection alignment would turn north, extending from the creek valley along an unnamed intermittent tributary. Following this tributary would allow the rail line to gain elevation, minimizing the fill material needed

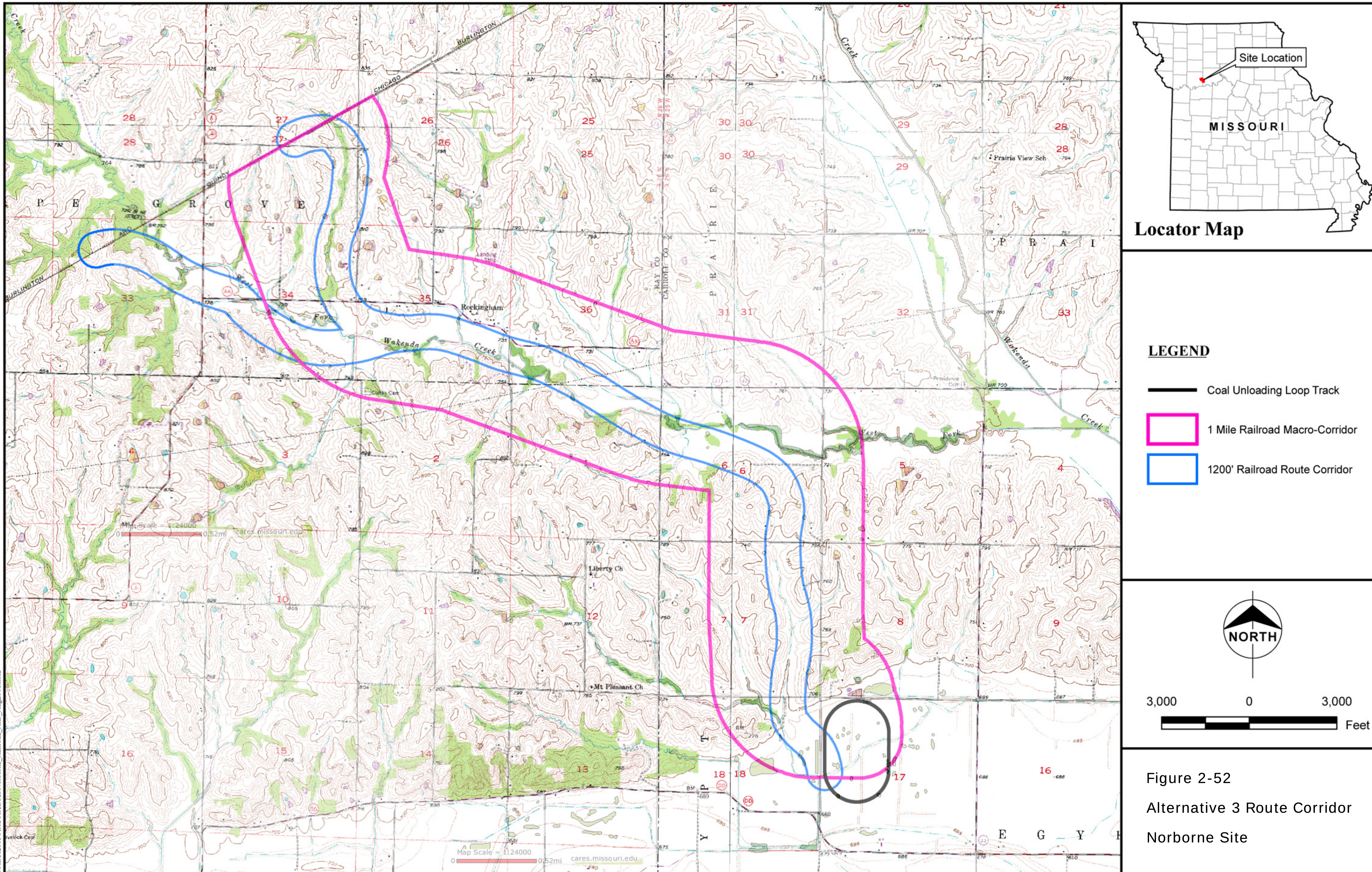

Figure 2-52

Alternative 3 Route Corridor

Norborne Site

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Source: USGS 1:24,000 Topographic Quadrangles: Norborne, Hardin, Roads, Stet.

Source: AECI, 2006i

to reach the elevation of the BNSF rail line for the connection. However, this alignment would create a difficult uphill turn. Over approximately 10,500 feet this connection would use the natural slope of the drainage to gain approximately 100 feet in elevation. Cut and fill would still be required to construct a suitable rail bed along the side slope of this drainage and at least one stream crossing would be necessary.

To establish a suitable grade, the rail line would likely need to begin to rise in elevation approximately 2,000 feet before turning up the drainage, requiring additional fill in the creek valley and cutting into the north side of the creek valley. Maximum fill for this area would be approximately 40 feet. This connection would be within the macro corridor previously identified for rail line construction.

A second option for the BNSF connection by Alternative 3 would be to continue west along the WF Wakenda Creek to connect to the BNSF line southwest of the BNSF crossing of the creek itself. For this connection, Alternative 3 would use the side slope of the creek to gain approximately 80 feet in elevation from the creek valley to the elevation of the BNSF line. Side sloping could occur over approximately 7,000 feet, minimizing the need to gain elevation from fill within the creek valley. This alignment would be relatively straight, lacking the uphill turn required for the other Alternative 3 connection.

While the length of fill would be less than the other Alternative 3 connection, the maximum depth of fill would be similar, approximately 40 feet.

Alternative 3 would be approximately 33,000 feet in length (6.25 miles) for either connection. It would be located in similar land use as Alternative 2, crossing undeveloped land, including approximately 20,000 feet of cropland with pasture making up the remainder (approximately 13,000 feet). These lengths vary slightly depending on the connection alignment but generally show that Alternative 3 would cross more and have a higher percentage of pasture along the alignment than Alternative 2. However, similar to Alternative 2 there would be likely concerns of landowners for fragmentation of fields by the rail line, making them more difficult to farm, decreased field size and isolating lands from access. In pasture, fencing would be necessary to keep livestock off the line. Similar issues as for cropland would arise where the line crosses pasture, however, these would not likely be as significant as for cropland.

Approximately 16-17 homes or farmsteads would be within 1,000 feet of Alternative 3. Both Alternative 3 alignments would cross Missouri Route AA and four county roads; the west option would also cross Missouri Route A. At this time it is assumed all road crossings would be at grade. However, the crossings of Routes A and AA may either require a grade separation (rail over road) or elevating the road where it crosses the rail line as the rail line would be gaining elevation at the locations of these road crossings and would likely be higher in elevation at the road crossing than the road itself.

Alternative 3 would have five to seven stream/drainage crossings, depending on the final alignment established for the connection options. These would generally be small and could easily be accommodated with concrete box or steel pipe culverts.

Approximately 800 feet of woodland would be cleared, most of which is located along the West Fork of Wakenda Creek or the tributaries connecting with it.

Wetlands along the rail line occur as streams/drainages and farm ponds. Only narrow bands of wetlands at stream crossing locations would be affected. One or two crossing of the WF Wakenda Creek would be required. The WF Wakenda Creek is classified as Waters of the U.S. by the USACE and these crossings would likely be subject to more extensive permitting, and potentially mitigation.

Alternative 3 would also cross an existing electrical transmission line, the same line discussed for Alternative 2. While this line and necessary clearance requirements would need to be considered during design, it is not anticipated that any modification to the transmission line would be required to maintain adequate clearance between the rail line and the electric line.

Recommended Route Corridor

AECI's tabulation of potential impacts and issues for each alternative is presented in Table 2-16. Note that Alternative 1 includes both the BNSF and the NS connections. If only the BNSF connection is considered, the fill would not be needed.

Table 2-16. Summary of Characteristics of Rail Alternatives

	Alternative 1	Alternative 2	Alternative 3 (eastern)	Alternative 3 (western)
Total Length (miles)	2.8	6.5	6.25	6.25
Length of Cut (feet)	0	8,000	7,000	7,000
Length of Fill (feet)	10,000	3,500	10,500	7,000
Max. depth of cut (feet)	0	35	20	20
Max. depth of fill (feet)	30	25	40	40
Home within 1,000 feet	1	3	16	17
No. of stream/drainage crossings	2	3-5	5-7	5-7
No. of at-grade road crossings	1	7*	6	6*
Length of woodland	0	1,600	800	800
No. transmission line crossings	0	1	1	1
No. of rail line crossings	1	0	0	0
* one of these roads may require a grade separation due to rail line elevation above that of the road.				

Source: AECI, 2006i

Table 2-17 is AECI's rating of alternatives, with 1 being the least impacting, 5 being the greatest impact. The unweighted ratings show Alternative 1 as having the least impact and Alternative 3 the most. The only substantial issue or concern with Alternative 1 is related to crossing the existing BNSF and NS lines, if the connection to the NS is included. Should AECI pursue the sub-alternative of the NS connection, extensive and potentially time consuming agency and railroad negotiations and regulatory approvals may be required before authority to construct the crossing could be obtained, reducing the attractiveness of this route.

Table 2-17. Comparison of Rail Alternative Characteristics

	Alternative 1	Alternative 2	Alternative 3 (eastern)	Alternative 3 (western)
Total Length (miles)	1	5	4	4
Length of Cut (feet)	1	5	4	4
Length of Fill (feet)	5	1	5	3
Max. depth of cut (feet)	1	5	3	3
Max. depth of fill (feet)	3	1	5	5
Home within 1,000 feet	1	1	5	5
No. of stream/drainage crossings	1	3	5	5
No. of at-grade road crossings	1	5	4	4
Length of woodland	1	5	3	3
No. transmission line crossings	1	5	5	5
No. of rail line crossings	5	1	1	1
TOTAL	21	36	44	42

Source: AECI, 2006i

After Alternative 1, AECI identified Alternative 2 for consideration as the proposed alignment for the proposed rail line connection. Although slightly longer than Alternative 3 and requiring more length and greater depth of cut to extend north from the plant site, Alternative 2 would provide much better track geometry, having more-open curves, particularly where the alignment is going uphill.

Alternative 2 would require substantially less fill to connect to the BNSF line, with both options for the connection of Alternative 3 being difficult as a result of the substantial differences in grade elevation over relatively short distance. Location of Alternative 2 in the wider Wakenda Creek Valley provides greater flexibility than the narrower valley of the WF Wakenda Creek for adjusting the alignment to minimize project related impacts while maximizing the alignment efficiency (grade, curvature).

Outside of Alternative 1, each of the alternatives analyzed had the greatest relative impacts in at least two of the categories considered in this evaluation. However, the analysis of the alternatives did not indicate any fatal flaws that would prevent any of the alternatives from being implemented.

Comparing Alternatives 2 and 3, Alternative 2 would have fewer homes within 1,000 feet, and fewer stream crossings, with the streams crossed also being smaller than those of Alternative 3. Alternative 3 would require less woodland be cleared, however Alternative 2 would have few wetland impacts (based on the NWI maps). Alternative 2 would have the same number of at-grade road crossings as Alternative 3 or possibly one more. Alternative 2 has fewer stream crossings than Alternative 3 and does not require a crossing of Wakenda Creek, while Alternative 3 requires crossing the WF Wakenda Creek twice (both are Waters of the United States).

During final design, some of the impacts of Alternative 2 may be reduced further by fine tuning the alignment. These adjustments are possible due to the greater flexibility provided by the wider Wakenda Creek floodplain compared with the WF Wakenda Creek. Such fine tuning would not be possible with Alternative 3. This flexibility, combined with Alternative 2 generally having less overall environmental impacts and better track geometry make it a more suitable alignment for the connecting track.

Therefore, Alternative 3 was eliminated from further consideration, and the refined alignments for Alternatives 1 and 2 were carried forward in the analysis.

2.2.11.3 Summary of Rail Alternatives for Proposed Action

Two potential rail lines for coal delivery to the Norborne Site would be the Norfolk Southern (NS) line about one mile south of the proposed plant site, and the Burlington Northern Santa Fe (BNSF) line about 6-7 miles north of the site. A high-speed BNSF line that runs parallel to the NS line was identified as having potential for equipment deliveries, but would not be suitable for slower moving coal trains. AECI identified one-mile wide corridors for rail connections from these lines to the plant. Based on engineering and environmental considerations, these corridors were reduced to quarter-mile widths and then ranked based on environmental and engineering criteria. The connecting line to the south, which was included primarily for the high-speed BNSF connection, had the most favorable score. Connecting to the NS for coal deliveries may not be an option: Union Pacific, who would supply this line, is not taking new delivery contracts; and the NS connection would require a large embankment in the floodplain and a bridge over the BNSF line, which may not be practicable. For coal deliveries from the BNSF line to the north, the eastern option, which generally follows Wakenda Creek, had the most favorable score and was identified by AECI as part of the Proposed Action. The actual alignment for the railroad would be about 150 feet wide and would be identified based on coordination with the railroads.

2.2.12 Transmission Routing Alternatives

This section describes the process of route corridor selection for the transmission lines needed to carry electrical energy from the proposed plant to AECI's system.

As part of the Alternatives Study (AECI, 2005a), AECI identified study areas for each of the major required transmission route segments. Within these study areas constraints were identified and macro corridors about 2 miles wide were selected.

In a later study that focused only on the transmission corridors, AECI narrowed the macro corridors and identified route corridors for both the Norborne and Big Lake Sites (AECI, 2005d). The route corridors were generally a quarter-mile wide and more or less centered on the macro corridors, except where there were constraints, where going off-center resulted in a more direct feasible option, and where the corridors needed to be expanded beyond the quarter-mile width to allow for flexibility to minimize impacts.

The final right-of-way (ROW) for the transmission lines would be 150 feet wide. In wooded areas trees within the ROW would be cleared using chain saws; the tree root systems would not be removed or disturbed. The cut trees would be piled at the edge of the ROW, cut into firewood, or burned in accordance with the option selected by the landowner. Certain large trees (danger trees) located outside the ROW would be cut if it was determined that these trees could damage the line if they fell (AECI, 2006u).

2.2.12.1 Public Input

This later study also addressed public comments from scoping meetings held in August 2005. Results of public scoping were presented in another report (AECI, 2005e). Most of the public comments related to transmission lines expressed concern about electric and magnetic fields (EMF); other expressed concerns about impacts to center-pivot irrigation systems and to migratory birds, specifically near the Squaw Creek NWR (Big Lake Site).

Impacts of EMFs are discussed in *Section 3.15.2.4.1, Impact Assessment*. To address this concern, the route corridors were located away from residences to the extent practicable.

Impacts to center-pivot irrigation systems, in areas where they are located, were avoided to the extent practicable in locating the route corridors, as discussed below.

Impacts to birds using the Mississippi flyway cannot be avoided. The Mississippi flyway extends across the entire state of Missouri, so any line built in the state has the potential to affect migrating birds to some degree. Impacts to birds are discussed in *Section 3.11.1.2.1, Migratory Birds*.

2.2.12.2 Evaluation Criteria

Criteria and the relative weights of each that AECI used in comparing alternative transmission line corridors are summarized in Table 2-18 (AECI, 2005e). This table assigns relative weights to those impacts that could not be avoided.

Table 2-18. Factor Weights

Factor	Unit of Measurement	Weight
Total length	Miles	5
Residences within 200 feet of centerline	Each	5
Cropland Crossed	Acre	3
Woodland Crossed	Acre	3
Wetlands Crossed	Acre	3
Businesses within 200 feet of centerline	Each	2
Public facilities within 200 feet of centerline	Each	2
Length parallel to Existing Transmission Lines	Miles	1
Perennial Waterways Crossed	Each	1

Source: AECI, 2005e

The length of each route corridor and proximity of residences were the factors assigned the most weight. Length is a surrogate for cost, and is also an indicator of general impact. The issue of most concern from the public, based on the public scoping, was living in proximity to a transmission line.

Crossings of cropland, woodland, and wetlands were all assigned equal weight. The transmission line eliminates cropland only at the locations of the supports, but these can interfere with crop farming (center pivot irrigation systems are addressed by location, in the discussions below). Woodland requires clearing along the alignment, for a width of about 200 feet. Wetlands can usually be spanned.

Businesses and public facilities within 200 feet of the centerline were assigned less weight than residences. Visual impacts and concerns about EMFs are generally more important to people at their homes.

Length parallel to existing lines is considered a marginally positive factor: placing the line in an area that is already impacted generally results in reduced overall impacts. But placing two lines together also may reduce the redundancy in the overall transmission system (a storm or failure could potentially put both lines out). Crossing of perennial waterways was assigned a relatively low weight because most can be spanned without impact.

The route corridors were ranked by each of the weight factors, then scored by summing the products of each rank and weighting factor. The lower the score, the less the impact for the criteria evaluated. For example, if four route corridors were being evaluated, the shortest would have a rank of 1 and the longest a rank of 4 for the category of length, which has a weight of five. The sub-score in the length category for the shortest route would be 5 (*1 x 5*) and for the longest route, 20 (*4 x 5*). The route with the fewest wetland crossings would have a rank of 1 (sub-score of 3) in the wetland category; and the route with the most wetland crossings would have a rank of 4 (sub-score of 12) in the wetland category.

The following items were quantified for each route corridor, but not included in the weighted scores: existing transmission line crossings, heavy angles (reinforcements need to hold the supports in place at locations of sharp angles), residences within the route corridor, businesses within the route corridor, public facilities within the route corridor, prime farmland crossed, and grassland/open land crossed.

2.2.12.3 Big Lake Site

To provide adequate outlet capacity for the Big Lake Plant, a new double-circuit 345-kV transmission line would be needed from the site to the existing Fairport Substation in DeKalb County, a distance of approximately 57 miles. A single-circuit 345-kV transmission line would be needed south from the Fairport Substation to a new 345/161-kV substation located near the town of Orrick in Ray County (approximately 53 miles distance). From Orrick, two new 161-kV transmission lines would need to extend to the existing Missouri City Substation in Clay County and to the existing Eckles Road Substation in Jackson County (AECI, 2005a). Figure 2-53 shows the location of these substations in relation to the Big Lake Site. These areas are discussed separately, below.

Big Lake to Fairport Transmission Line

Study Area

The study area AECI identified for locating the Big Lake to Fairport transmission line is shown in Figure 2-54. Primary features within this study area include Squaw Creek NWR and Big Lake State Park, located just to the east of the Big Lake Site; and several relatively large state CAs, including Nodaway Valley, Brown, Riverbreaks, Honey Creek, Monkey Mountain, Happy Holler (which is in two discontinuous locations, one northeast of Savannah, and another northeast of that), and King Lake.

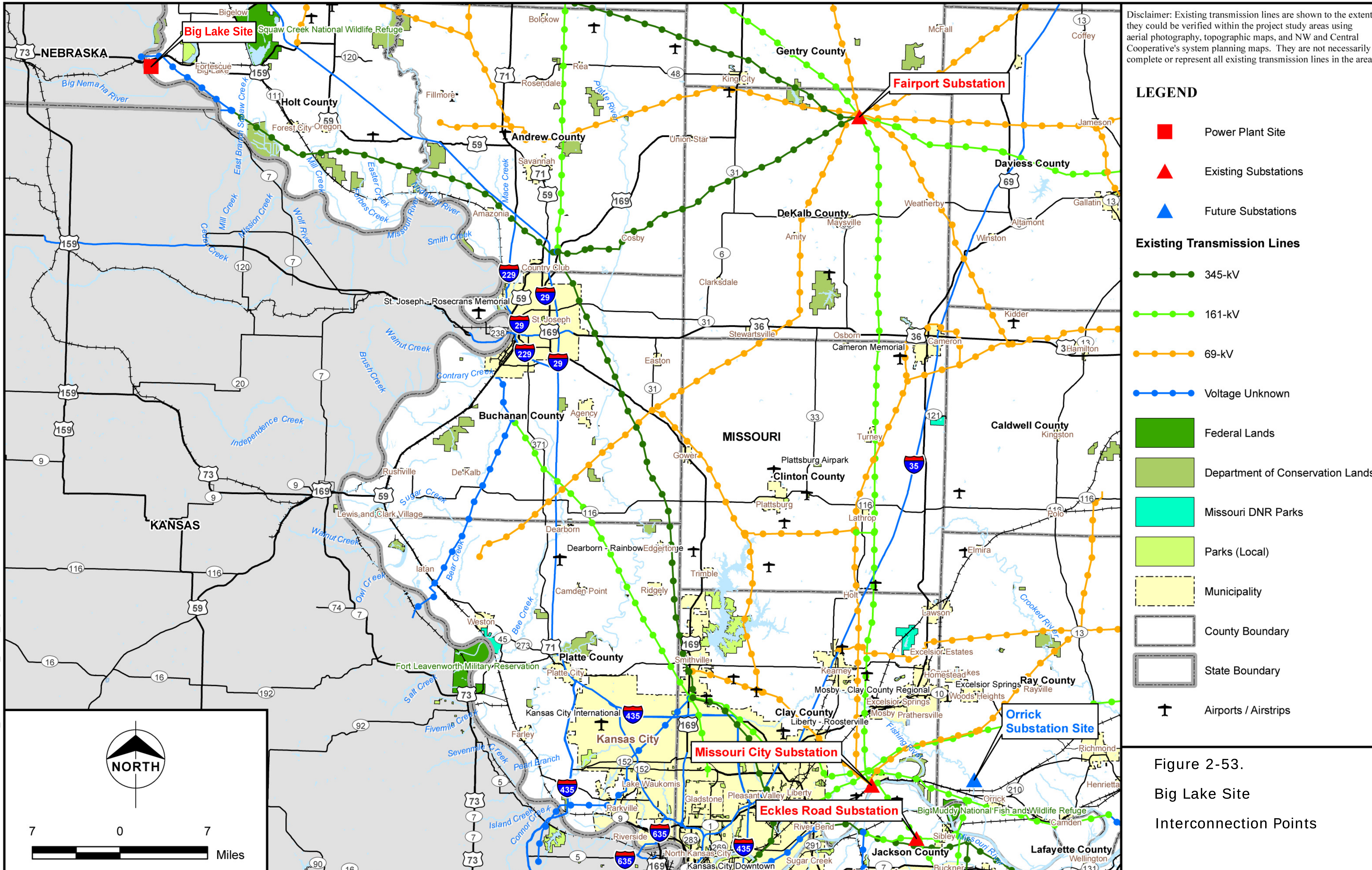

Figure 2-53.
Big Lake Site
Interconnection Points

Source: AECI, 2005a

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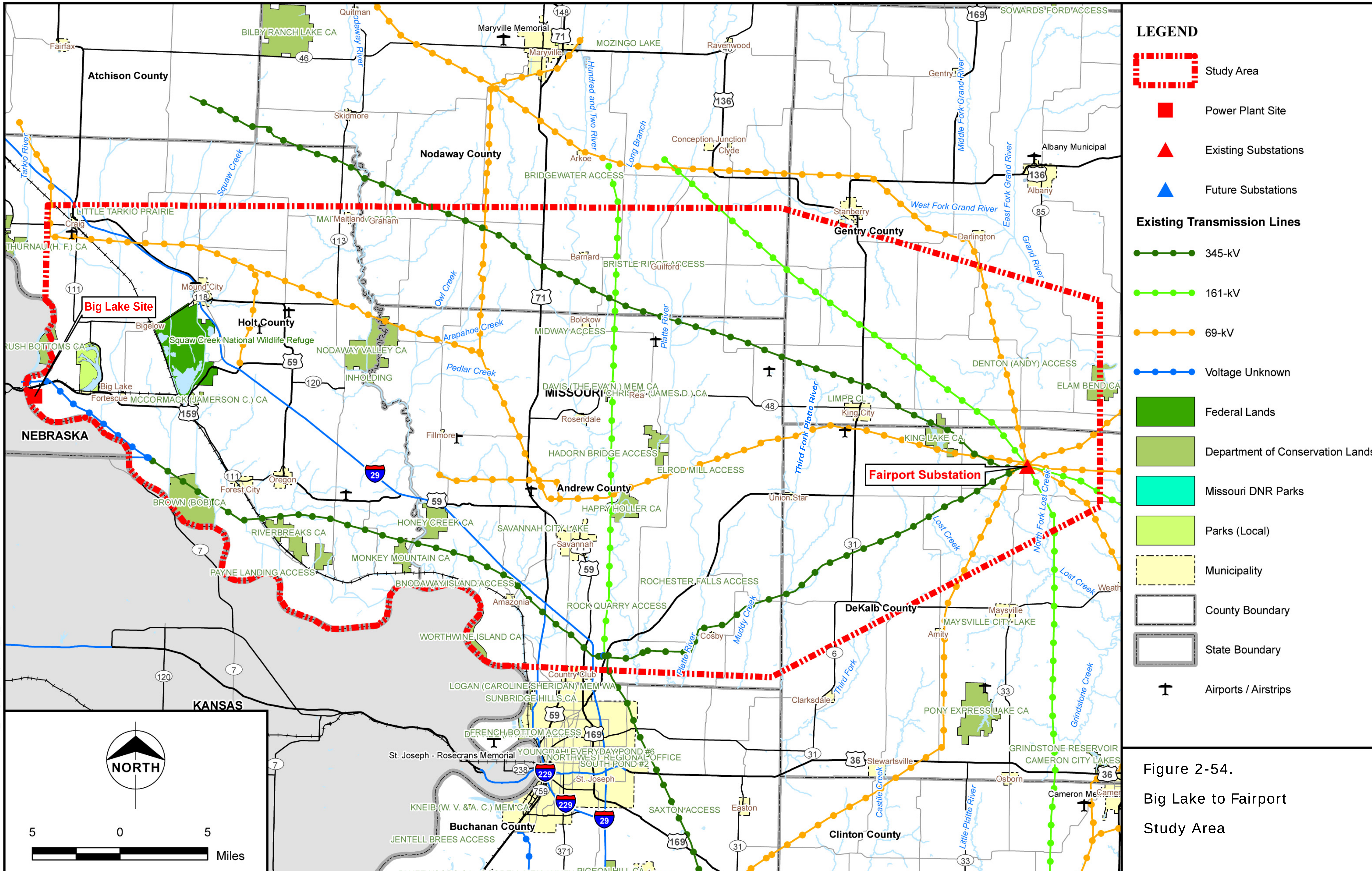

Figure 2-54.
Big Lake to Fairport Study Area

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Disclaimer: Existing transmission lines are shown to the extent they could be verified within the project study areas using aerial photography, topographic maps, and NW and Central Cooperative's system planning maps. They are not necessarily complete or represent all existing transmission lines in the area.

Source: AECI, 2005a

There are several smaller state CAs: McCormack, located just south of Squaw Creek NWR; Davis Memorial, Worthwine and Christie in Andrew County; and part of Elam Bend in Gentry County. There is one designated Missouri Natural Area (NA) within the study area: McCormack Loess Mound NA.

The Platte River, One Hundred and Two River, and Nodaway River are major streams that cross the study area. The Grand River crosses a part of the east end of the study area. There are a number of public access points along these rivers within the corridor that are managed by the MDC.

Towns within the study area include Mound City (population 1,193), Oregon (population 935), Forest City (population 338), Savannah (population 4,762), King City (population 1,012), and a number of smaller communities.

The area is primarily rural and the major land use is farming. Center-pivot irrigation systems are common in the Missouri River floodplain part of the study area, but not in the remainder of the study area.

As shown in Figure 2-54, there are a number of highways, small private airports, and transmission lines within the study area.

Almost all of the land in the Big Lake to Fairport study area is considered prime farmland, prime farmland if drained or not flooded, or farmland of statewide importance. Typically, impacts from transmission lines to prime farmland are minimal. All of the agricultural land crossed by the line, with the exception of where the poles are placed and where possible guy wires are anchored, can remain in agricultural production (AECI, 2005a).

Wetlands are located throughout the study area and are typically associated with rivers, streams and lakes. Two major wetland complexes are found in the western portion of the study area. The largest one is in Squaw Creek NWR. Nearly the entire area of Squaw Creek is a series of small islands of upland surrounded by a combination of emergent, scrub-shrub and forested wetlands. The north end of Big Lake, in Big Lake State Park is also a large complex of different wetland types. Both of these areas are a representation of the local pre-settlement landscape. Wetlands such as these provide high quality habitat for migratory birds and other wildlife and are considered a major constraint when routing a transmission line (AECI, 2005a). Big Lake Marsh, a 150-acre marsh in Big Lake State Park, is one of only three marshes in Missouri that have been designated as Outstanding State Resource Waters (Title 10 of the Code of State Regulations, Division 20, Chapter 7.031 (10 CSR 20-7.031). It is the largest of the three.

Macro Corridor Alternatives

The macro-corridors identified between Big Lake and Fairport ranged from about 58 to 68 miles in length (Figure 2-55). The macro corridors shown represent three reasonable alternatives, given the constraints of the public lands and the desire to avoid communities, allow for potential co-location with existing lines as practicable, and create a reasonably direct route.

As shown in Figure 2-55, two of the corridors pass to the south of Big Lake State Park, Squaw Creek NWR and Nodaway Valley CA, and one passes to the north. The two southern corridors lie to the north of the group of CAs along the Missouri River south of Big Lake.

Route Corridors

As shown in Figure 2-56, the route corridors are labeled by segment. Each segment is an independent piece that can be combined with other segments to form a continuous route. Figure 2-57 shows route expansions, on Segments C1, C2, C3 and C7.

Segments C1, C2, and C3 were expanded in the vicinity of the Big Lake Site, within the floodplain area where center-pivot irrigation systems are prevalent.

Most of the systems extend a quarter-mile in any given direction, effectively covering a half-mile in diameter. Therefore, a quarter-mile width would not allow much maneuvering of the route to avoid these systems where necessary. Segment C7 was also expanded to approximately one-half-mile wide at Missouri Route H, just north of the intersection of I-29 and U.S. Highway 59. The frequency and positions of the houses along Missouri Route H and in the vicinity, as well as the presence of a substation and an existing transmission line, necessitated the expansion of the corridor to allow for some future routing adjustments, if necessary (AECI, 2005e). Figure 2-57 shows the details of the expansion areas and the constraints, including locations of irrigation systems and houses.

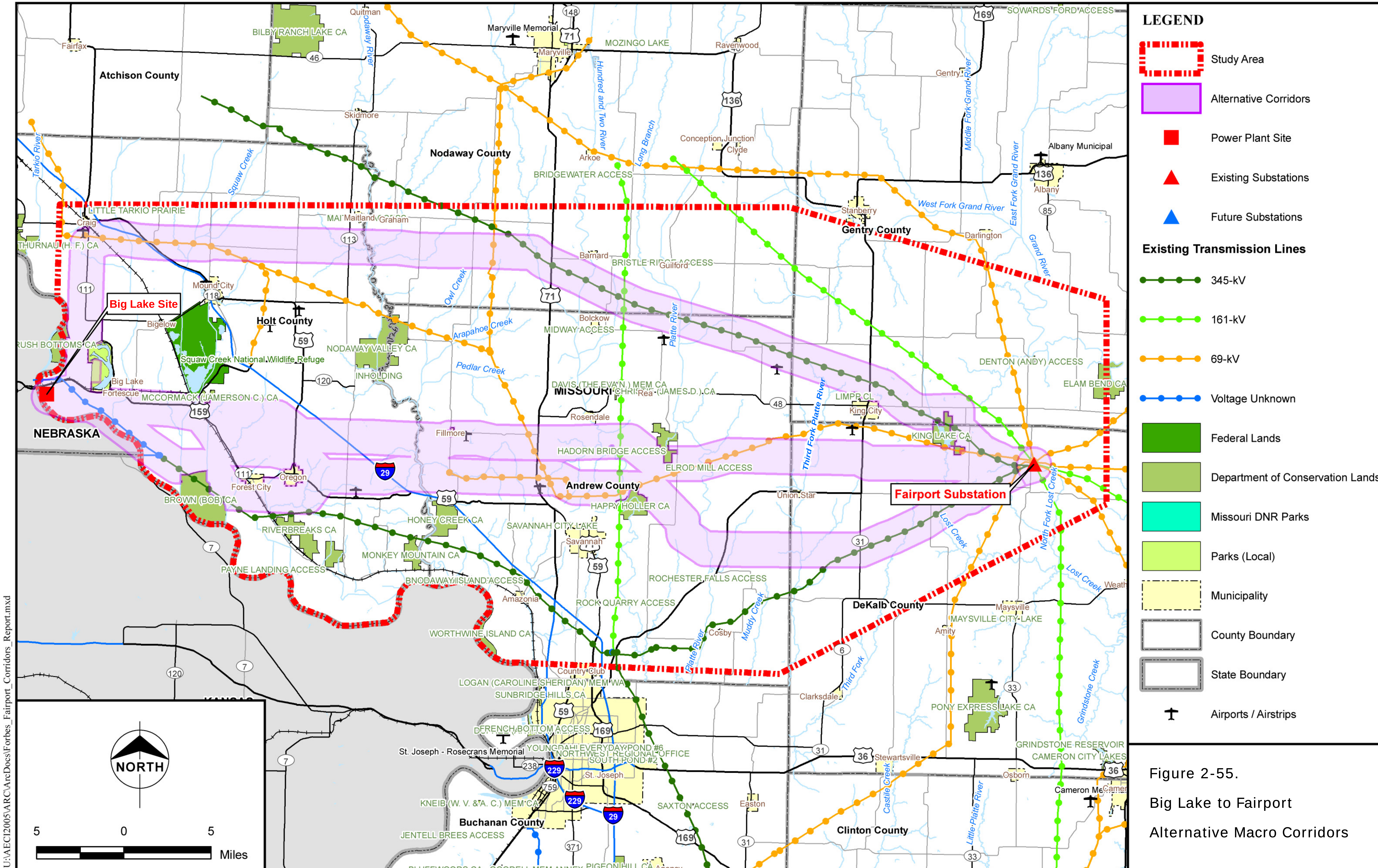

Figure 2-55.
Big Lake to Fairport
Alternative Macro Corridors

Disclaimer: Existing transmission lines are shown to the extent they could be verified within the project study areas using aerial photography, topographic maps, and NW and Central Cooperative's system planning maps. They are not necessarily complete or represent all existing transmission lines in the area.

Source: AECI, 2005a

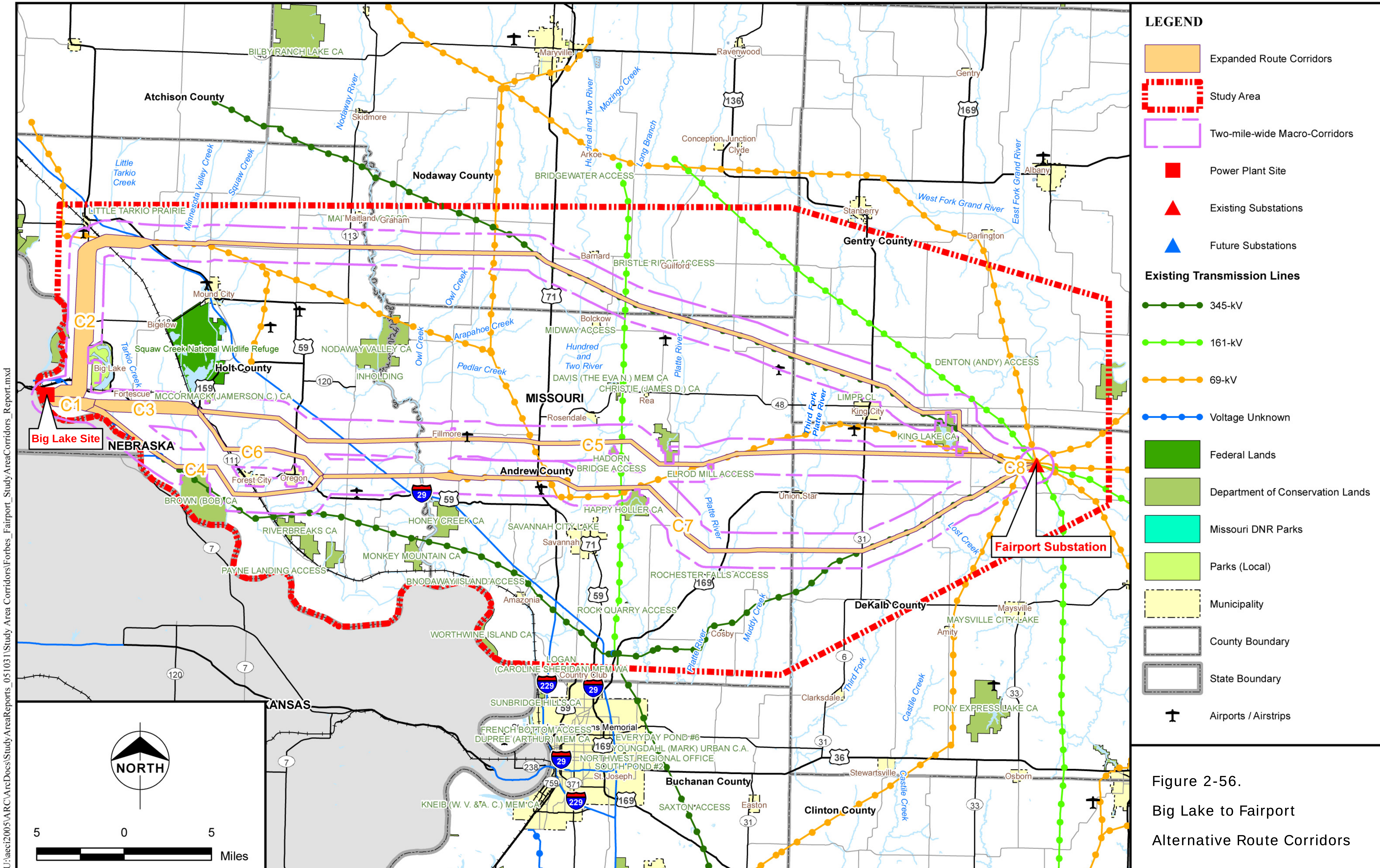

Figure 2-56.
Big Lake to Fairport
Alternative Route Corridors

Disclaimer: Existing transmission lines are shown to the extent they could be verified within the project study areas using aerial photography, topographic maps, and NW and Central Cooperative's system planning maps. They are not necessarily complete or represent all existing transmission lines in the area.

Source: AECI, 2005e

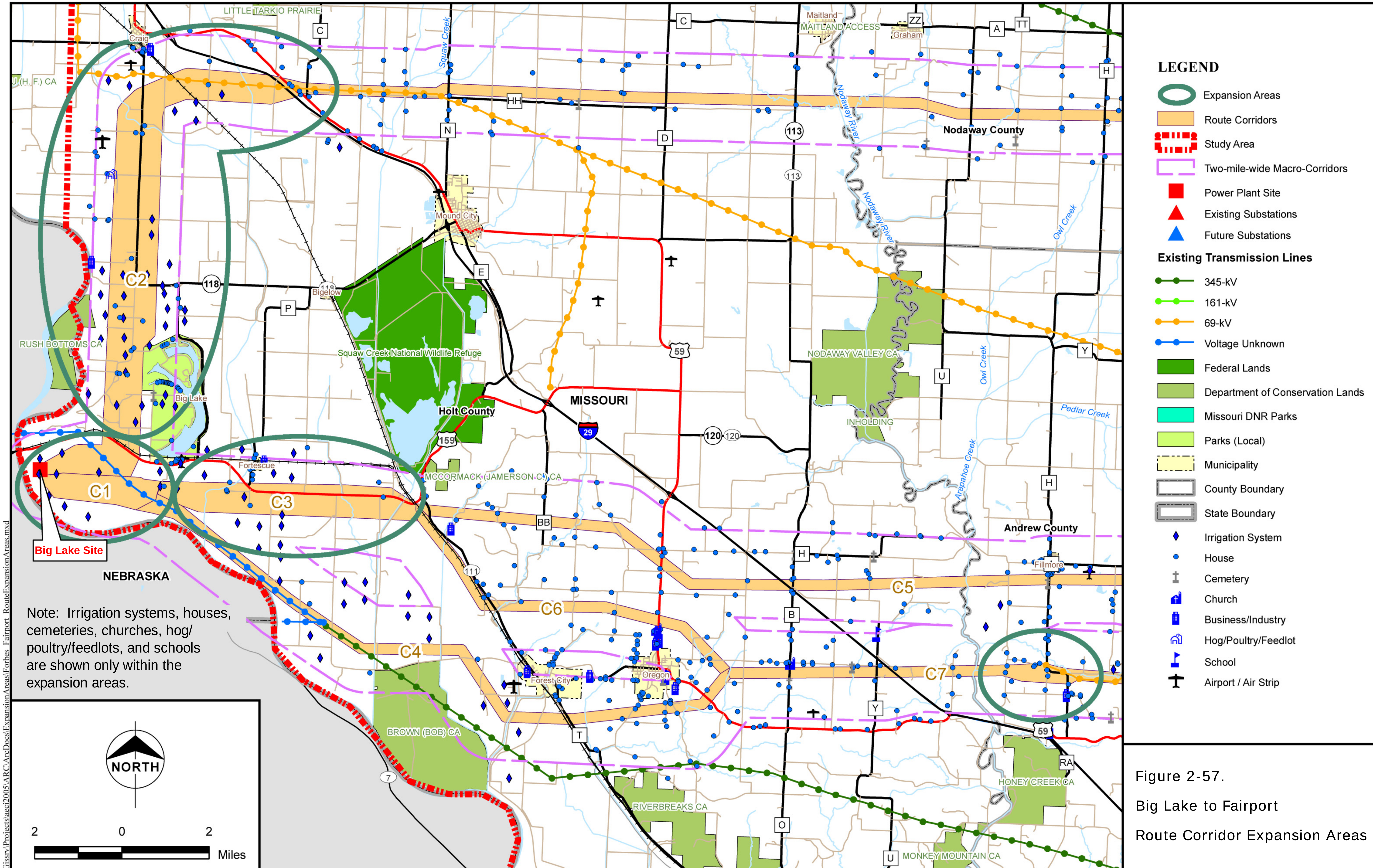

Figure 2-57.
Big Lake to Fairport
Route Corridor Expansion Areas

Disclaimer: Existing transmission lines are shown to the extent they could be verified within the project study areas using aerial photography, topographic maps, and NW and Central Cooperative's system planning maps. They are not necessarily complete or represent all existing transmission lines in the area.

Source: AECI, 2005e