

2. *North Saverton (River Mile 303–304)*: A second potential river crossing approximately 1 mile north of Saverton was considered. This crossing includes steep slopes and topography in a densely forested area on the Missouri side, but does not include any floodplain area outside of the edge of the river. The approximate span length across the river is 4,000 feet. On the Illinois side, the route crosses approximately 26,450 feet of floodplain. Landownership on the Missouri side of the river is private and the route crosses the Camp Oko-Tipi, a non-profit youth camp. USACE Rock Island District administers land on the Illinois side of the river and the route crosses an unnamed island. This Potential Route is approximately 2 miles north of the Saverton lock and dam. The USFWS noted the pool, which forms at the head of the lock and dam, is used by wintering and migratory waterfowl.

USACE Rock Island District stated that the land administered by USACE is leased to USFWS and the state of Illinois. In this area, the land use designation is Wildlife Management/Reserve Forest, and USACE maintains the timber rights. Like the northernmost crossing, USFWS also stated this Potential Route may have a higher potential occurrence of both Indiana bat winter hibernacula and summer roosting habitats. In addition, several archaeological sites would require further investigation for this crossing alternative.

3. *South Saverton (River Mile 299–300)*: The third crossing is approximately 2.5 miles south of the town of Saverton. Like the previous crossing, this Potential Route goes from steep topography with dense forest cover to crossing 500 feet of floodplain and the Mississippi River. The Potential Route has an approximate span of 3,370 feet across the river and crosses approximately 36,750 feet of floodplain on the Illinois side. Land ownership on both sides of the river is private; however, the Anderson Conservation Area owned by MDC is located just south of the crossing on the Missouri side of the river. The route also crosses land on the Missouri side of the river owned by Knox County Stone Company, which has an active quarry located just north of the route. A structure would be required on Jim Young Island, which would reduce both the overall span length between structures and their required height.

USACE St. Louis District has jurisdiction over this river crossing (and all crossings further south), although the Rock Island District maintains jurisdiction over the land on the Illinois side of the river. USACE St. Louis District stated a preference for this crossing location.

Similar to the two crossings discussed previously, USFWS noted a higher potential occurrence of both winter hibernacula and summer roosting habitat. In addition, the Saverton lock and dam, a National Register Historic District (also known as Lock and

Dam No. 22) is located approximately 1.5 miles north of the crossing location and USFWS noted this as a concern for potential impacts to bald eagles. In particular, the USFWS noted concerns related to potential collision issues with the transmission line. Due to these potential impacts to bald eagles in the area south of Saverton Lock and Dam, the USFWS requested a crossing north of the lock and dam be selected.

The crossing location in this area has some flexibility and would require additional engineering prior to determining the exact location. Archaeological sites would require further investigation for this crossing alternative.

4. *Louisiana (River Mile 284–285)*: This river crossing, located approximately 1.25 miles north of the town of Louisiana, Missouri, is the only crossing that paralleled an existing linear feature across the river (a gas pipeline). The Potential Route crosses very little floodplain on the Missouri side and transitions from steep slopes down to the river. The Potential Route crosses the southern edge of Blackburn Island, parallel to the existing gas pipeline. Once on the Illinois side of the river, the Potential Route crosses 28,000 feet of floodplain. The total span across the river at this location is 3,200 feet. Structures would be placed on Blackburn Island, which would reduce the span length between structures crossing the river and decrease their required height.

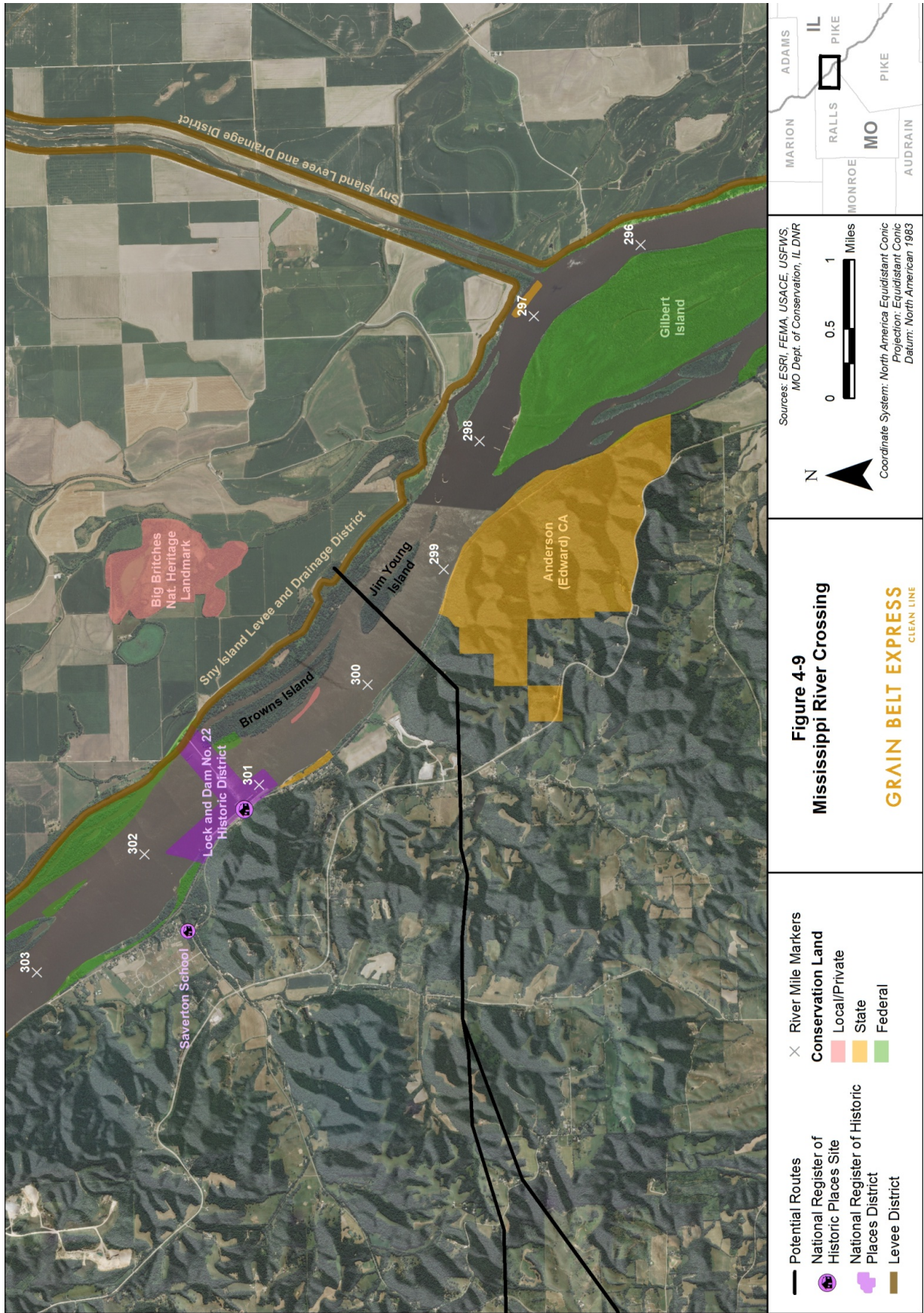
Both USFWS and MDC stated this particular location is known for the presence of bald eagles as well as numerous migratory birds, and USFWS expressed concern about potential avian impacts. In addition, USACE St. Louis District and MDC discouraged the use of this crossing because of public land associated with the Ted Shanks Conservation Area on Blackburn Island. The conservation area is undergoing a large-scale environmental restoration project for forests and wetlands and further impacts on the island are discouraged. In addition, it was noted that bald eagles, herons, and egrets are known to nest on the island. Although this Potential Route parallels an existing pipeline, USACE noted that impacts from the transmission line may be greater because permanent vegetation clearing would be required to maintain appropriate electrical clearances.

The town of Louisiana is the most densely populated area of the five crossings and contains a historic downtown that is included in the National Register. In addition to the above considerations, the Missouri Department of Transportation is evaluating whether to rebuild the bridge at Louisiana in its current location or re-locate the bridge. Therefore, potential conflicts may arise if the bridge is relocated close to the Potential Route crossing.

5. *Clarksville (River Mile 276–277)*: The final river crossing that was presented at the Open Houses is approximately 3 miles north of Clarksville. The topography is steep and rapidly transitions to the river without crossing floodplain area on the Missouri side. The Potential Route crosses over Pharrs Island before reaching the Illinois side of the river and crossing 24,950 feet of floodplain. The crossing in this location would span approximately 7,950 feet of the river and would require a structure s on Pharrs Island to decrease the overall span length between structures and their height. Pharrs Island is surrounded by a bullnose that was constructed to increase habitat for waterfowl and fisheries. The island includes suitable habitat for bald eagle nesting and roosting, as well as Indiana bat habitat. It also provides recreational uses for waterfowl hunting with numerous blinds scattered on the island. In addition to Pharrs Island, a state wildlife management area just south of the crossing location is managed for waterfowl and other migratory birds. Additionally, numerous cultural sites have been identified along this stretch of the Mississippi River and the Missouri SHPO believes more sites may exist along the bluffs on the Missouri side.

Once all the information was reviewed, the preferred river crossing location was determined to be the South Saverton crossing between river miles 299 and 300 (**Figure 4-9**). This crossing location was preferred by USACE St. Louis District and had the fewest conflicts associated with current land use of any the crossings. Although the USFWS considered this crossing less desirable due to potential for bald eagle impacts, residential development in this location is low with a quarry bordering the north side of the route and the Anderson Conservation Area on the south side. From an engineering perspective, the South Saverton crossing offered some flexibility in the exact alignment across the river and would allow a structure to be placed on Jim Young Island to reduce span length and structure height. In addition, this crossing is located south of the lock and dam where the river is narrower, which also would help reduce structure height. Collision may be considered a potential risk for bald eagles as well as other avian species at waterbody crossings such as at the Mississippi River. Grain Belt Express will implement an Avian Protection Plan in accordance with the Avian Power Line Interaction Committee guidance to minimize any potential impacts to avian resources.

The selection of the preferred river crossing location allowed other Potential Route links to the river crossings to be removed from consideration. The result was a refined route network with Alternative Routes from a specific Missouri River crossing location (identified in the Kansas Siting Study) to a specific Mississippi River crossing location. Section 4.3.3 below discusses the Alternative Routes carried forward in this siting study.



4.3.3 Description of Alternative Routes

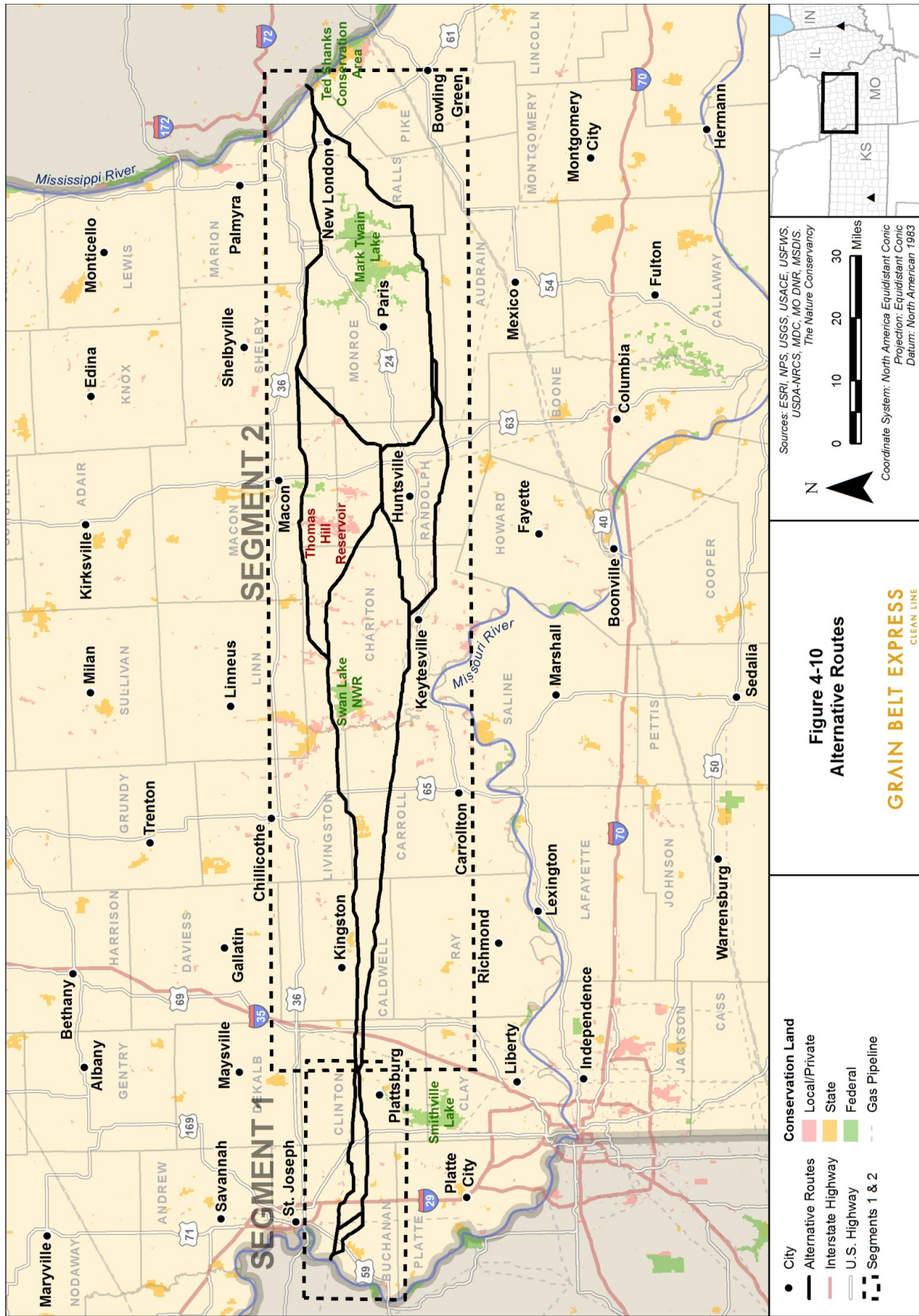
The Routing Team compiled the remaining links in the Refined Potential Route Network into Alternative Routes (**Figure 4-10**). To accommodate a reasonable comparison between Alternative Routes, the Routing Team divided the routes into two distinct segments, Segment 1 (Alternative Routes A–C) (**Figure 4-11**) and Segment 2 (Alternative Routes D–I) (**Figure 4-12**).

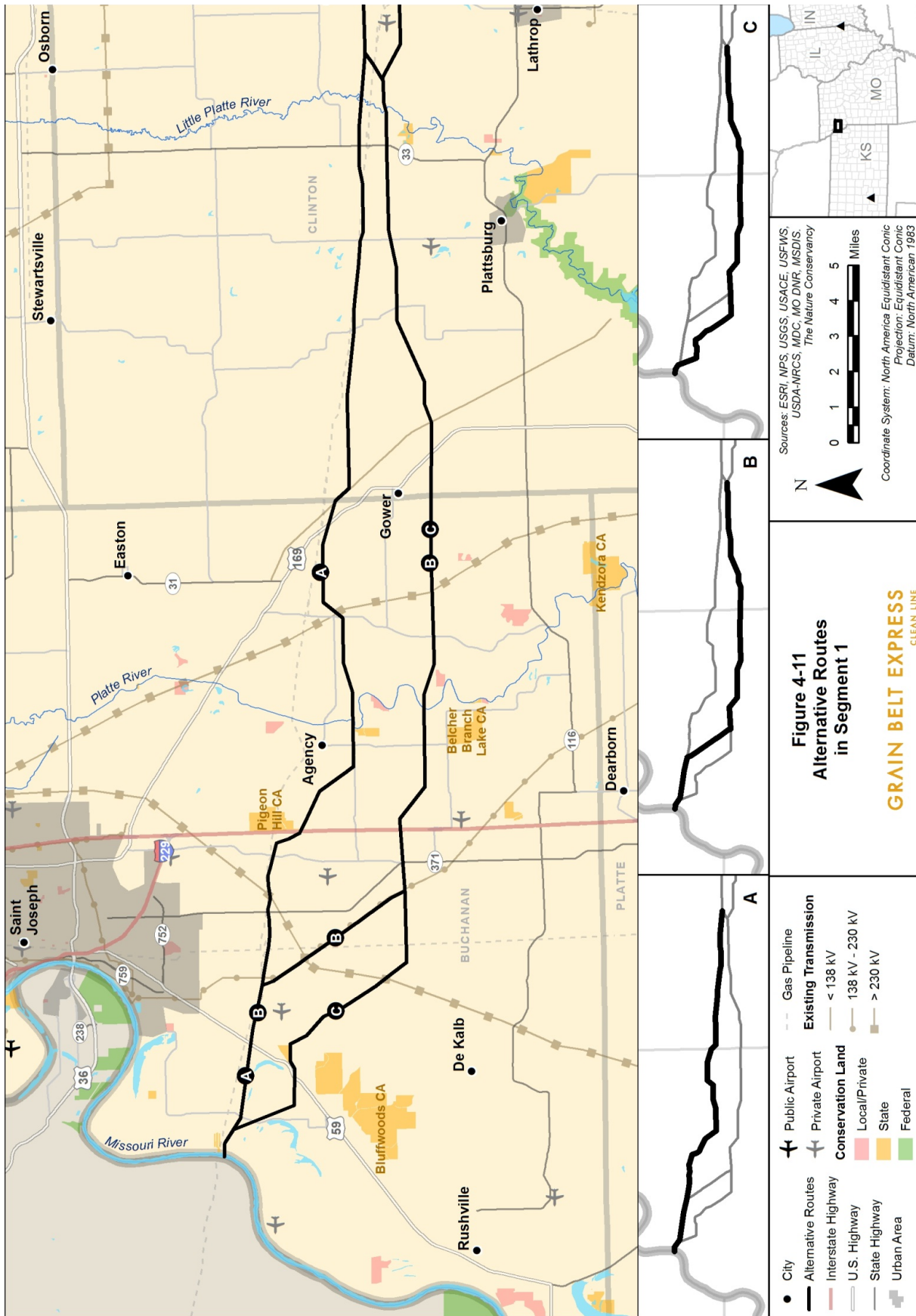
Each segment begins and ends at a common point for all of the Alternative Routes within that segment, which provides for a reasonable comparison between each of the Alternative Routes. From each of the segments, one Alternative Route is ultimately selected, and when both Alternative Routes are connected, the Proposed Route is formed. Segment 1 begins at the Missouri River crossing south of St. Joseph and terminates in Clinton County, just southwest of Turney, Missouri. Segment 1 carries forward three Alternative Routes for consideration. Segment 2 begins at the termination point of Segment 2 and covers the remaining portion of Missouri to the Mississippi River crossing. Segment 2 carries forward six Alternative Routes. The Alternative Routes are the focus of the comparative analysis presented in Chapter 5. Below is a description of each Alternative Route.

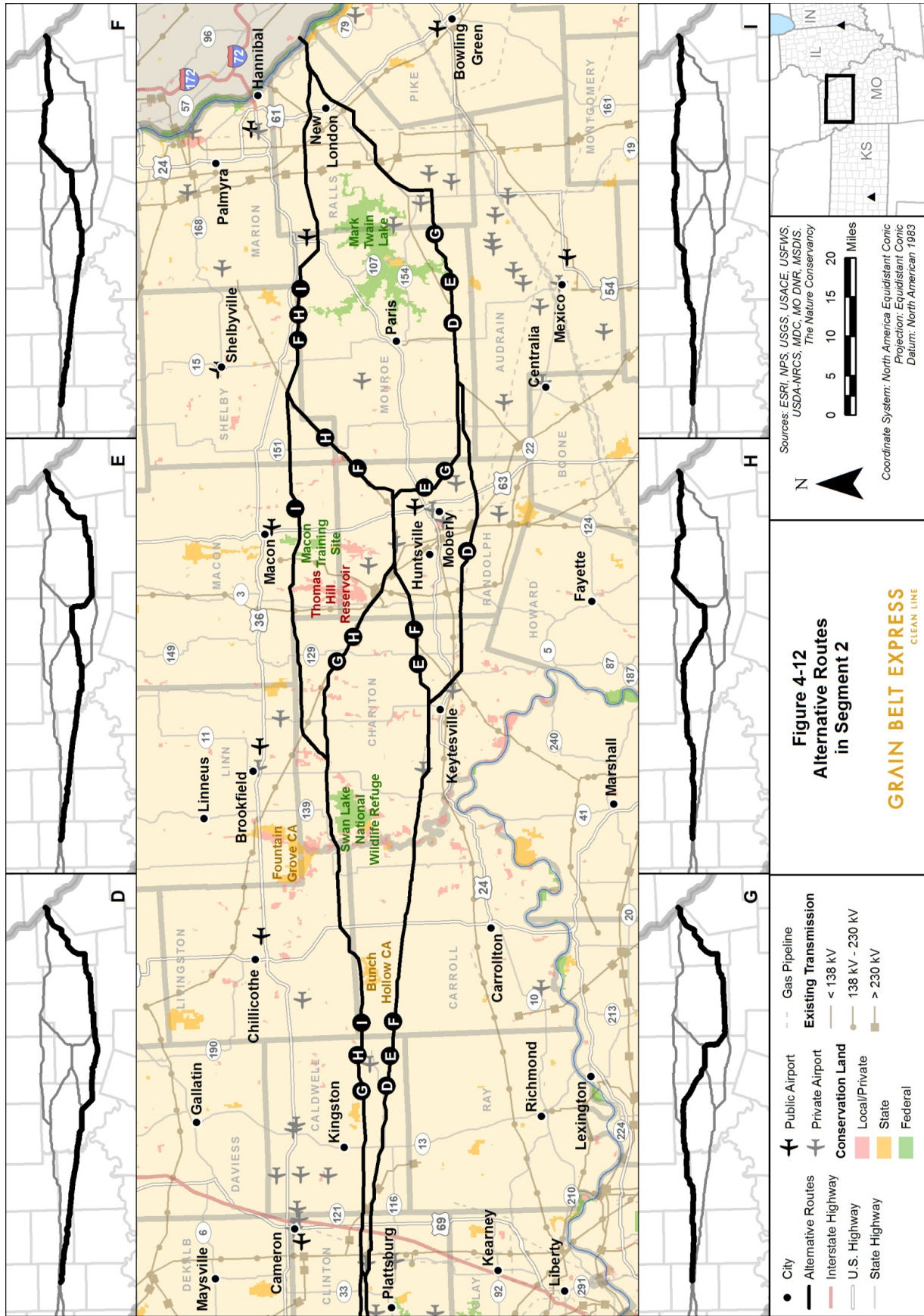
Segment 1

Alternative Route A

Alternative Route A (**Figure 4-10**) crosses the Missouri River close to the Rockies Express/Keystone Pipeline, just south of the Jentell Brees access area on County Road 207 in Buchanan County. After crossing the Missouri River and the Halls Levee, the route turns southeast continuing for approximately 1 mile and then turns east crossing County Road 54 SW. The route continues east over County Road 41 SW before dropping south a half section across U.S. Highway 59. The route continues east for approximately 1 mile before running parallel, south of the Rockies Express/Keystone Pipeline for approximately 5 miles to U.S. Interstate 29. Prior to crossing Interstate 29, the route turns southeast around several residences before continuing toward the intersection of State Route H and County Road 65 SE, just southwest of the town of Agency. The route turns east crossing over the intersection of State Routes MM and H and the Platte River then moves north a half section crossing agriculture and pasture lands. Just before State Route E, the route turns northeast and crosses over the St. Joseph Light and Power Company's 345 kV transmission line and Mt. Moriah SE Road. The route then turns east, continuing 2 miles to U.S. Highway 169. North of Gower, the route turns southeast and parallels the Gower – Plattsburg 115 kV transmission line for approximately 0.5 mile before turning east where it follows along section/parcel boundaries across agricultural land toward the intersection of NW 29th Street and NW Perkins Road. The route continues east parallel to the Rockies Express/Keystone Pipeline for approximately 6 miles before crossing over the gas pipeline near Missouri Highway 33. The route continues east for 0.5 mile along section/parcel boundaries, dropping south a half section and ending near the intersection of NE 228th Street and Breckenridge Road.







Alternative Route B

Alternative Route B (**Figure 4-10**) follows the same path as Alternative Route A for the first 5 miles before diverting south-southeast to parallel the west side of the exiting Nashua – Lake Road 161 kV transmission line for 4.5 miles. Just northwest of the town of Faucett, the route turns east crossing the existing transmission line and continuing approximately 2 miles to Interstate 29. After crossing Interstate 29, the route shifts slightly south for approximately 0.5 mile then turns, heading southeast crossing Tillery SE Road for approximately 1 mile. Near County Road Kelley SE, the route turns east again continuing 2.5 miles crossing the Platte River. The route shifts south a quarter section crossing County Road 95 SE then continues east over the Hawthorne – St. Joseph 345 kV transmission line to U.S. Highway 169 just south of Gower. After crossing U.S. Highway 169, the route continues east over Castile Creek and NW Poage Road then turns northeast for approximately 0.5 mile. The route then turns to the east for approximately 1 mile. After crossing County Road 326, the route again turns northeast for approximately 1 mile before crossing NW Prairie View Road. The route continues northeast for approximately 1 mile before turning east along section/parcel boundaries for approximately 2 miles. The route crosses over NW Country Land Road, moves north a quarter section and continues along section/parcel boundaries before terminating 0.5 mile east of NE Dixon Road.

Alternative Route C

Alternative Route C (**Figure 4-10**) follows the same path as Alternative Routes A and B for the first mile before diverting in a more south-southeast direction. The route continues south-southeast for approximately 2 miles, crossing County Road 54 SW and Crockett SW Road. It turns east after crossing Cottonwood SW Road continuing 1 mile before crossing U.S. Highway 59 and St. Joseph Sub railroad. The route continues east for approximately 0.5 mile before turning northeast for a short distance and then turning east again for 0.5 mile. Alternative Route C then turns southeast, and crosses State Route JJ, County Roads Dittimore SW and SW 25, and the intersection of Lower Dekalb SW and Bethel SW roads. The route continues in a south-easterly direction crossing the Iatan – St. Joseph 345 kV transmission line. Just south of intersection State Route V and County Road Call SW, the route turns continuing east across agriculture and pasture lands and merges with Alternative Route B to follow the same path to the termination point.

Segment 2

Alternative Route D

Alternative Route D (**Figure 4-11**) begins near the intersection of NE 288th Street and NE Crowley Corner Road approximately 2 miles southwest of the town of Turney in Clinton County. The route continues due east for a short distance before it drops south a section and continues east along section/parcel boundaries south of the Lathrop Substation. The route

crosses State Route A and the Fairport – Lathrop 161 kV transmission line and continues east a short distance before turning southeast for approximately 2 miles to Interstate 35. The route crosses Interstate 35 and continues east for approximately 1 mile before paralleling the Rockies Express/Keystone Pipeline on the south side for approximately 3 miles before shifting south a half section and crossing the intersection of State Route Z and Ore Road. The route continues east along section/parcel boundaries for approximately 2 miles before turning southeast to parallel the south side of the gas pipeline for another 4 miles until it turns southeast for approximately 1 mile before crossing Missouri Highway 13. In an effort to parallel section/parcel boundaries, the route turns east for approximately 6.5 miles to just north of the town of Cowgill. It then turns southeast, crossing the gas pipeline once more, and continues east for nearly 1 mile before turning southeast again to parallel the south side of the gas pipeline for 12.5 miles. Near the intersection of State Route C and County Road 151 in Carroll County, the route crosses over the gas pipeline and continues to parallel on the north side for approximately 9 miles to U.S. Highway 65.

After crossing U.S. Highway 65, the route crosses over and continues to parallel the gas pipeline on the south side for approximately 9 miles before crossing back to the north side to avoid impacting an Emergency Watershed Protection Easement. The route continues paralleling the gas pipeline on the north side for approximately 6 miles before crossing back to the south side to avoid a residence located near the gas pipeline. The route maintains this parallel alignment for approximately 6 more miles. Near the intersection of Powell Avenue and Hickory Grove Road, the route turns east along section/parcel boundaries for approximately 5.5 miles. It then turns southeast (east of Keytesville) for approximately 6 miles before turning east and crossing over the gas pipeline. Because of residential development along the gas pipeline, the route deviates north of the pipeline and heads southeast for approximately 7 miles before beginning its parallel alignment again on the north side for approximately 4 miles. The route then turns due east crossing over the Thomas Hill 345 kV transmission line, and continues east over U.S. Highway Business 63 and the St. Louis District Railroad, approximately 1 mile south of Moberly and just north of the town of Renick. The route then angles northeast and then turns due east 0.5 mile north of the intersection of State Route Y and County Road 1039. The route continues east along section/parcel boundaries for approximately 2.5 miles then moves north a half section crossing over Missouri Highway 151. It continues east along State Route M for 5 miles before picking up the parallel alignment to the Thomas Hill 115 kV transmission line for 9.5 miles.

South of the intersection of State Route D and County Road 779, the route and the 161 kV line split and the route continues east along pasture and agricultural land. At the intersection of State Route D and County Road 624, the route turns northeast then east again approximately 1 mile north of the town of Santa Fe. The route crosses the South Fork Salt River then turns northeast before the intersection of State Routes D and E. After approximately 1.5 miles, the

route turns east again continuing along section/parcel boundaries for 3 miles before moving north a half section and continuing due east crossing over Missouri Highway 19 in Ralls County.

Approximately 1 mile east of Missouri Highway 19, the route makes a 90 degree turn continuing north along Wyoming and York roads. The route turns northeast and parallels Missouri Highway 19 for 6 miles before diverting north and east around the town of Center. The route turns east and continues east for 2.5 miles, crossing over Missouri Highway 19. The route then turns northeast for 2 miles, east for 2.5 miles, and finally northeast for another 3.5 miles. The route crosses over the Ameren Missouri 161 kV transmission line and U.S. Highway 61 before turning east-northeast and crossing the Salt River. It continues east-northeast with slight deviations for approximately 5 miles, then it turns east near the intersection of Oakhill and Malaruni roads. After crossing Missouri Highway 79, approximately 2 miles south of Saverton, the route continues east approximately 0.5 mile before turning northeast for approximately 0.5 mile prior to reaching the Mississippi River.

Alternative Route E

Alternative Route E (**Figure 4-11**) follows the same alignment as Alternative Route D to the point just north of Keytesville. Here, Alternative Route E continues east along the north side of Dooley Ford Road. At the intersection of State Route UU and Scribner Road, the route turns northeast crossing over Log Cabin Lane and then turns east crossing the Chariton River. The route continues due east for approximately 3 miles along section/parcel boundaries before moving north a half section and crossing Missouri Highway 129. The route continues east for 1.5 miles, crossing Prairie Valley Avenue, and then begins paralleling the north side of the Salisbury – Thomas Hill 161 kV transmission line. The route continues the parallel alignment, with one deviation around several residences along the existing transmission line, for approximately 6 miles. After the route crosses Missouri Highway 3, it crosses the Salisbury – Thomas Hill 161 kV transmission line and turns northeast near County Road 1135. The route crosses a 161 kV and a 115 kV transmission line as it proceeds northeast. Approximately 0.5 mile north of the State Route Z and County Road 1145 intersection, the route turns east crossing a 345 kV transmission line before merging and paralleling south of another Kansas City Power and Light Company 161 kV transmission line. The route continues to parallel the 161 kV transmission line for approximately 7 miles crossing U.S. Highway 63 and then turns south near the intersection of County Roads 1490 and 1495. The route continues south, parallel to a lower voltage transmission line, crossing U.S. Highway 24, for approximately 4.5 miles then turns southeast to parallel north of the Ameren Missouri 69 kV transmission line for 5.5 miles. Approximately 0.75 mile northwest of the County Roads 1018 and 1023 intersection, the route turns due east and follows the same alignment as Alternative Route D to the Mississippi River.

Alternative Route F

Alternative Route F (**Figure 4-11**) follows the same alignment as Alternative Route D to the point just north of Keytesville. Here, Alternative Route F continues east along the same alignment as Alternative Route E to the intersection of County Roads 1490 and 1495, east of Cairo. It turns north-northeast crossing State Route K and continues north along section/parcel boundaries for 1.5 miles. The route crosses State Route FF then turns northeast to parallel the south side of a Kansas City Power and Light Company 161 kV transmission line for approximately 16.5 miles with two diversions around residences and an NRCS Wetland Reserve Program (WRP) easement.

Approximately 3 miles west of Shelbina (in Shelby County) near the intersection of County Roads 425 and 432, the route diverts from the Kansas City Power and Light Company 161 kV transmission line to the southeast. The route diagonally crosses agriculture and pasture land towards the intersection of State Route WW and County Road 439 then turns east crossing Missouri Highway 15. The route continues east mostly along section/parcel boundaries for 3.5 miles, dropping south a half section into Monroe County. After crossing State Route PP, the route continues east along the border of Shelby and Monroe counties for 2 miles before turning southeast. Approximately 0.5 mile south of Hunnewell, the route turns due east continuing along section/parcel boundaries for approximately 2 miles. It turns south-southeast crossing near the intersection of County Roads 375 and 390. The route continues for 2.5 miles, crossing the Hannibal District Railroad then turning east, 2 miles south of Monroe City. Continuing east for 1.0 mile, the route crosses Missouri Highway 24 and parallels north of County Road 594 and Hereford Lane into Ralls County.

Alternative Route F continues east from the county line for approximately 1.5 miles then turns northeast. The route continues in a northeasterly direction for approximately 5 miles turning east near the intersection of Huntington Lane and Hawthorne Road. The route continues east crossing Ameren Missouri's Maywood - Montgomery 345 kV transmission line and State Route H. It continues east for 2 miles crossing a Central Electric Power Cooperative 115 kV transmission line and the Marblehead – Tap 161 kV transmission line just south of Rensselaer and Hannibal. Continuing east, the route crosses State Route M then turns southeast for 2 miles. Near the intersection of Choctaw Trail and U.S. Highway 61, the route turns east again continuing along the north side of the Salt River. Just south of the intersection of State Route O and Flint Hill Road, the route turns east-southeast for approximately 1 mile before heading due east along section/parcel boundaries for 1 mile. It continues to travel east, making three slight deviations to avoid residences before joining with the same alignment as Alternative Routes D and E to the Mississippi River.

Alternative Route G

Alternative Route G (**Figure 4-11**) begins near the intersection of NE 288th Street and Breckenridge Road approximately 1.5 miles southwest of the town of Turney in Clinton County. The route continues east for 5 miles to NE Estep Road. It moves south a half section, crosses Interstate 35 and U.S. Highway 69 continuing east along section/parcel boundaries. Near the Clinton and Caldwell County line, the route moves south a half section and continues east for 3 miles to the intersection of Duroc Drive and Texas Road. The route moves south another half section, crossing State Route D and continues east along section/parcel boundaries for 5 miles to Missouri Highway 13. After crossing Missouri Highway 13, the route moves south a half section continuing east across agriculture and pasture land for about 7 miles. The route moves north a section and parallels south of Ayres and Honeysuckle Drive. Approximately 1.5 miles north of the town of Braymer, the route shifts south a section crossing State Route A and continuing east along section/parcel boundaries into Carroll County.

The route continues east along section boundaries approximately 3 miles into Carroll County. Just after crossing State Route D, the route moves south a half section continuing east, north of County Road 110. The route passes north of Bunch Hollow Conservation Area then turns northeast near the intersection of County Road 110 and State Route Z. The route continues for 1.5 miles, parallels for a short distance a Northwest Missouri Electric Cooperative 69 kV transmission line, and then turns east crossing the 69 kV transmission line. The route continues east for approximately 1.5 miles then turns northeast crossing County Roads 451 and 430. Just west of U.S. Highway 65, the route turns and continues east 7 miles crossing Missouri Highway 139 approximately 1.5 miles north of the town of Hale. The route briefly parallels the south side of a Northwest Missouri Electric Cooperative 69 kV transmission line then crosses the 69 kV transmission line and continues east for 3 miles. After the route crosses the Brookfield Sub Railroad, it turns northeast crossing the Grand River into Chariton County.

The route continues in a northeast direction in Chariton County, avoiding NRCS WRP easements, several residences, and a cemetery then turns east at the intersection of Lakeside Road and State Route Ra. The route continues east passing between the town of Sumner and the Swan Lake National Wildlife Refuge before moving north a half section and continuing east for 5 miles to Missouri Highway 11. After crossing Missouri Highway 11, the route moves south a half section, crosses the Marceline Sub Railroad and continues another 5 miles to Missouri Highway 5. The route continues east and moves north at Cumberland Avenue to avoid several residences. The route moves back south just west of State Road ZZ and continues east for 1.5 miles. It then turns southeast to move south a section and then turns east again until reaching the Thomas Hill 161 kV transmission line. The route parallels the west side of the 161 kV transmission line for 10 miles, crossing Missouri Highway 3, and then turns east-southeast near the intersection of State Route F and County Road 1150. The route crosses four different transmission lines coming out of the Thomas Hill power plant, before

turning south-southeast near the intersection of County Roads 1155 and 1160. It crosses and parallels the east side of a Northeast Missouri Electric Power Cooperative 69 kV transmission line for 1.5 miles. Continuing south-southeast, it crosses State Route C and a Kansas City Power and Light Company 161 kV transmission line. The route parallels the 161 kV transmission line on the south side and follows the same alignment as Alternative Route E to the Mississippi River.

Alternative Route H

Alternative Route H (**Figure 4-11**) is a combination of Alternative Routes G and F. Alternative Route H follows the same alignment as Alternative Route G from the starting point to just east of Cairo where Alternative Routes E and G head south and Alternative Routes F and H head northeast. From here, Alternative Route H follows the same alignment as Alternative Route F to the Mississippi River.

Alternative Route I

Alternative Route I (**Figure 4-11**) follows the same alignment as Alternative Routes G and H from the starting point to just below the town of Rothville in Chariton County. After the routes cross the Marceline Sub Railroad, Alternative Route I turns northeast and parallels the railroad for 4.5 miles. North of the Twichell Road and Pioneer Avenue intersection, the route turns east crossing Northwest Missouri Electric Cooperative 161 and 69 kV transmission lines. Approximately 0.5 mile south of Marceline, the route crosses Missouri Highway 5 continuing east mostly along parcel boundaries for 8.5 miles before crossing Missouri Highway 129. After crossing Missouri Highway 129, the route continues east for 2 miles then gradually moves north a section into Macon County. It continues east crossing the Chariton River and the Ameren Missouri 161 kV transmission line before reaching Missouri Highway 3. After crossing Missouri Highway 3, the route diverts north of the Thomas Hill Reservoir then moves south a section continuing east crossing State Route FF and C. The route continues east crossing a Kansas City Power and Light Company 161 kV transmission line, then passes between the U.S. Army National Guard Macon Training Site south of Macon. Near the intersection of Kayak Avenue and Keswick Place, the route turns east crossing U.S. Highway 63 continuing for 3.5 miles before moving north a section close to the intersection of Nature Avenue and Noble Road. The route continues east for approximately 4 miles into Shelby County crossing U.S. Highway 151 just south of Clarence. The route continues east for 7 miles then turns southeast near the intersection of County Roads 417 and 432. It crosses a Kansas City Power and Light Company 161 kV transmission line and then follows the same alignment as Alternative Routes F and H to the Mississippi River crossing.

5. Alternative Route Evaluation

This chapter describes the key resources in the Study Area and a comparative analysis of the potential impacts of each Alternative Route on these resources. The analysis relies on a combination of information collected in the field, GIS data sources, supporting documents, stakeholder input, and the knowledge and experience of the Routing Team. Information presented throughout the chapter is based on an aerial photo-aligned centerline for each Alternative Route. The final location of any route is subject to modification based on final engineering, ground surveys, minimization of impacts on site specific resources, and landowner negotiations.

5.1 Natural Environment Impacts

5.1.1 Water Resources

Water resources of northern Missouri fall within the Missouri River and Upper Mississippi River basins. As a result of the areas' glacial past, the drainage patterns consist of nearly parallel streams that trend south in northwestern Missouri and drain into the Missouri River. Streams in northeastern Missouri flow southeast and into the Mississippi River. The glacial till of northern Missouri has low permeability; therefore, infiltration is low and runoff is rapid (Vandike 1995). This low permeability and a lack of groundwater inflow make for low base flows during dry weather. Northern Missouri is extensively row-cropped, and glacial till is easily eroded, especially on steeper slopes. This combination leads to high suspended sediment loads in many streams and rivers in northern Missouri (Vandike 1995). Water resources in the study area are presented in **Figure 5-1**.

The vast majority of the ponds and lakes in Missouri are privately owned and used for agricultural or recreational purposes. USACE has constructed numerous reservoirs for flood control, including the Mark Twain Lake in Monroe and Ralls counties. Wetlands are typically located in the floodplains along rivers and streams, in swales associated with rivers, or as margins of lakes and impoundments.

In Segment I, all streams and rivers drain to the Missouri River. The segment begins at the Missouri River and crosses the Independence-Sugar, Platte, and Upper Grand watersheds. Major surface water features include the Missouri River, Platte River, Little Platte River, Grand River, Shoal Creek, and the East Fork Grand River. Groundwater resources are poor with the exception of the Missouri River alluvium, which averages well yields of 1,000 gallons per minute (Miller and Vandike 1997).

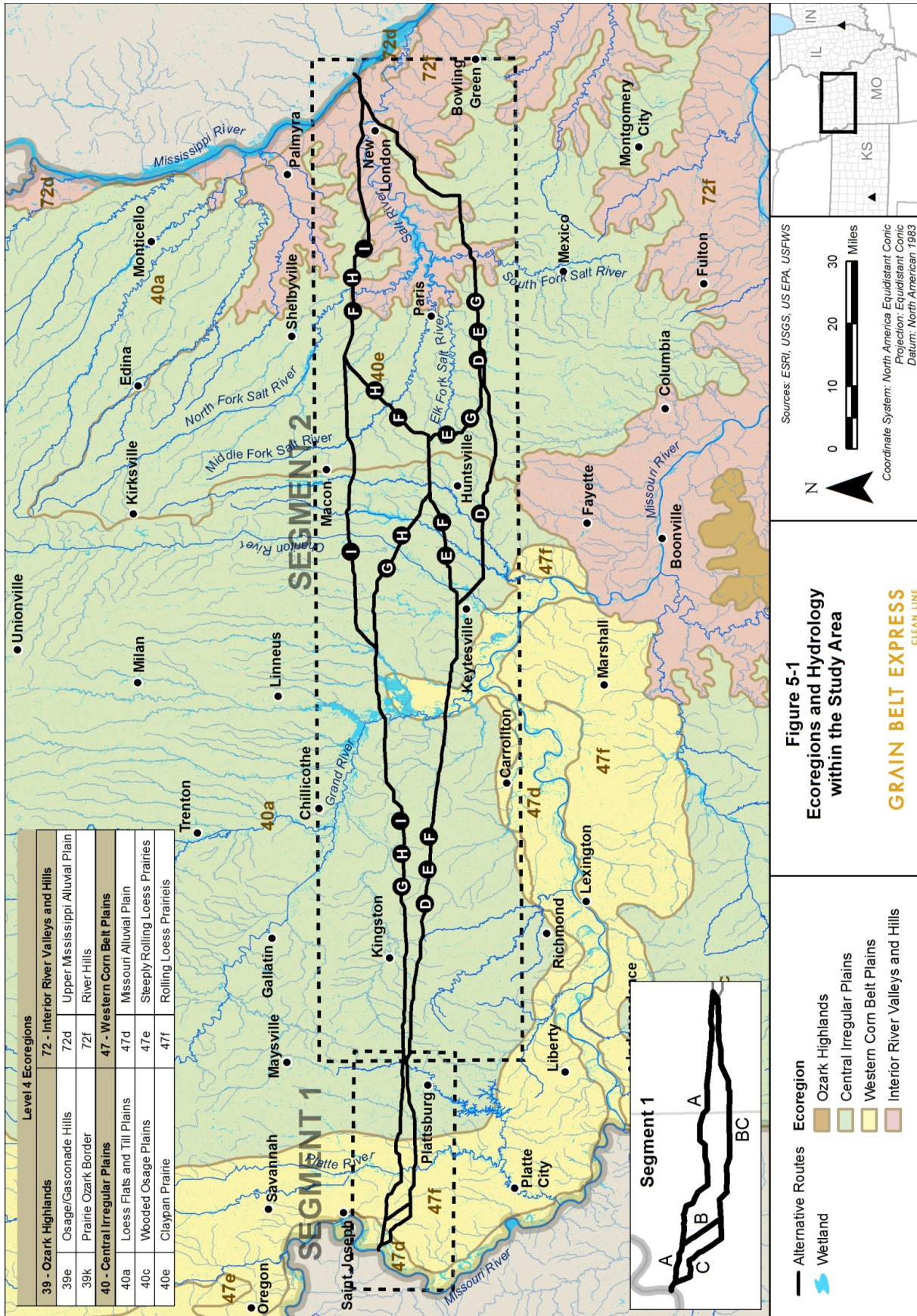


Figure 5-1
Ecoregions and Hydrology
within the Study Area

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, USGS, USEPA, USFWS
 Coordinate System: North America Equidistant Conic
 Projection: Equidistant Conic
 Datum: North American 1983

In Segment 2, streams and rivers drain to the Missouri and Mississippi rivers. The segment crosses nine watersheds including the Upper Grand, Lower Grand, Lower Chariton, Little Chariton, Lower Missouri-Crooked, Salt, North Fork Salt, South Fork Salt, and the Sny. Major surface water features include the Chariton River, Mussel Fork, Grand River, North Fork Salt River, South Fork Salt River, Crooked River, Salt River, and the Mississippi River. Segment 2 also has two large reservoirs, Thomas Hill Reservoir and Mark Twain Lake. Groundwater resources are more diverse in the northeastern part of the state and can have areas of moderate yields for irrigation (Miller and Vandike 1997).

Portions of Shoal Creek, Crabapple Creek, Log Creek, and Brush Creek in the Bonanza Conservation Area are designated Outstanding State Resource Waters (State of Missouri 2012). In contrast, several waters in this segment are also listed on the state's 303(d) list that identifies impaired waterbodies that are not currently meeting water quality standards. Other 303(d) listed waters in the area of Segment 2 include Salt Creek in Chariton County, Middle Fork – Salt River in Macon County, a tributary to Coon Creek in Randolph County, and Salt River in Ralls/Pike County, all of which are impaired for low dissolved oxygen levels (MDNR 2013).

Swan Lake National Wildlife Refuge, managed by USFWS, is located in the floodplain of the Grand River near its confluence with the Missouri River. The refuge provides 7,000 acres of wetlands and more than 3,000 acres of open water (USFWS 2013a). In addition, numerous NRCS WRP conservation easements are located along the Grand River.

Mark Twain Lake, impounded by Clarence Cannon Dam, is the only major reservoir in northeastern Missouri in the Mississippi River basin. Clarence Cannon Dam is 1,940 feet long and 138 feet high. At multipurpose pool level (elevation 606 feet), the surface area of Mark Twain Lake is 18,600 acres, and storage is 457,000 acre-feet (Vandike 1995). Mark Twain Lake is used for flood control, recreation, and water supply.

Thomas Hill Reservoir was formed by damming the Middle Fork Little Chariton River in Randolph County. The reservoir, which is privately owned by Associated Electric Cooperative, is used primarily to supply cooling water for the Thomas Hill Power Plant. The lake drains 147 square miles and has a normal surface area of about 4,400 acres. Although it is primarily used for cooling water, it is also a source of water for Thomas Hill Public Water Supply District #1 and is used for recreation (Vandike 1995).

General Impacts and Mitigation Measures

Surface Waters

Direct impacts on hydrologic features are often minimized or avoided by spanning wetlands, rivers, or drainages, when feasible. In the absence of other constraints, engineers typically seek to place structures at high points in topography, inherently resulting in the avoidance of

structure placement that impacts water or wetland features in low-lying areas. However, in a few rare instances, such as at crossings of large wetland areas or complexes, a structure may need to be placed within a wetland. In these instances, the area of permanent wetland loss is limited to the area of the footprint of the structure foundation, typically between 0.0005 and 0.0009 acre of permanent impact (average permanent impact acreage for lattice steel and steel monopole structures, respectively).

Regardless of the type of impact, Grain Belt Express will continue to coordinate with USACE concerning potential impacts on jurisdictional wetlands and attempt to minimize permanent impacts when feasible and practicable. Grain Belt Express would implement best management practices during the design, construction, and operational phases to avoid or minimize impacts on wetlands. These practices may include the consideration of designs that limit clearing forests near drainages and in areas of steep topography, requiring the use of wetland mats to minimize impacts of construction traffic, and avoiding construction during seasonally wet periods in certain areas.

At the Mississippi River crossing location, no structures would be placed in the river; however, a structure would be placed on Jim Young Island. Although impacts to the Mississippi River are not anticipated, wetlands may occur on the island and along the riparian margins of the Mississippi River. Grain Belt Express will continue coordination with USACE to identify and mitigate potential impacts that may be associated with wetlands located at the crossing as well as across the project.

Other indirect impacts to surface waters, such as sedimentation and erosion of surrounding soils, can result from ground-disturbing activities. Typically, sedimentation is easily controlled with proper perimeter controls around the transmission line construction area. Best management practices may include implementation of sediment control measures such as silt fences, access road drainage management measures, and timely reseeding of disturbed soil areas. Grain Belt Express will coordinate with MDNR and obtain and comply with the necessary storm water permits for construction of the Project.

Groundwater

Generally, transmission line construction does not impact groundwater. In some instances, dewatering may need to occur in areas with a high water table to place foundations in the ground. Any dewatering activities required by construction would follow best management practices and be covered under the National Pollution Discharge Elimination System Permit or under a separate dewatering permit, as appropriate.

Alternative Route Comparison

For each segment, Alternative Routes were analyzed for the number of stream crossings (including streams, rivers, or drainages that can be perennial, seasonal, intermittent, or

ephemeral), number of waterbodies (lakes or ponds) crossed, and acres of wetlands (forested and scrub/shrub). **Figure 5-1** shows the ecoregions and hydrology for both segments.

Segment 1

Excluding the Missouri River itself, all streams and waterbodies in Segment 1 can be easily spanned, and potential wetland acreage within the ROW of each Alternative Route is generally similar (**Table 5-1**). Alternative Route A crosses the fewest streams; however, it also crosses the greatest number of waterbodies and has the greatest total wetland acreage and forested wetland acreage within the ROW. Alternative Routes B and C are comparable with a similar number of stream crossings, waterbody crossings and wetlands within the ROW.

Table 5-1. Segment 1 Alternative Routes Water Resources Information			
Water Resources Category	Alternative Routes		
	A	B	C
Stream crossings (count)	53	58	63
Waterbody crossings (count)	9	6	3
Wetlands ¹ within the ROW ² (acres)	41	36	33
Forested wetlands ¹ within the ROW ² (acres)	21	11	12
Scrub-shrub wetlands ¹ within the ROW ² (acres)	--	--	--

¹ National Wetlands Inventory (2013)

² ROW is 100 feet on either side of centerline

Segment 2

Excluding the Mississippi River crossing, all waterbodies and streams can be spanned by all of the Alternative Routes. Wetlands will be spanned when feasible. No structures will be placed in the Mississippi River; however, taller structures and longer spans will be required. Alternative Route D has the fewest stream crossings, while Alternative Route F has the most stream crossings, though the number of stream crossings and waterbody crossings is generally similar across all six alternatives (**Table 5-2**).

All of the Alternative Routes intersect one or more reaches of a 303(d) impaired water. However, based on the impairments listed for these streams (*Escherichia coli*, or E. coli, and low dissolved oxygen), the Project is not likely to further impair the streams crossed. Alternative Route D has the fewest stream crossings and the fewest acres of total wetlands within the ROW. Therefore, Alternative Route D would likely have the least overall impact on water resources in Segment 2.

Water Resources Category	Alternative Routes					
	D	E	F	G	H	I
Stream crossings (count)	228	248	252	245	249	238
Waterbody crossings (count)	24	24	25	24	25	27
Wetlands ¹ within the ROW ² (acres)	118	129	132	137	141	143
Forested wetlands within the ROW ¹ (acres)	69	76	77	76	77	77
Scrub-shrub wetlands within the ROW ¹ (acres)	1	1	1	<1	<1	<1

¹ National Wetlands Inventory (2013)

² ROW is 100 feet on either side of centerline

5.1.2 Wildlife and Habitat

Vegetation and Habitats

Missouri was once a complex mixture of grassland (or prairie), savanna, woodland, and forest occurring on a diversity of landforms that vary in degree of relief, dissection, and geologic parent materials. Grasslands occupied approximately one-third of the state occurring as both upland grasslands and wet grasslands on the wide alluvial plains along rivers.

Today, native grasslands are rare with most converted to pastures composed of planted nonnative pasture species. Existing native vegetation in Missouri has undergone extensive fragmentation into smaller tracts. The general land cover today is a complex mixture of cropland on smoother surfaces and better soils, pasture on irregular surfaces and eroded soils, and woodlands and forests on steeper soils and rougher areas (Nigh and Schroeder 2002).

Along the Missouri River, on the Missouri River alluvial plain, lands that were once wet prairies and marshes with narrow bands and isolated pockets of bottomland forest have been drained and are now devoted mainly for use as highly productive croplands. However, a substantial number of wetlands still remain, and since the flood of 1993, several large areas have been converted to managed wetlands (Nigh and Schroeder 2002).

Just east of the Missouri River alluvial plain, an area of rolling loess prairies occurs that was historically mainly grasslands with oak savannas and woodlands in valleys and on steeper side slopes. This area is now mostly farms with cropland on alluvial plains and less dissected uplands and nonnative pastures occurring on more sloping lands (Nigh and Schroeder 2002).

North central Missouri consists of loess flats and till plains of varied topography due to several larger stream headwaters occurring in this area creating topography from flat to moderately

hilly causing a dissected land surface in areas. The area is mostly in cropland on the alluvial plains and flat uplands and nonnative pastureland on more sloping lands with true savannas and open woodlands nearly absent. Small forested patches and fencerows mainly consist of invasive woody species. However, some of the rougher ground contains patches of oak and mixed hardwood woodland and forest (Nigh and Schroeder 2002).

Eastern Missouri, north of the Missouri River and west of the Mississippi River, consists of claypan prairie with topography mostly flat or gently rolling. Most former prairies are now used as cropland with extensive nonnative pasture and hay land on rolling lands with an emphasis on livestock production. Most woodlands are mixed with invasive woody species, and very little natural vegetation remains (Nigh and Schroeder 2002).

In the far eastern portion of Missouri, north of the Missouri River, the Mississippi River hills area includes a broad belt of hills, valleys, and blufflands along the western side of the Mississippi River. Topography ranges from moderately rolling to steep and rugged. Steeper areas remain in woodland and forest. Uplands and broad bottoms have a mixture of nonnative pasture and cropland with former prairie openings in forested areas eliminated. The area nearest the Mississippi River consists of an alluvial plain, most of which are drained for cropland; although, many islands are forested with riverfront species (Nigh and Schroeder 2002).

Wildlife

The mosaic of grassland, savanna, woodland, and forest communities and their associated edge habitat significantly affected the types and numbers of wildlife that occurred historically in Missouri (MDC 2003).

Missouri's natural communities support and provide habitat for a great diversity of wildlife species including more than 150 native breeding bird species (Jacobs and Wilson 1997), 108 native reptile and amphibian species (Johnson 2000), 67 native mammal species (Schwartz 2001), 200 native fish species (Pflieger 1997), 65 native mussel species (Oesch 1995), 32 native crayfish species (Pflieger 1996), and more than 130 native dragonfly and damselfly species (Triel 2005). Missouri ranks 21st in the nation in a ranking of the aggregate native species diversity of vascular plants, mammals, birds, reptiles, amphibians, and freshwater fishes of the 50 states (Stein 2002). Many of these species depend partially or wholly on woodlands and forests (MDC and USDA Forest Service 2010). Game species managed for hunting include big and small game animals, furbearing animals, upland game birds, migratory game birds, and waterfowl.

In addition, Missouri lies within the Mississippi Flyway, one of the four major North American migratory bird corridors. The Mississippi Flyway stretches from the Gulf Coast of Louisiana, Mississippi, and Alabama up through Canada. During early spring and late fall, many bird species migrate between wintering grounds and summer nesting grounds along this Flyway.

Currently, in the area north of the Missouri River very little natural habitat remains with a small percentage of land covered by forests and native grasslands. A large percent is cropland with approximately 20 percent pasture or hay lands. Some species of grassland birds will nest in cropland, grass waterways, pastures, hayfields, and roadsides adjacent to agricultural lands. However, species diversity in these altered habitats typically is very low, and reproductive success appears to fall far below that necessary to maintain stable populations (MDC and USDA Forest Service 2010).

Remaining forest, woodland, and savanna communities provide nesting, cover, and foraging sites for a variety of wildlife from amphibians and reptiles, birds, and small mammals to large mammal species. Riparian forest cover is also important to fishes and other aquatic organisms while ephemeral pools in forest and woodland are important breeding sites for amphibians.

Native prairies are important habitats in Missouri, although few remain. Fewer than 90,000 acres of native prairie still exist in Missouri today and only approximately 25,000 acres are protected by either state or private entities. Prairies are important areas of biodiversity and more than 800 different species of plants can be found on Missouri prairies (Missouri Prairie Foundation 2014). Numerous bird species also use prairies for summer breeding habitat and migration layovers, while fewer use these areas for overwintering. Additionally, up to 3,000 insect species can occur on high quality prairie remnants (Nelson 2005).

Conservation Lands

Conservation lands in Missouri primarily include lands in the NRCS WRP, lands in the U.S. Department of Agriculture's (USDA) Conservation Reserve Program (CRP), and lands in MDC's conservation areas. The NRCS WRP is a voluntary program that allows landowners to protect wetlands on their property under conservation easements. These easements are federal easements that can either be permanent or implemented in 30 year terms (USDA NRCS 2013). The CRP program is also a voluntary program where areas are planted with native plants to provide soil stability, water conservation, and wildlife habitat. Incentives to landowners include compensation for the acreage enrolled in the CRP program (USDA CRP 2013). MDC administers 995,628 acres of Conservation Area lands located throughout the state, some of which is leased, but the majority is owned in fee.

The Swan Lake National Wildlife Refuge, administered by USFWS, is located in north-central Missouri in Chariton County, in the floodplain of the Grand River near its confluence with the Missouri River. The primary purpose of the refuge is to provide nesting, resting, and feeding areas for waterfowl (including the Eastern Prairie population of Canada geese). The refuge is considered a primary wintering area for Canada geese and is also part of an Audubon Important Bird Area (**Figure 5-2**). The purpose of Swan Lake National Wildlife Refuge is: 1) to act as a refuge and breeding ground for migratory birds and other wildlife; 2) for use as an inviolate sanctuary, or for any other management purpose, for migratory birds; and 3) to carry out the

national migratory bird management program (USFWS 2013a). In addition to waterfowl habitat, the refuge provides habitat for resident wildlife, protects endangered and threatened species, and provides wading bird and shorebird habitat. The refuge receives more than 30,000 shorebirds annually and up to 100,000 ducks during the fall migration.

The Nature Conservancy designs conservation plans on an ecoregional basis and maintains portfolios of sites within an ecoregion that would collectively conserve the native species and community types found in that ecoregion. These portfolios are intended to provide a framework for The Nature Conservancy and its partners to make decisions regarding conservation actions on a site by site basis. The Central Tallgrass Prairie ecoregional portfolio includes Swan Lake as one of its conservation areas designated for landscape restoration. The area includes lands in the vicinity of the Grand River and Locust Creek. The area has six significant bodies of water including Swan Lake and Silver Lake (The Nature Conservancy 2000 2008).

The Lower Grand River Conservation Opportunity Area includes Swan Lake National Wildlife Refuge, Pershing State Park, Fountain Grove Conservation Area, and Yellow Creek Conservation Area as core managed areas. Conservation Opportunity Areas are priority sites for implementing conservation actions and comprehensive wildlife conservation by MDC and its partners (MDC 2005). Pershing State Park and Fountain Grove Conservation Area are north of the Swan Lake National Wildlife Refuge, and Yellow Creek is located to the southwest. MDC owns and manages these areas.