



Spire STL Pipeline Project

Resource Report 10
Alternatives

FERC Docket No. CP17-___-___

FERC Application
January 2017

Public



RESOURCE REPORT 10 - ALTERNATIVES	
SUMMARY OF FILING INFORMATION	
Information	Found in
1. Address the “no action” alternative. (§ 380.12(l)(1)). Discuss the costs and benefits associated with the alternative.	Section 10.2
2. For large projects, address the effect of energy conservation or energy alternatives to the project. (§ 380.12(l)(1))	Section 10.2
3. Identify system alternatives considered during the identification of the project and provide the rationale for rejecting each alternative. (§ 380.12(l)(1)). Discuss the costs and benefits associated with each alternative.	Section 10.3
4. Identify major and minor route alternatives considered to avoid impact on sensitive environmental areas (e.g., wetlands, parks, or residences) and provide sufficient comparative data to justify the selection of the proposed route. (§ 380.12(l)(2)(ii)). For onshore projects near to offshore areas, be sure to address alternatives using offshore routings.	Section 10.3
5. Identify alternative sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site. (§ 380.12(l)(2)(ii))	Section 10.5
INFORMATION RECOMMENDED OR OFTEN MISSING	
1. Ensure that project objectives that serve as the basis for evaluating alternatives are consistent with the purpose and need discussion in Resource Report 1.	Section 10.2, Section 10.3, and Section 10.4
2. Identify and Evaluate alternatives identified by stakeholders.	Section 10.4
3. Clearly identify and compare the corresponding segments of route alternatives and route variations to the segments of the proposed route that they would replace if adopted.	Section 10.4



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Acronyms and Abbreviations

CO ₂	carbon dioxide
Dth/d	dekatherms per day
FERC	Federal Energy Regulatory Commission
GIS	geographic information systems
HCA	high consequence area
HDD	horizontal directional drill
LGC	Laclede Gas Company
M&R	metering and regulating
MoGas	MoGas Pipeline, LLC
MP	milepost
Enable MRT	Enable Mississippi River Transmission, LLC
NGPL	Natural Gas Pipeline Company of America, LLC
NHD	National Hydrography Dataset
NWI	National Wetlands Inventory
NRIS	Natural Resource Information System
PHMSA	Pipeline and Hazardous Materials Safety Administration
PPRO	Preliminary Pipeline Route Optimization
Project	Spire STL Pipeline Project
REX	Rockies Express Pipeline LLC
Spire	Spire STL Pipeline LLC
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service



Alternatives

Consistent with the National Environmental Policy Act of 1969 and the Federal Energy Regulatory Commission’s (“FERC”) regulations, this resource report describes the alternatives that were considered during development of Spire STL Pipeline LLC’s (“Spire”) proposed Spire STL Pipeline Project (“Project”), including the no action alternative, energy alternatives, system alternatives, pipeline route alternatives, minor route variations, and aboveground facility site alternatives, and the resulting decisions that led to selection of the proposed Project scope.

10.1 Introduction

Spire undertook extensive alternative routing analyses for the Project. The primary objective in performing these analyses was to develop a viable Project that could accomplish Spire’s objective to provide 400,000 dekatherms per day (“Dth/d”) of additional natural gas transportation capacity to the St. Louis metropolitan area, eastern Missouri, and southwestern Illinois, through transportation paths and from gas supply areas distinct from the areas historically relied upon to serve the greater St. Louis area. Spire evaluated alternatives based on environmental considerations, population densities, and construction safety and engineering feasibility considerations.

10.2 No-Action Alternative

The Project is designed to provide approximately 400,000 Dth/d of year-round transportation service from an interconnect with Rockies Express Pipeline, LLC (“REX”) in Scott County, Illinois to markets in the St. Louis metropolitan area, eastern Missouri, and southwestern Illinois. Its purpose, first and foremost, is to provide additional firm pipeline capacity and associated natural gas supply from additional supply basins to homes and businesses in the St. Louis metropolitan area and surrounding counties. Moreover, the Project will enhance reliability and supply security, reduce reliance upon older natural gas pipelines and propane peak-shaving infrastructure, and help meet the strategic supply planning and reliability enhancement objectives of the Foundation Shipper, Laclede Gas Company (“LGC”).

Under the “no-action” alternative, the temporary and permanent impacts associated with construction and operation of the proposed new pipeline would be avoided. However, the needs that the Project is designed to fulfill would also not be met. In particular, the St. Louis region and surrounding counties in Missouri and southwest Illinois would not have affordable firm access to gas supplies sourced from new supply basins, and would be left with only their historical gas supply options. The historical supply areas have only modest growth projections, in contrast to significant growth projections in newer gas supply basins in other regions. In addition, because these mature supply basins are also located near developing new markets for natural gas consumption and export, increased competition for supply out of these regions will result in increased natural gas price risk to the St. Louis market absent the introduction of new sources and new transportation paths to access those new sources.



In addition, if the Project were not constructed, the St. Louis region would not obtain the new physical natural gas transportation path that one of the primary purposes of the Project. Its absence would reduce reliability, and the St. Louis region would continue to experience increased risk of service interruption given its disproportionate dependence on a single incumbent pipeline system, Enable Mississippi River Transmission, LLC (“Enable MRT”). The fact that the incumbent pipeline system traverses an acknowledged area of increased seismic activity magnifies the risk associated with such lack of transportation path diversity. Additionally, without the Project the Foundation Shipper, LGC, would have lost a peak day supply option and would need to consider whether any viable alternatives exist to address its current dependence on a propane peak-shaving facility that does not meet its system’s operational and reliability needs.

Thus, if the Project were not pursued, the Foundation Shipper and similarly situated customers in eastern Missouri and southwest Illinois would need to explore different pipeline construction projects or risk negative price and reliability issues. Those projects would carry their own environmental effects, as discussed in Section 10.3, System Alternatives, below.

In addition to direct impacts on gas supply competitive options and resource security and reliability, there would be no increase in firm transportation capacity into the region, and thus the anticipated benefits of providing access to incremental gas supplies to support market growth, particularly in the industrial and electric generation sectors, would not be met. This has both economic consequences and negative environmental effects, where additional gas supply would not be available to displace coal and other fossil fuels that have greater emissions of greenhouse gases.

10.2.1 Energy Conservation

The goal of reducing energy usage is an important alternative to include in the portfolio of strategies to deal with growth in energy demand. Energy conservation has been embedded in federal and state regulatory policy in recent years. The Project’s Foundation Shipper, LGC, to which the majority of the Project’s capacity is dedicated, has a number of energy efficiency programs for residential, commercial, and industrial customers. All of these programs are aimed at assisting customers to use natural gas as efficiently as possible, both as a means of achieving savings for the customer as well as an environmentally friendly way to conserve the use of a natural resource. These programs, while effective, are not a viable alternative for the Project for a number of reasons:

First, the Project is not premised primarily on the need to meet existing or future load demands but also on the need to obtain additional diversity in the pipeline capacity and gas supply sources currently serving the St. Louis market.

Second, while energy efficiency programs are important, much of the efficiency gains have already been achieved and the remaining overall impact on load growth is limited, and not a significant enough factor to reduce or eliminate the need for the Project.

Third, by delivering natural gas through a new pipeline facility that will have less potential for fugitive methane emissions, the Project will complement the environmental and economic goals of energy efficiency programs, rather than compete with them.



For all of these reasons, energy conservation efforts, while important and ongoing, would not be a viable or practicable alternative to the planned new pipeline facility.

10.2.2 Alternative Energy Sources

The use of alternative sources of energy in place of the natural gas transportation service to be provided by the Project would not meet the Project's purpose and need. As described above, this Project is fundamentally intended to enhance the long-term supply security and cost competitiveness of natural gas to meet the needs of existing residential, commercial, and industrial natural gas customers of the Foundation Shipper, LGC. Those natural gas customers' needs could not be met with alternative fuels.

In addition, the Project's support of increased natural gas supply to meet new industrial and electric generation demand is intended to displace alternative fuels such as coal that emit more carbon dioxide ("CO₂") per unit of usable energy produced than natural gas. Thus, foregoing this additional natural gas infrastructure would have the harmful environmental effect of undermining the reduction of CO₂ emissions that could be achieved through conversion to natural gas. This could, in turn, challenge the region's ability to meet United States Environmental Protection Agency ("USEPA") and other environmental goals and standards.

Moreover, it is well recognized that renewable electricity generation, such as wind and solar power, require flexible and complementary electric power production from facilities such as natural gas fired generators in order to address their intermittency (Popp et al. 2016). To the extent the Project would be used to support new gas-fired generation, the no-action alternative could negatively affect the development of alternative, renewable energy sources.

10.3 System Alternatives

System alternatives are alternatives to the proposed action that would make use of other existing, modified, or proposed natural gas pipeline systems or compression to meet the stated purpose and need for the proposed Project. System alternatives involve the transportation of the equivalent amount of incremental natural gas volumes by the use or expansion of existing pipeline systems or by the construction and operation of other new pipeline systems.

To be a viable system alternative for consideration, a potential system needs to be capable of transporting 350,000 Dth/d from the REX system to a point near the LGC underground storage facility in St. Louis County, Missouri. Spire does not have existing transmission infrastructure within its local distribution system, therefore alternatives are limited. Currently, unsubscribed capacity on existing pipeline systems into the St. Louis region is limited to approximately 45,000 to 60,000 Dth/d as a combined total on the systems of Enable MRT and MoGas Pipeline, LLC ("MoGas"). Thus, there is no existing system alternative that could meet the purpose and need of the Project and any system alternative would require the construction of substantial modified or additional pipeline facilities. Such modifications or additions would result in environmental impacts that would in all likelihood be similar to, and potentially greater than, those associated with construction of the proposed Project. Mapping in Appendix 10-A shows the system alternatives considered.



10.3.1 Natural Gas Pipeline Company of America, LLC

Natural Gas Pipeline Company of America, LLC's ("NGPL") Gulf Coast line runs from South Texas to Chicago, Illinois with a spur running east-to-west toward St. Louis and terminating near Glen Carbon, Illinois. The NGPL system does not currently deliver gas directly into the St. Louis, Missouri region.

To meet the needs of Spire's shippers, NGPL would need to expand its existing system in multiple respects in order to provide firm service that would replicate the service proposed by the Project. First, NGPL would need to construct greenfield facilities extending its existing east-west line in Illinois in order to make deliveries to the St. Louis region. Second, Spire understands that NGPL would need to add compression to expand that existing east-west line to meet the volume needs of Spire's Foundation Shipper. The addition of compression would have impacts on air quality that are not presented by the Project as proposed. Third, Spire's Foundation Shipper would need to contract for firm transportation service on the NGPL Gulf Coast Main Line in order to receive gas from NGPL's interconnection with REX for delivery to the St. Louis region. An incremental 350,000 Dth/d of available, unsubscribed, north-to-south firm capacity on NGPL does not presently exist and therefore an expansion of that mainline pipeline system would need to be undertaken, with consequent environmental and cost effects.

NGPL is currently seeking to expand its system in a southbound direction. In the "Gulf Coast Expansion Project" certificate application pending in Docket No. CP16-488-000,¹ NGPL has proposed to expand its mainline system to serve growing industrial markets along the Gulf Coast. The Project, which is fully subscribed under long-term customer contracts, is designed to provide 460,000 Dth/d of firm transportation service from NGPL's interstate pipeline interconnects with REX in Illinois and other pipelines in Arkansas, Oklahoma, and Texas to points south on NGPL's pipeline system. It uses both existing capacity and new expansion capacity of 240,000 Dth/d created through the construction of new and upgraded compression and other ancillary facilities. In May 2016, NGPL proposed a second southbound expansion, and the indicative rates advertised in NGPL's solicitation of interest were \$0.40 Dth/d and \$0.45 Dth/d.² Based on these illustrative upstream capacity charges (which do not include the additional costs that would be associated with greenfield and expanded capacity in Illinois), an NGPL system alternative would not have been economically viable for the Project's market and therefore deemed not a reasonable alternative.

10.3.2 MoGas Pipeline, LLC

The MoGas system runs from Curryville, Missouri south toward the St. Louis region, with branches running southwest toward Rolla, Missouri and east toward Alton, Illinois.

¹ Abbreviated Application of Natural Gas Pipeline Company of America LLC for a Certificate of Public Convenience and Necessity to Construct and Operate Facilities for Authorization to Abandon Facilities, FERC Docket No. CP16-488-000 (filed August 1, 2016).

² Natural Gas Pipeline Company of America LLC, Gulf Coast Southbound Expansion Project Phase 2, Notice of Nonbinding Solicitation of Interest (May 10, 2016). See http://www.kindermorgan.com/content/docs/NGPL_GCML_posting.pdf.



MoGas's current system total firm capacity is approximately 100,000 Dth/day.³ It is, therefore, substantially smaller than the Project and could not meet the needs of Spire's shipper(s) even if that pipeline system was not already substantially subscribed to other customers (which it is).⁴

Moreover, no expansion of the current MoGas pipeline system could accommodate the needs of Spire's market. Instead, an entire new pipeline system more than 80 miles in length would need to be constructed along the MoGas pipeline corridor. Such a new pipeline system would encompass the entire MoGas mainline segment as well as the entire branch of MoGas running to West Alton, Missouri. Though collocation of such a new pipeline with the existing MoGas system might result in some benefits, the significantly greater length would also have greater environmental effects than the Project. The substantially higher rates likely to be associated with this system alternative also made it not viable for Spire's shipper(s) and therefore not a reasonably practicable alternative.

10.4 Route Alternatives

Spire has evaluated many route alternatives for the Project as presented below. For the purpose of this resource report, Spire has analyzed major and minor route alternatives and minor route deviations. Major alternatives are those which significantly deviate from the Proposed Route; minor route alternatives are those which deviate from the Proposed Route but are still located within the same general area. Minor route deviations consist of those minor route adjustments which are incorporated into the Project route in order to avoid specific features (e.g., structures, topography, or sensitive resources).

Spire utilized a Preliminary Pipeline Route Optimization ("PPRO") tool to initially identify route alternatives during the planning stages of the Project. The PPRO tool is a proprietary geographic information systems ("GIS") enabled desktop pipeline routing tool and pipeline routing database that can generate multiple preliminary pipeline routes based on engineering, construction, environmental, land, and socioeconomic factors. PPRO provides impact analysis reporting and crossing reports such as slope, landownership, structures, wetlands, waterbodies, roads, and railroads. Route alternatives identified and considered during the Project planning to date are described below.

In order to provide a common comparison between the Proposed Route and the major and minor alternatives, Spire utilized aerial imagery and publically available environmental datasets to analyze the potential environmental constraints associated with each route. This method of analysis provides an equivalent comparison of each route since field surveys are not conducted along the alternative routes. The analyses presented below are based on publically available datasets, and do not account for the baseline civil, biological and cultural surveys that Spire undertook on its Proposed Route. In addition, while Spire completed geotechnical investigations at the proposed HDDs on the Proposed Route, no geotechnical studies have been conducted to determine the feasibility of the required drills for the major river crossings on the alternative routes. Field-collected environmental data

³ MoGas Pipeline LLC, FERC Docket No. CP16-26-000, Abbreviated Application of MoGas Pipeline LLC for Abandonment Authority and for a Certificate of Public Convenience and Necessity to Lease Pipeline Facilities (submitted November 30, 2015).

⁴ See MoGas Pipeline LLC, Index of Customers, <http://www.gasnom.com/ip/mogas/>.



and Project-related construction and operational impacts related to the Proposed Route are provided elsewhere within this Environmental Report. The major and minor alternatives reviewed are generally located in similar areas, therefore it is anticipated that equivalent effects to the environment would be identified along the other alternative routes.

10.4.1 Major Route Alternatives

Two major route alternatives were considered for the 24-inch pipeline portion of the Project, as described in detail below. Mapping included in Appendix 10-B shows the major route alternatives considered, including Spire’s Proposed Route. An environmental comparison table based on publically available desktop data is provided as Table 10.4-1.

Table 10.4-1. Environmental Comparison of Major Route Alternatives

Environmental Factor¹	Proposed Route with Line 880 Modifications	Illinois Major Route Alternative with Line 880 Modifications	Missouri Major Route Alternative with Line 880 Modifications
Total Length			
Greenfield Pipeline (mile)	59	66	78
Existing Pipeline (mile)	7	7	7
Type of Right-of-Way			
Adjacent to Existing Pipeline Right-of-Way (mile)	2.3	5.7	7.5
Adjacent to Other Existing Right-of-Way/Corridors (mile)	16.9	15.2	25.8
Right-of-Way Requirements			
Construction Right-of-Way and ATWS (acre) ²	641.9	726.2	860.3
Permanent Easement (acre)	358.2	399.4	473.9
Compression Requirements (acre)	0.0	15.0	30.0
Wetlands			
Forested (PFO) (mile)	0.5	0.7	1.6
Scrub-Shrub (PSS) (mile)	0	< 0.1	0.1
Total Wetland Impacts (PFO, PSS, PEM, PUB) (acre)	7.2	9.4	32.7
Wetland Complexes (number)	12	13	25
Waterbodies			
Total Perennial Crossed [National Hydrography Dataset (NHD) Flowline Data] (number)	10	14	6
Major Crossings (more than 100 feet) (number)	2	2	3
Designated Natural and Scenic Rivers (number)	0	0	0
Ponds/lakes (number)	2	1	16



Table 10.4-1. Environmental Comparison of Major Route Alternatives (Continued)

Environmental Factor ¹	Proposed Route with Line 880 Modifications	Illinois Major Route Alternative	Missouri Major Route Alternative with Line 880 Modifications
Federally Listed Endangered or Threatened Species			
Critical Habitat (number)	0	0	0
Cultural Resources			
NRIS Cultural Site (number)	0	0	0
Land Use			
Barren (mile)	0.2	< 0.1	< 0.1
Developed (mile)	8.8	10.9	8.7
Forest (mile)	4.5	6.7	11.1
Herbaceous (mile)	0.0	0.1	0.8
Planted/Cultivated (mile)	50.8	53.1	61.9
Shrubland (mile)	0.0	0.0	0.2
Water (mile)	0.9	0.7	0.5
Wetlands (mile)	0.6	1.8	2.0
Residences and Other Structures			
Within 50 Feet of Construction Work Area (number)	25	28	42
Land Ownership			
Conservation Easement (mile)	0	0	2.7
Protective Management Area - Land, Lake or River (mile)	0.5	0	1.9
USACE-owned Land ³ (mile)	0.3	1.3	0

Notes:

- ¹ Data is based on publically available datasets and desktop analysis, unless otherwise noted.
- ² For the alternative routes, the assumed construction right-of-way is 90 feet wide, and the assumed permanent easement is 50 feet wide.
- ³ Mapping was provided by USACE St. Louis District for owned lands and flowage easements and digitized into a GIS data layer for areas within the vicinity of the Proposed Route. This may not be inclusive of all lands owned by the USACE. On the Proposed Route this area overlaps with the area identified as the Upper Mississippi Conservation Area (included under Protective Management Area).

10.4.1.1 Illinois Route

The Illinois Route was developed to provide an alternative crossing of the Mississippi River. The Illinois Route originates at REX in Morgan County, Illinois, and travels south through Macoupin and Madison Counties, Illinois, before crossing the Mississippi River and terminating at the intersection of Line 880 and Enable MRT in St. Louis County, Missouri. The total length of greenfield pipeline would be approximately 66 miles, along with utilization of Line 880, which consists of approximately seven miles of existing pipeline. Under the Illinois Route, Spire would need to acquire and modify the existing Line 880 to deliver gas to the Foundation shipper’s desired delivery



location in north St. Louis County. Approximately 29 percent of this alternative route would collocate with existing pipeline, powerline, and road or railroad right-of-ways. This major route alternative would avoid crossing the Missouri River and its associated levee, but would cross federal lands owned by the United States Army Corps of Engineers (“USACE”) on the east side of the Mississippi River. There is also a crossing of a canal that serves vessels utilizing the Mississippi River for shipping. It would be likely that one horizontal directional drill (“HDD”) would be required for the Mississippi River and a second HDD would be required to cross the canal, since traversing both the river and the canal may not be technically feasible in a single drill.

Under this alternative it is anticipated that approximately 3,300 horsepower of compression would be needed in order to provide the pressure required to flow the gas to the northern end of Line 880, which connects to a storage field owned by the Foundation Shipper. An approximately 15-acre site would be anticipated for construction of the compression facility, with approximately 10 acres maintained for operations.

The greenfield portion of the Illinois Route is approximately seven miles longer than the 24-inch pipeline portion of the Proposed Route, and would therefore be expected to result in greater impacts as a result of construction and operation. In addition, the greenfield portion of the Illinois Route impacts a larger proportion of highly populated areas and developed areas, including more medium intensity and high intensity areas than the 24-inch pipeline portion of the Proposed Route. Impacts associated with the Line 880 modifications are equivalent between the routes. Based on United States Fish and Wildlife Service (“USFWS”) National Wetlands Inventory (“NWI”) data, the Illinois Route with Line 880 modifications would be expected to cross 0.7-mile forested/shrub wetlands and 13 wetland complexes. While this is comparable to the number of crossings that would be expected on the Proposed Route, the total mileage of forested/shrub wetlands crossed would be approximately 0.3-mile greater for the Illinois Route with an additional two acres of wetland impact. With the Illinois Route having additional pipeline mileage, the construction of an above-ground compressor station facility, and the crossing of more populated areas, it would be expected to consequently result in a greater environmental impact and an increase in air emissions. Therefore, Spire has determined in comparison to the Illinois Route that the Proposed Route is the better option for the project.

10.4.1.2 Missouri Route

The Missouri Route originates at REX, west of the Mississippi River in Pike County, Missouri, and travels southeast through Lincoln and St. Charles Counties, Missouri, before terminating at the existing Line 880 in St. Louis County, Missouri. The total length of greenfield pipeline would be approximately 78 miles, along with utilization of Line 880, which consists of approximately seven miles of existing pipeline. Under the Proposed Route and the Missouri Route, Spire would need to acquire and modify the existing Line 880 to deliver gas to the Foundation shipper’s desired delivery location in north St. Louis County. Approximately 39 percent of this alternative route would collocate with existing pipeline, powerline, and road or railroad right-of-ways. This major route alternative would eliminate the need for a crossing at the Mississippi River, and would include one HDD crossing of the Missouri River and its associated levee. In addition, compression would be needed on this alternative to achieve the necessary delivery pressures on Line 880, which would result in additional permanent impacts associated with the construction of a new compressor station. An approximately 30-acre site would be anticipated for the compression facility, with approximately 20 acres maintained for operations.



The greenfield portion of the Missouri Route is approximately 20 miles longer than the 24-inch pipeline portion of the Proposed Route, and would therefore be expected to result in greater impacts during construction and operation, particularly in forested areas. Based on review of aerial mapping, the areas crossed by the Missouri Route would cross significantly more Pipeline and Hazardous Materials Safety Administration (“PHMSA”) Ecological High Consequence Areas (“HCAs”) than the Proposed Route. Based on USFWS NWI data, the Missouri Route with Line 880 modifications would be expected to cross 1.7 miles of freshwater forested/shrub wetlands and 25 wetland complexes, which is significantly greater than the other alternatives considered. As it would require additional compression, the Missouri Route would result in an increase in air emissions during operation. The Missouri Route crosses two Protective Management Areas in St. Charles County managed for multiple uses, one controlled by Whistling Wings and the second by Decoy Inn, LLC. With the Missouri Route having additional pipeline mileage, the construction of an above-ground compressor station facility, and the crossing of more populated areas, it would be expected to consequently result in a greater environmental impact and an increase in air emissions. Therefore, Spire has determined in comparison to the Missouri Route that the Proposed Route is the better option for the Project.

10.4.1.3 Proposed Route

The Proposed Route traverses the shortest constructible route between the desired source of gas and the St. Louis delivery location on existing Line 880. The Proposed Route originates at REX in Scott County, Illinois, and travels south through Greene and Jersey Counties, Illinois, before crossing the Mississippi River and extending east in St. Charles County, Missouri. The route then crosses the Missouri River and ties into the existing Line 880 in St. Louis County, Missouri. The total length of greenfield 24-inch pipeline would be approximately 59 miles, along with utilization of Line 880, which consists of approximately seven miles of existing pipeline. As is the case with either of the two major route alternatives, under the Proposed Route, Spire would need to acquire and modify the existing Line 880 to deliver gas to MRT. The proposed 24-inch pipeline portion of the Proposed Route would be colocated with existing pipeline, powerline, road or railroad corridors for approximately 29 percent of the route.

The Mississippi and Missouri Rivers would be crossed via two HDDs. The HDD of the Mississippi River would also cross the Upper Mississippi Conservation Area and federal lands owned by the USACE on the south side of the Mississippi River. No earth disturbance or clearing will occur on this property. Based on USFWS NWI data, the Proposed Route would be expected to cross 0.5-mile of freshwater forested/shrub wetlands and 12 wetland complexes.

The Proposed Route crosses property owned by The Principia on the north side of the Mississippi River. However, this area is the portion of the Proposed Route that is colocated to minimize environmental impacts and provides the most technically feasible HDD crossing of the Mississippi River and federally-owned land as further described in Section 10.4.2.4.

Overall, the Proposed Route is expected to have fewer environmental impacts due to the shorter length and smaller construction footprint of greenfield pipeline. Also, no additional compression is required for the Proposed Route, which avoids the construction of an above-ground compressor station facility as well as its consequent



increase in emissions and impacts on air quality during operation of the Project. The Proposed Route has the least impact among the alternative routes to forests; of which 0.8 miles is colocated adjacent to an existing pipeline right-of-way through the largest area of contiguous forest on the north side of the Mississippi River. The Proposed Route also has the least impact on forested/shrub wetlands among the alternative routes and would affect fewer residences than the major alternative routes. For these reasons, the Proposed Route is the preferred route which meets the purpose and need of the Project, while minimizing environmental impact.

10.4.2 Minor Route Alternatives

Five minor alternatives were considered for the 24-inch pipeline portion of the Project, as described in detail below. A table showing a quantitative comparison of the minor alternatives and the corresponding segment of the Proposed Route is provided in Table 10.4-2. A map of the minor route alternatives is included in Appendix 10-C. Minor Alternatives 1 through 3 were initially considered for other potential interconnect points with the REX pipeline system. Minor Alternative 4 was considered for the crossing of the Mississippi River, and Minor Alternative 5 was considered as an alternative to the Line 880 modifications.

10.4.2.1 Minor Alternative 1

Minor Alternative 1 is a route variation considered between approximate milepost (“MP”) 0.0 and MP 2.2 in Scott County, Illinois. This variation would move the interconnect with REX west of the Proposed Route. This alternative is not preferred because it would cross one freshwater pond and impact approximately 0.4-mile of additional deciduous forest versus the Proposed Route. Therefore, this alternative was not incorporated into the Proposed Route.

10.4.2.2 Minor Alternative 2

Minor Alternative 2 is a route variation considered between approximate MP 0.0 and MP 7.4 in Scott and Greene Counties, Illinois. This variation would move the interconnect with REX east of the Proposed Route. The route would increase the overall length by approximately one-mile. Minor Alternative 2 would reduce impacts to deciduous forests by approximately 0.4-mile and reduce the crossing of freshwater forested/shrub wetland by 0.03-mile. However due to the increase length of the route, the total construction impacts would be increased by approximately 12 acres. This alternative also includes colocation with existing right-of-ways along 20 percent of the route, whereas the Proposed Route is colocated for 33 percent of the route. Therefore, this alternative was not incorporated into the Proposed Route.



Table 10.4-2. Environmental Comparison of Minor Route Alternatives

Environmental Factor ^{1,2}	24-inch Pipeline								Line 880	
	Alternative at MP 0.0 to MP 2.2		Alternative at MP 0.0 to MP 7.4		Alternative at MP 0.0 to MP 13.0		Alternative at MP 43.1 to MP 47.0		Alternative at MP 0.0 to MP 7.0	
	Proposed Route	Minor Alternative 1	Proposed Route	Minor Alternative 2	Proposed Route	Minor Alternative 3	Proposed Route	Minor Alternative 4	Proposed Route ³	Minor Alternative 5
Total Length (miles)	2.0	2.1	7.4	8.5	13.0	13.2	3.9	4.0	7.0	6.5
Type of Right-of-Way										
Adjacent to Existing Pipeline Right-of-Way (mile)	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.6
Adjacent to Other Existing Right-of-Way/Corridors (mile)	0.0	0.0	2.4	1.7	5.3	2.0	0.5	0.0	0.2	1.1
Right-of-Way Requirements										
Construction Right-of-Way (acre)	22.1	22.7	80.6	92.8	142.1	144.3	37.0	43.7	8.0	71.4
Permanent Easement (acre)	12.3	12.6	44.8	51.5	79.0	80.2	23.5	24.3	0.4	39.6
Wetlands										
Forested (PFO) (mile)	0.0	0.0	<0.1	0.0	<0.1	0.0	0.1	0.2	0.0	0.0
Scrub-Shrub (PSS) (mile)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Wetland Impacts (PFO, PSS, PEM, PUB) (acre)	0.0	0.0	0.3	0.0	0.3	0.3	1.6	2.4	0.1	0.4
Wetland Complexes (number)	0	0	1	0	1	1	2	2	1	2
Waterbodies										
Total Perennial Crossed (NHD Flowline Data) (number)	0	0	3	0	4	2	1	1	1	1
Major River Crossings (more than 100 feet) (number)	0	0	0	0	0	0	0	0	0	0
Designated Natural and Scenic Rivers (number)	0	0	0	0	0	0	0	0	0	0
Ponds/Lakes (number)	0	1	0	0	0	1	1	1	0	3



Table 10.4-2. Environmental Comparison of Minor Route Alternatives (Continued)

Environmental Factor ^{1,2}	24-inch Pipeline						Line 880			
	Alternative at MP 0.0 to MP 2.2		Alternative at MP 0.0 to MP 7.4		Alternative at MP 0.0 to MP 13.0		Alternative at MP 43.1 to MP 47.0		Alternative at MP 0.0 to MP 7.0	
	Proposed Route	Minor Alternative 1	Proposed Route	Minor Alternative 2	Proposed Route	Minor Alternative 3	Proposed Route	Minor Alternative 4	Proposed Route ³	Minor Alternative 5
Federally Listed Endangered or Threatened Species										
Critical Habitat (number)	0	0	0	0	0	0	0	0	0	0
Cultural Resources										
NRIS Cultural Site (number)	0	0	0	0	0	0	0	1	0	0
Land use										
Developed (mile)	0.1	0.2	1.2	0.5	1.4	0.6	0.6	0.1	<0.1	0.0
Forest (mile)	<0.1	0.5	1.0	0.6	1.0	0.8	0.9	1.3	5.3	2.3
Planted/Cultivated (mile)	1.9	1.5	5.1	7.5	10.6	11.9	1.5	1.6	1.0	1.9
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.0	<0.1
Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.6	2.0
Residences and Other Structures										
Within 50 Feet of Construction Work Area (number)	0	1	0	0	0	0	2	2	21	12
Land Ownership										
Conservation Easement (mile)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Protective Management Area - Land, Lake or River (mile)	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	0.0
USACE-owned Land (mile)	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0

Notes:

- ¹ Data is based on desktop analysis.
- ² For the alternative routes, the assumed construction right-of-way is 90 feet wide, and the assumed permanent easement is 50 feet wide.
- ³ Modifications are proposed at specific locations along the existing Line 880. Land use estimates are reported for the complete line.



10.4.2.3 Minor Alternative 3

Minor Alternative 3 is a route variation considered between approximate MP 0.0 and MP 13.0 in Scott and Greene Counties, Illinois. This variation would move the interconnect with REX further east of the Proposed Route and pass to the east of White Hall, Illinois. The length of the pipeline would increase by approximately 0.2-mile. It crosses two additional perennial waterbodies and a fresh water pond, and also includes two additional railroad crossings. The amount of forested/shrub wetland is reduced by one. Minor Alternative 3 is located in closer proximity to the residential areas of White Hall and Roodhouse, Illinois. Approximately 15 percent of this alternative is colocated with existing rights-of-way, whereas the proposed route is colocated for approximately 41 percent of its length. This alternative would potentially be affected by the future plans to improve the US 67 corridor, as a bypass is proposed to the east of White Hall and Roodhouse, Illinois. This alternative was not incorporated into the Proposed Route because of this potential future conflict.

10.4.2.4 Mississippi River Crossing Alternatives

In determining constructability of any north to south route, the crossing location of the Mississippi River was the foremost consideration. A siting review was completed using both desktop data and field reconnaissance. A variety of constraints are present in the area including densely populated and extensively developed areas to the east, and the presence of the Illinois River to the west, which would result in additional environmental impacts if also crossed. Given these constraints, potential Mississippi River crossing locations for the Proposed Route were considered within a 15-mile length of the river between Grafton, Illinois and Melville, Illinois. In evaluating the crossing location for the Illinois Route major alternative, Spire also reviewed an approximately 4 mile section of the river south of Alton, from Lewis and Clark State Historic Site to Interstate 270, as discussed in Section 10.4.1.1.

When reviewing this area for potential HDD crossings, a variety of factors were evaluated, including:

- a relatively level area at least 200 feet by 200 feet such that it would provide adequate space to conduct drilling operations;
- a sufficient pipe staging area that is approximately the length of the crossing to facilitate the proper stringing and welding of the pipe in advance of pull-back; stopping and restarting the pull-back of the pipeline would introduce increased stress on the pipe and introduce a higher risk that the pipe may get stuck, which may result in failure of the drill;
- sufficient access for heavy equipment to the drilling operation site;
- minimized elevation differences between the two entry/exit locations, as large elevation differential increases the risk of pipe damage and/or inadvertent returns of the drilling fluid;
- location of HDD workspaces outside of sensitive resources such as conservation easements, flowage easements, areas prone to flooding, and sensitive habitats;
- location of residences or other occupied structures that may be impacted by the sound of the drilling operations; and
- minimized length of the overall drill which increases success rates (see Figure 10.4-1).



Figure 10.4-1 illustrates a compilation of successfully completed crossings in North America by major HDD contractors (Mott MacDonald 2015). The common range of industry experience/capability, in green, was established based on the requirement that several contractors have completed similar installation lengths at the specific diameter. Installation lengths and diameters that are considered feasible given an experienced contractor and favorable ground conditions are in yellow. Other installation lengths and diameters are considered to be at or beyond the state-of-practice for the industry.

Figure 10.4-1. Summary of HDD Industry Drill Success in North America

Product Pipe Diameter	Installation Length												
	1,000 m 3,281 ft	1,200 m 3,937 ft	1,400 m 4,593 ft	1,600 m 5,249 ft	1,800 m 5,905 ft	2,000 m 6,562 ft	2,200 m 7,218 ft	2,400 m 7,874 ft	2,600 m 8,530 ft	2,800 m 9,186 ft	3,000 m 9,842 ft	3,500 m 11,483 ft	3,750 m 12,303 ft
200 mm (8 inch)	16	9	14	4	5	10	5	0	0	0	1	0	1
250 mm (10 inch)	9	9	4	11	1	0	3	1	0	0	0	0	0
300 mm (12 inch)	14	10	9	4	3	1	0	1	1	0	0	1	0
350 mm (14 inch)	3	5	3	0	1	0	0	0	0	0	0	0	0
400 mm (16 inch)	9	4	4	6	4	1	3	0	0	0	2	0	0
450 mm (18 inch)	0	0	0	2	0	0	0	0	0	0	0	0	1
500 mm (20 inch)	8	10	9	1	0	1	2	1	0	0	0	0	0
600 mm (24 inch)	29	30	9	12	9	4	1	2	0	0	1	0	0
750 mm (30 inch)	23	10	10	11	8	3	1	3	0	0	1	0	0
900 mm (36 inch)	23	21	21	6	2	1	2	0	1	0	0	0	0
1050 mm (42 inch)	29	21	11	5	1	1	0	0	0	0	0	0	0
1200 mm (48 inch)	1	2	1	0	0	0	0	0	0	0	0	0	0

Colour Coding:

- Within typical capabilities of industry. Multiple experienced contractors.
- Zone of limited industry application. Considered feasible with an experienced contractor and favourable ground conditions.
- Exceeds current capabilities of industry. Considered risky even with an experienced contractor and favourable ground conditions.

Note:

Information presented is based solely on the reported installation lengths and diameters. Site-specific geotechnical and installation based risks were not considered in developing this chart.

The northern bank of the Mississippi River presents several constraints in siting a potential crossing. It consists of high bluffs with few locations of low relief, which result in large elevation differences and isolated pockets of concentrated development. Several populated towns are located on the north bank of the Mississippi in Jersey County, including Grafton, Chautauqua, Elsay, Lockhaven, Melville, and Alton, Illinois. The Raging Rivers Water Park is located between Grafton and Chautauqua, and Pere Marquette State Park and the Two Rivers National Wildlife Refuge are located west of Grafton.

The south bank consists of multiple conservation easements and environmentally sensitive areas, including a floodplain with protected islands and flooded sloughs. Portage Island, near Portage des Sioux, Missouri, is part of the Two Rivers National Wildlife Refuge. As a result, there are limited opportunities for constructible pipeline crossings.

The proposed crossing is located in one of the few undeveloped low relief areas of the bluffs on the north bank and minimizes overall drill length, while still allowing Spire to cross federally-owned lands on the south bank via a trenchless method. The proposed crossing location also provides the opportunity to minimize the elevation differences between the entrance and exit locations of the proposed HDD due to an existing cutout in the bluffs.



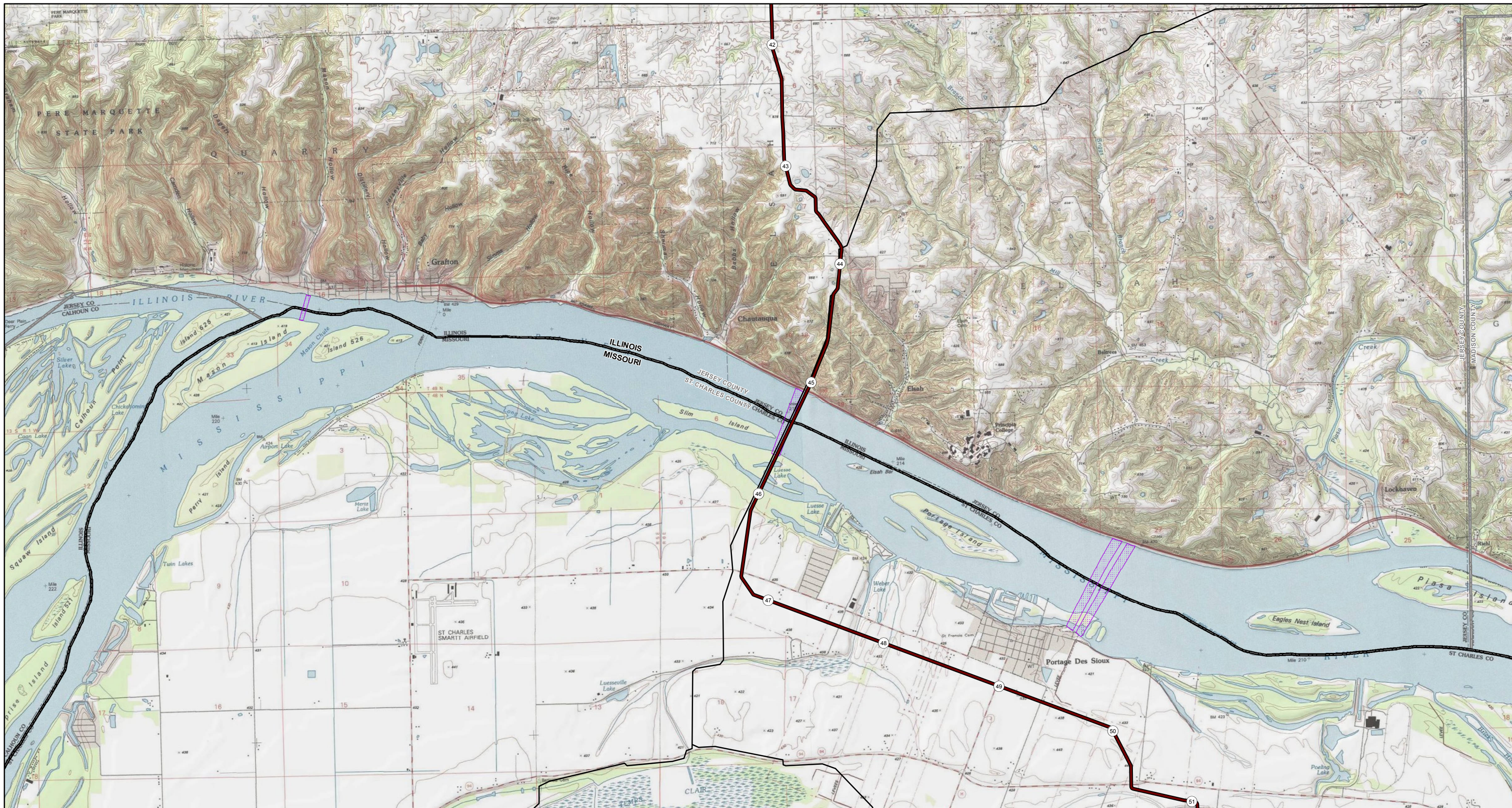
Both overall drill length and elevation differences are two of the key risk factors considered when evaluating an HDD crossing for the potential of inadvertent release of drilling fluids. The Proposed Route collocate with an existing right-of-way at the crossing of the Mississippi River, thereby minimizing tree clearing and other impacts; there are no other collocation opportunities available within the area reviewed. Other locations evaluated in the area failed to provide constructible low relief locations at the bluffs on the north bank; avoidance of impacts to conservation easements and sensitive areas on both the north and south banks; avoidance of direct impacts to protected lands on the south bank; and/or minimized total length of the HDD for acceptable constructability risks.

In addition, Spire reviewed the entire area between Grafton, Illinois and Alton, Illinois for known utility corridors in which to collocate the proposed route. The only known utility identified was the existing pipeline right-of-way adjacent to the Proposed Route (NuStar) near river mile 215. Two pipeline/cable crossings are identified on USACE navigation charts near river mile 212 near Portage Des Sioux; however Spire was unable to confirm the presence, type, or ownership of these lines, and did not identify a constructible crossing of the river in this area (USACE 2011). The crossing location for the Proposed route is shown relative to other existing utility crossings on Figure 10.4-2.

As a result of this review, Spire identified one potentially constructible alternative crossing, described below as Minor Alternative 4. However, no other constructible alternative routes were identified due to the engineering and environmental constraints discussed; therefore no further environmental analysis of minor alternatives at the Mississippi River crossing is available.

Minor Alternative 4

Minor Alternative 4 is an alternative considered between MP 43.1 and MP 47.0 as an alternative crossing of the Mississippi River. This alternative would involve relocating the HDD crossing of the Mississippi River approximately 3,800 feet upstream from the Proposed Route. The increase in length of pipeline would be negligible at approximately 0.1-mile. The HDD would be approximately 400 feet longer than currently proposed route. This alternative would result in 0.14-mile greater crossing length of freshwater forested/scrub-shrub wetlands, as well as an increase of 0.5-acre of impacts to forest land. Minor Alternative 4 also crosses the New Piasa Chatauqua Historic District in Jersey County, Illinois; the Upper Mississippi Conservation Area via HDD in St. Charles County, Missouri; and the adjacent conservation easement of Ducks Unlimited, which is also registered as the privately owned Protective Management Area Raccoon Ranch and managed for multiple uses including hunting. The length of pipeline on USACE-owned lands would be comparable to the Proposed Route; however, this alternative would cross both USACE controlled lands and a flowage easement. Unlike the Proposed Route, this alternative route does not collocate with existing rights-of-way and would therefore impact extensive and unfragmented forest lands.



① MILE POST	BURIED PIPELINE OR CABLE FROM U.S. ARMY CORPS OF ENGINEERS UPPER MISSISSIPPI RIVER CHART MAPS (DIGITIZED) **
PROPOSED 24-INCH DIAMETER PIPELINE	COUNTY BOUNDARY
EXISTING NUSTAR PIPELINE (DIGITIZED)*	STATE BOUNDARY

* THE NUSTAR CENTERLINE WAS DIGITIZED UTILIZING THE PHMSA NATIONAL PIPELINE MAPPING SYSTEM DATA VIEWER. (HTTPS://WWW.NPMS.PHMSA.DOT.GOV/)
 ** BURIED PIPELINE OR CABLE EASEMENT DIGITIZED APPROXIMATE LOCATIONS WERE CREATED BASED ON THE U.S. ARMY CORPS OF ENGINEERS RIVER CHART MAPS. FOR REPRESENTATION PURPOSES ONLY. MAP COMPILED UTILIZING ESRI TOPOGRAPHIC BASEMAP.

SPIRE STL PIPELINE

PROPOSED MISSISSIPPI RIVER CROSSING

QUAD OVERVIEW

JERSEY COUNTY, ILLINOIS AND
ST. CHARLES COUNTY, MISSOURI

4,000 2,000 0 4,000 8,000 FEET

ABSOLUTE SCALE:
1:48,000

REFERENCE SCALE:
1 IN = 4,000 FEET

PREPARED FOR

Spire STL Pipeline

PREPARED BY

M M

**MOTT
MACDONALD**

DRAWN BY:	NDK 12/19/2016
CHECKED BY:	EAP 12/19/2016
APPROVED BY:	JW 12/19/2016
REV. DATE:	01/2017
REVISION:	0
DESC:	ISSUE FOR FERC
PAGE:	1 OF 1



The northern HDD entry/exit location would require a drilling spread and equipment setup near Fern Glen Valley Road in Chautauqua, Illinois. Several structures in this area, including occupied structures, are located within 0.25-mile of the alternative drill location and would be impacted by the noise of the construction. Temporary workspace for pipe staging would be located south of the river in Missouri. Based on the location of the new exit location and the increased length of the HDD installation, multiple strings would need to be staged (with intermediate welds needed during pull-back operations) due to a lack of space to stage the entire pipeline in a single pipe string. Stopping to complete intermediate welds during pullback operations increases risks to the installation due to increased installation loads and stresses to recommence pullback operations. In evaluating these additional risks on the success of the drill, the potential impact to the surrounding community due to the proximity of the drill to occupied structures, and the increased impact to unfragmented forest, it was determined that Minor Alternative 4 would be significantly less desirable than the Proposed Route.

10.4.2.5 Minor Alternative 5

Minor Alternative 5 is a route variation considered between MP 0.0 to MP 7.0 on Line 880 that would involve construction of a new pipeline loop between the Laclede/Lange Delivery Station and the MRT Bi-directional Station. In some areas the proposed loop would be up to one mile away from LGC's existing pipeline. The approximately 6.5-mile 24-inch diameter loop would maintain the planned delivery locations at Laclede/Lange Delivery Station and at MRT Bi-directional Station while leaving Line 880 in LGC's distribution system. In addition, this will also eliminate the need to transfer Line 880 into interstate service and corresponding work at the existing Redman Delivery Station. It has been reviewed as an alternative in the event that Line 880 cannot be transferred from LGC to Spire as presently planned. The construction of this alternative would involve traditional mainline techniques similar to those for the 24-inch pipeline, and stove pipe techniques in some densely populated areas. It crosses one additional wetland complex, and an additional nearly one mile of forest. This alternative would also result in greater disturbance to croplands. Approximately 26 percent of this alternative is colocated with existing rights-of-way. Unlike the Proposed Route of Line 880, which has a limited construction footprint of 8.0 acres and utilizes existing easements with public rights-of-way, Alternative 5 would require approximately 71.4 acres of construction right-of-way, and 39.6 acres of new permanent easement. Alternative 5 would reduce the number of landowners affected by the Project as it is primarily located in a less developed area, and would be within 50 feet of an estimated 12 occupied structures, compared to 21 on the proposed Line 880 modifications. This alternative would require greater construction traffic compared to the modifications currently planned along Line 880, and the construction duration is anticipated to be longer. While Minor Alternative 5 would reduce impacts to developed residential areas, it would require more disturbance to land use and environmental resources as it would be a new pipeline. Spire is continuing to evaluate the Minor Route 5 Alternative.

10.4.3 Minor Route Deviations

A minor route deviation would include minor adjustments to the Proposed Route to avoid minor issues such as topographic and man-made features. Because route deviations are considered to resolve localized resource issues (e.g., wetlands, residence, cultural resource sites), they are normally much shorter than major or minor route alternatives. A summary of minor deviations incorporated into the route is included in Table 10.4-3. Field data



was utilized for the route deviations analysis and supplemented with desktop data where field surveys were not complete. Environmental surveys were not completed for all original routes, as noted in the resource impacts description. In these areas, desktop data was utilized for all or significant portions of the original route. Field survey data for the Proposed Route may not be comparable to desktop data.

Table 10.4-3. Minor Route Deviations

Facility/ Deviation MP	Description and Justification	Change from Previous Route (miles)	Resource Impacts at Centerline
24-Inch Pipeline			
0.0 - 0.9	Shifts the pipeline east up to 660 feet to allow easier crossings of existing pipelines, and creates a perpendicular crossing at Ansley Glasgow Road.	0.0	No change.
1.2 - 2.8	Shifts the pipeline west up to 720 feet to increase offset with an existing powerline and avoid proximity to a church, and allows for easier crossing of Gourley Road at an area with lower road banks. Also creates perpendicular crossings of Havens Road and SR-106. No net change to landowner impacts.	0.1	Avoids one waterbody.
3.3 - 3.9	Shifts the pipeline west up to 270 feet to avoid pipe installation in a gully. Improves stream crossing and reduces elevation variation. No net change in landowner impacts.	0.0	Avoids one wetland and two waterbodies.
3.9 - 4.6	Shifts the pipeline west up to 300 feet to minimize tree clearing, reduce the number of stream crossings, and reduce slope crossings. No net change in impacted landowners.	0.0	Avoids two waterbodies.
5.5 - 6.8	Shifts the pipeline east up to 475 feet for constructability purposes and to minimize landowner impacts. Also minimizes impacts to PFO wetland.	0.0	Avoids one wetland and one waterbody.
10.2 - 10.3	Shifts the pipeline east up to 130 feet to improve constructability of stream and road crossing. No additional landowner impacts.	0.0	Avoids 1 waterbody.
13.3 - 16.1	Shifts the pipeline west up to 990 feet to allow for sufficient workspace when avoiding ponds adjacent to US-67, and avoid powerline alongside road. Also avoids potential conflict with future US-67 corridor improvements. Though environmental survey was not completed on the original route, crews observed very wet conditions suggesting extensive wetland areas would have been crossed. One additional landowner impacted.	0.1	Three additional wetlands (environmental survey not completed on original route).
17.8 - 24.0	Shifts pipeline west up to 3,010 feet from MP 17.8 to MP 22.1 to avoid potential conflict with future US-67 corridor improvements, with one less landowner impacted. Shifts pipeline east up to 1,500 feet from MP 22.1 to MP 23.6 to accommodate landowner preference and avoid environmentally sensitive areas. Shifts pipeline west up to 410 feet from MP 23.6 to MP 24.0 at the landowner's request. No change in landowner impacts.	0.7	Six additional waterbodies (environmental survey not completed on original route).
25.9 - 27.4	Shifts pipeline west up to 1,545 feet to accommodate landowners' preference. No net change in landowner impacts.	0.1	No change.
27.8 - 29.3	Shifts pipeline east up to 50 feet to avoid a working side crossover.	0.0	No change.
31.2 - 34.9	Shifts pipeline east up to 50 feet to avoid a working side crossover.	0.0	Two additional waterbodies.
35.1 - 41.5	Shifts pipeline west up to 2,590 feet to accommodate landowners' preference.	0.1	Four additional wetlands and 13 additional waterbodies (environmental survey not completed on original route).



Table 10.4-3. Minor Route Deviations (Continued)

Facility/ Deviation MP	Description and Justification	Change from Previous Route (miles)	Resource Impacts at Centerline
24-Inch Pipeline (Continued)			
31.2 - 34.9	Shifts pipeline east up to 50 feet to avoid a working side crossover.	0.0	Two additional waterbodies.
31.2 - 34.9	Shifts pipeline east up to 50 feet to avoid a working side crossover.	0.0	Two additional waterbodies.
35.1 - 41.5	Shifts pipeline west up to 2,590 feet to accommodate landowners' preference.	0.1	Four additional wetlands and 13 additional waterbodies (environmental survey not completed on original route).
42.6 - 45.0	Shifts pipeline west up to 1,440 feet to avoid two road crossings of Elsay Road and minimizes proximity to powerlines and streams adjacent to Elsay Road. Also adjusts route to abut existing Nustar pipeline easement. Avoids 4 landowners on the original route, and adds 3-4 additional landowners depending on workspace requirements.	0.1	One additional wetland.
46.7 - 51.1	Shifts pipeline west up to 50 feet from MP 46.7 to MP 46.9, and shifts pipeline east up to 1,875 feet from MP 46.9 to MP 50.5. The deviation then parallels the original route closely between MP 50.5 to MP 51.1. This deviation is designed to avoid environmentally sensitive resources, accommodate landowners' preference, and allow for more room for a road crossing, MLV, and bends in the area.	0.2	Five additional wetlands and one additional waterbody.
52.2 - 56.5	Shifts pipeline northeast up to 890 feet to locate the pipe adjacent to the railroad. No net change in landowner impacts.	0.1	Two additional wetlands.
57.7 - 58.8	Shifts pipeline east up to 610 feet to avoid construction on side slopes and connect to Laclede/Lange Delivery Station at its new location. Affects 2 additional parcels.	0.1	One additional wetland.
Line 880			
2.1 - 2.3	Shifts the pipeline east up to 290 feet to improve constructability of the Line 880 relocation at the crossings of State Highway 367 and Coldwater Creek.	0.0	Avoids One waterbody.

Spire will continue to incorporate minor route deviations as suggested by landowners, regulatory agencies, or to avoid or minimize environmental concerns as necessary. Should Spire identify new minor route deviations, details will be provided in supplemental filings such as the FERC Implementation Plan, and consistent with any applicable certificate conditions. Maps of the minor route deviations are provided in Appendix 10-D.

10.4.3.1 Deviation Analysis for Residences

Spire evaluated the potential to increase the offset between residences and work areas for residences within 50 feet of the construction work area for the 24-inch pipeline and within 10 feet of the construction work area of the existing Line 880, as presented in Table 10.4-4.



Table 10.4-4. Deviation Analysis for Residences

Facility/ State/ Milepost	County	Building Type	Distance from Work Area (feet) ¹	Distance from Pipeline Centerline (feet) ¹	Deviation Analysis
24-Inch Pipeline					
<i>Illinois</i>					
N/A	N/A	N/A	N/A	N/A	N/A
<i>Missouri</i>					
46.4	St. Charles	Residence	39	1,394	Workspace associated with an existing access road that will be utilized to access the HDD drill site. Alternatives to the access road would result in construction of a new road and disturbing an agricultural field. This alternative was not preferred.
46.6	St. Charles	Residence	47	712	Workspace associated with an existing access road that will be utilized to access the HDD drill site. Alternatives to the access road would result in construction of a new road and disturbing an agricultural field. This alternative was not preferred
58.3	St. Louis	Commercial	40	766	Industrial site where HDD operations are taking place for the Missouri River crossing. See Section 10.4.2.4 for a detailed discussion on alternative crossings evaluated, which were determined to pose additional risks to the Project constructability.
58.7	St. Louis	Residence	12	51	Installing the pipeline north of Fort Bellefontaine Road was evaluated. The terrain and the need for tree clearing made it a more challenging route, therefore this alternative was not preferred.
Line 880					
<i>Missouri</i>					
0.9	St. Louis	Residence	9	43	Workspace required to excavate existing pipeline system for modification.
1.6	St. Louis	Residence	8	37	Workspace required to excavate existing pipeline system for modification.
2.5	St. Louis	Residence	7	35	Workspace required to excavate existing pipeline system for modification.
2.5	St. Louis	Commercial	0	19	Workspace required to excavate existing pipeline system for modification.
2.6	St. Louis	Residence	4	51	Workspace required to excavate existing pipeline system for modification. Existing syphon needs to be removed. Proposed workspace uses open area near existing house in order to minimize disruption to traffic.
5.3	St. Louis	Residence	7	27	Workspace in the roadway required to excavate existing pipeline system for modification.

Note:

¹ Distances are approximate and derived from aerial photography.



10.5 Alternative Metering and Regulating Sites

No major aboveground facilities are proposed as part of this Project. The locations of the proposed metering and regulating (“M&R”) stations are largely driven by the terminus of each pipeline. Based on landowner feedback and/or civil survey of the proposed site locations, no alternatives are considered at this time for the REX Receipt Station, Laclede/Lange Delivery Station, or Redman Delivery Station, which is an existing facility that will be modified as part of the proposed Project.

Spire considered an alternative site for the MRT Bi-directional Station at approximate MP 6.7 on Line 880, as shown in Appendix 10-E. The property currently consists of undeveloped former residential land, with open land and some shrubs and trees. The alternative site is bordered to the west by Prigge Road and residential properties, to the north by an educational facility and agricultural land, to the east by residential property, and to the south by Prigge Road, forested land, and a senior healthcare facility. Spire would purchase the approximately three-acre parcel for construction of the new M&R facility. Unlike the proposed MRT Bi-directional Station, the alternative would be located outside of the floodplain of the Mississippi River. No streams or wetlands were identified on site, and no recognized environmental conditions were identified during a Phase I Environmental Site Assessment. Spire is continuing to evaluate the potential to locate the proposed MRT Bi-direction Station at this location.

10.6 References

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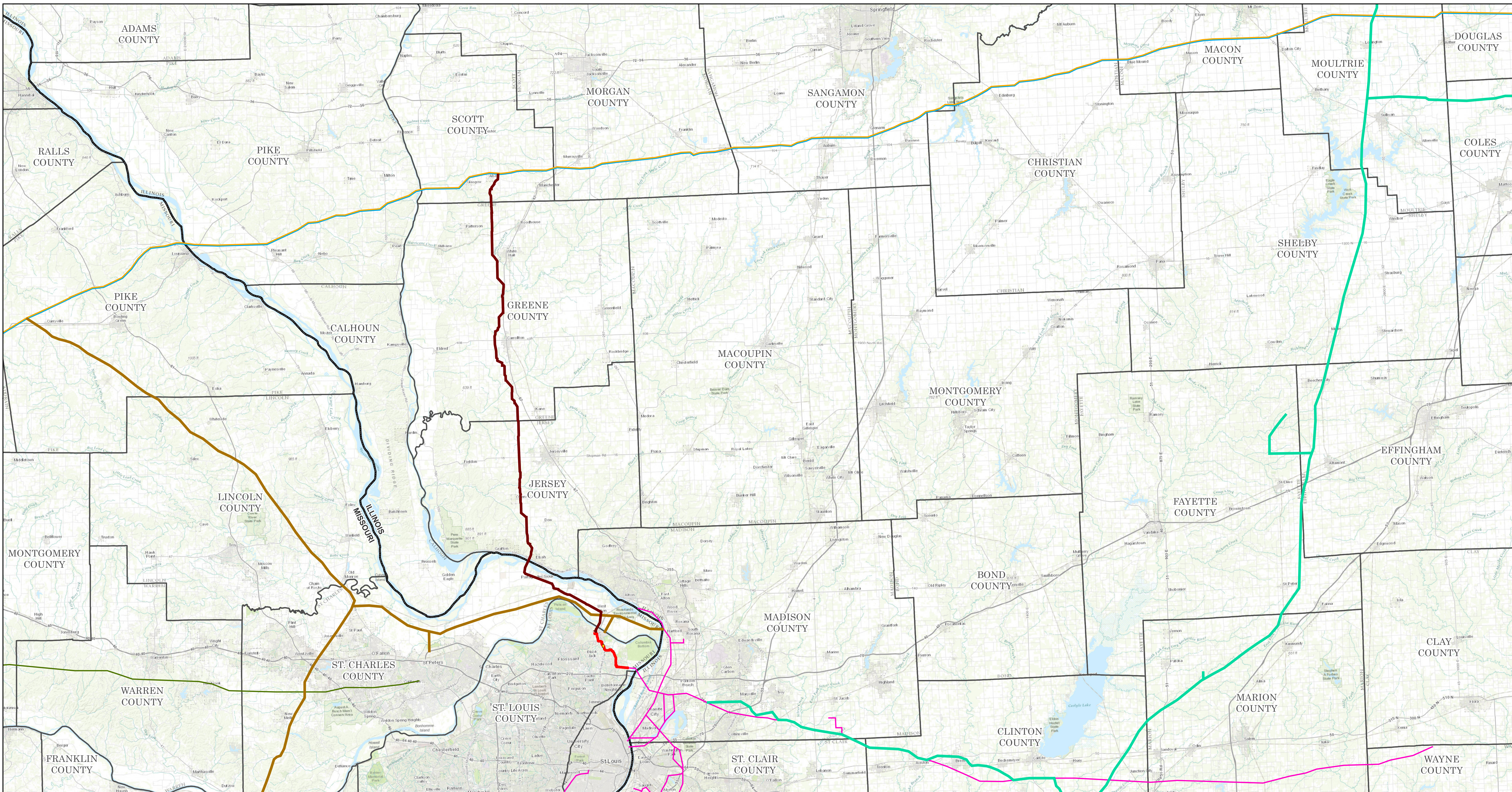
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APPENDIX 10-A
System Alternatives Map



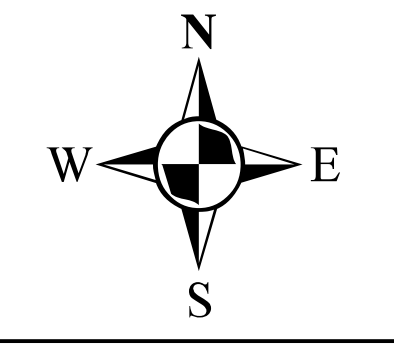
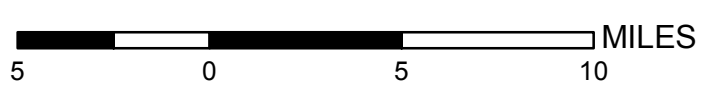
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|---|------------------------------------|-----------------|
| PROPOSED 24-INCH DIAMETER PIPELINE | OTHER PIPELINE FACILITIES | COUNTY BOUNDARY |
| LINE 880 20-INCH DIAMETER RELOCATION | ROCKIES EXPRESS PIPELINE (REX) | STATE BOUNDARY |
| EXISTING LINE 880 20-INCH DIAMETER PIPELINE | PANHANDLE EASTERN | |
| SYSTEM ALTERNATIVES | ENABLE MRT PIPELINE | |
| NGPL PIPELINE | SOUTHERN STAR CENTRAL GAS PIPELINE | |
| MOGAS PIPELINE | | |

SPIRE STL PIPELINE

SYSTEM ALTERNATIVES

PROPOSED 24-INCH DIAMETER PIPELINE

SCOTT, GREENE, & JERSEY COUNTIES, ILLINOIS
AND ST. CHARLES & ST. LOUIS COUNTIES, MISSOURI



ABSOLUTE SCALE:
1:316,800

REFERENCE SCALE:
1 IN = 5 MILES

PREPARED FOR
Spire STL Pipeline

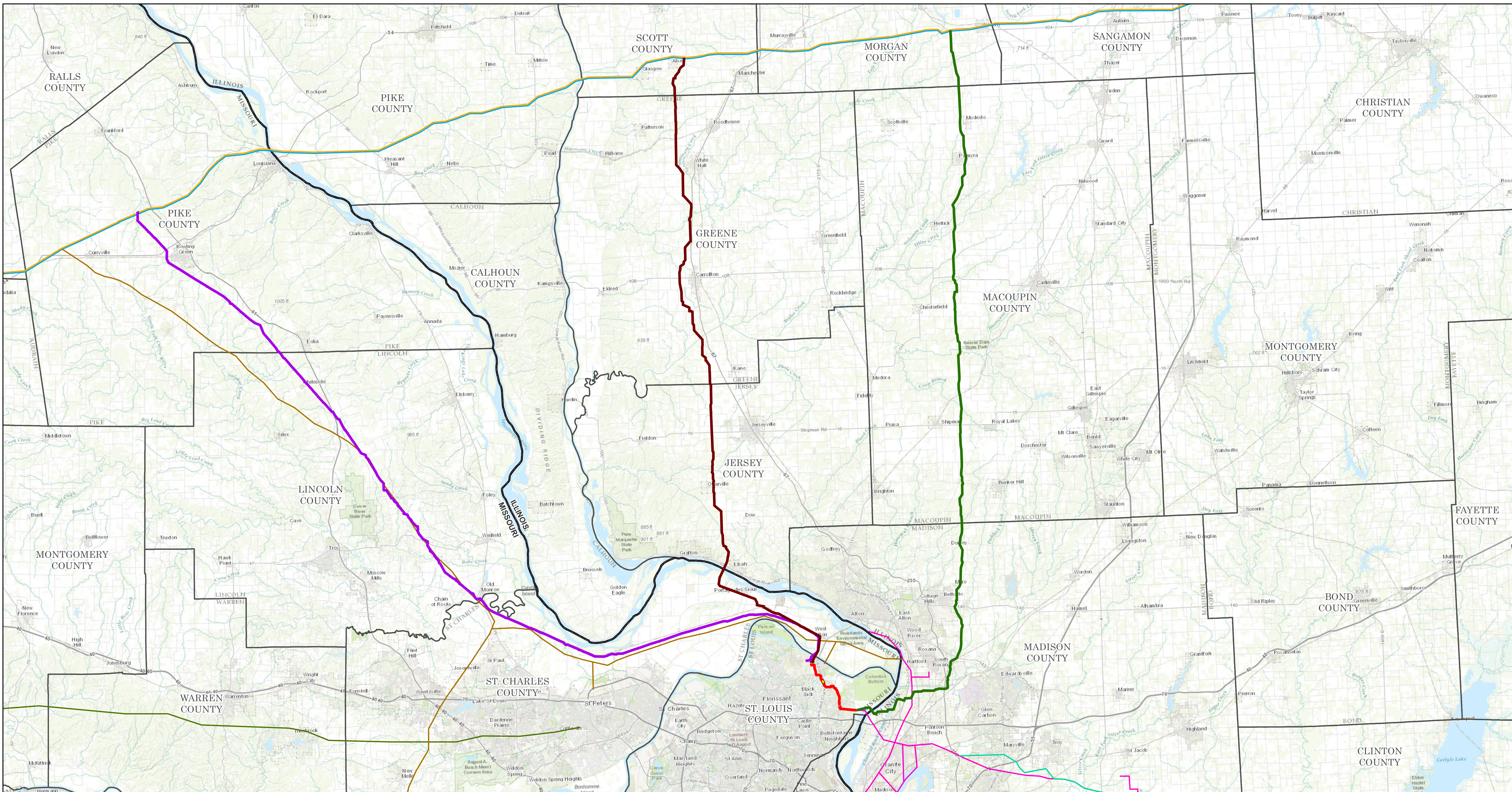
PREPARED BY
M M
MOTT MACDONALD

DRAWN BY:	EAP 12/20/2016
CHECKED BY:	NDK 12/20/2016
ENG. APPROVAL:	DG 12/19/2016
APPROVED BY:	JW 12/20/2016
REV. DATE:	01/2017
REVISION:	0
DESC:	ISSUE FOR FERC
PAGE:	STLP-SYSALT-001

MAPS COMPILED UTILIZING ESRI TOPOGRAPHIC BASEMAP. DIGITIZED APPROXIMATE LOCATIONS OF THE FOLLOWING PIPELINE CENTERLINES: ENABLE MRT, MOGAS, NGPL, SOUTHERN STAR AND REX WERE CREATED BASED ON A PROVIDED SCREEN CAPTURE FROM SPIRE TAKEN FROM THE SNL PLATFORM (12/08/2016). PANHANDLE CENTERLINE CREATED TO RUN PARALLEL TO REX CENTERLINE. FOR REPRESENTATION PURPOSES ONLY.



APPENDIX 10-B
Major Route Alternatives Map



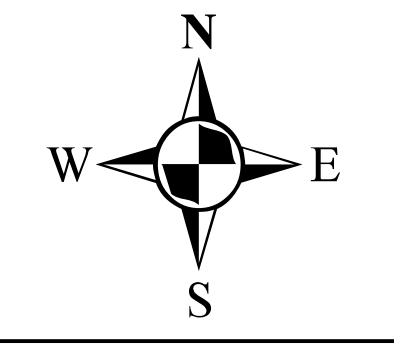
- PROPOSED 24-INCH DIAMETER PIPELINE
- ROCKIES EXPRESS PIPELINE (REX)
- COUNTY BOUNDARY
- LINE 880 20-INCH DIAMETER RELOCATION
- PANHANDLE EASTERN
- STATE BOUNDARY
- ILLINOIS ROUTE
- ENABLE MRT PIPELINE
- MISSOURI ROUTE
- NGPL PIPELINE
- EXISTING LINE 880 20-INCH DIAMETER PIPELINE
- MOGAS PIPELINE
- SOUTHERN STAR CENTRAL GAS PIPELINE

SPIRE STL PIPELINE

MAJOR ROUTE ALTERNATIVES

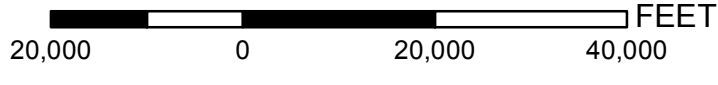
PROPOSED 24-INCH DIAMETER PIPELINE

SCOTT, GREENE, JERSEY, MORGAN, MACOUPIN, & MADISON COUNTIES, ILLINOIS
AND PIKE, LINCOLN, ST. CHARLES, & ST. LOUIS COUNTIES, MISSOURI



ABSOLUTE SCALE:
1:240,000

REFERENCE SCALE:
1 IN = 20,000 feet



PREPARED FOR
Spire STL Pipeline

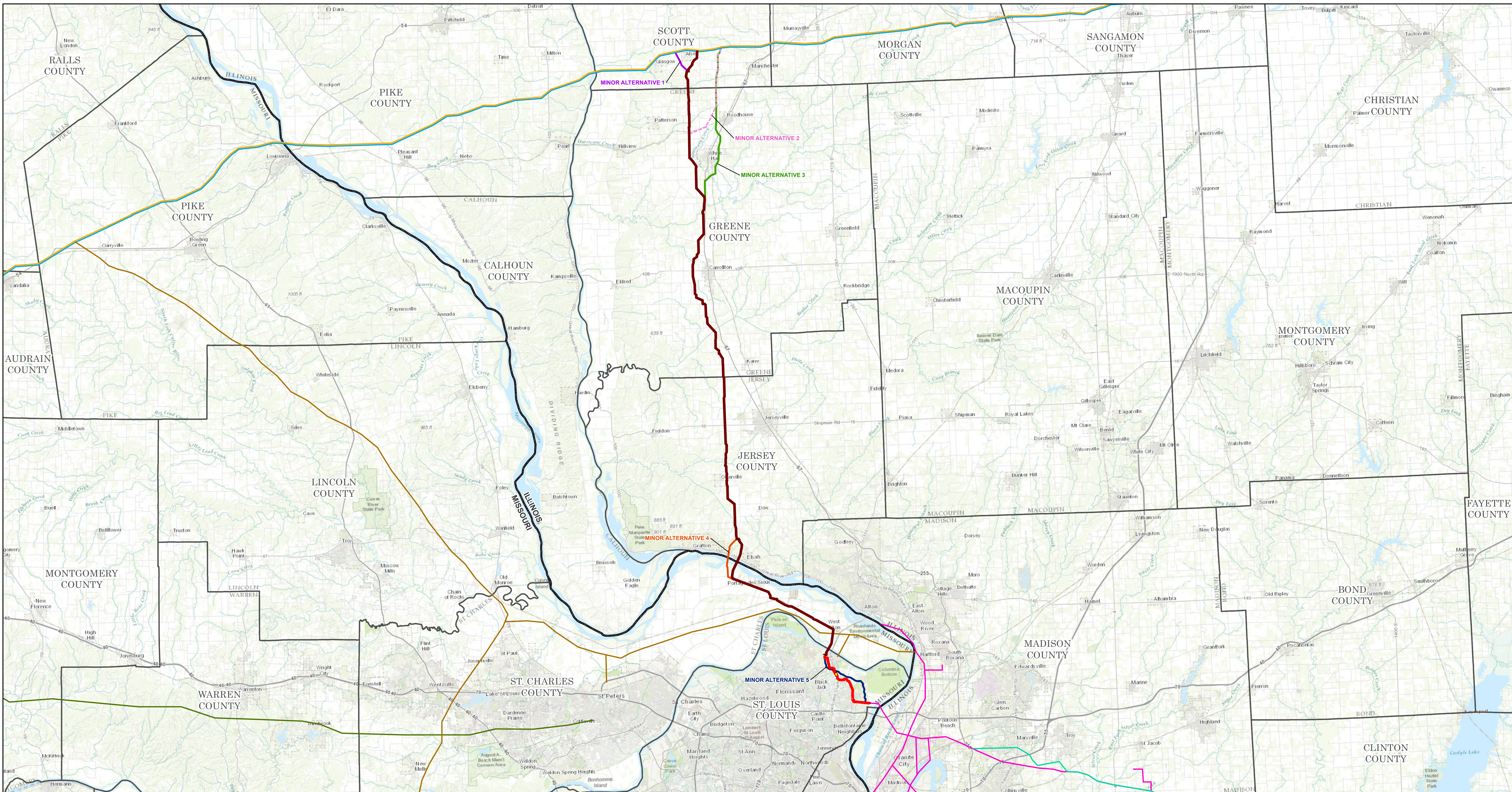
PREPARED BY
M M
MOTT MACDONALD

DRAWN BY:	EAP 12/16/2016
CHECKED BY:	KPW 12/19/2016
ENG. APPROVAL:	DG 12/19/2016
APPROVED BY:	JW 12/19/2016
REV. DATE:	01/2017
REVISION:	2
DESC:	ISSUE FOR FERC
PAGE:	STLP-MJALT-001

MAPS COMPILED UTILIZING ESRI TOPOGRAPHIC BASEMAP. DIGITIZED APPROXIMATE LOCATIONS OF THE FOLLOWING PIPELINE CENTERLINES: ENABLE MRT, MOGAS, NGPL, SOUTHERN STAR AND REX WERE CREATED BASED ON A PROVIDED SCREEN CAPTURE FROM THE SML PLATFORM (12/08/2016). PANHANDLE CENTERLINE CREATED TO RUN PARALLEL TO REX CENTERLINE. FOR REPRESENTATION PURPOSES ONLY.



APPENDIX 10-C
Minor Route Alternatives Maps



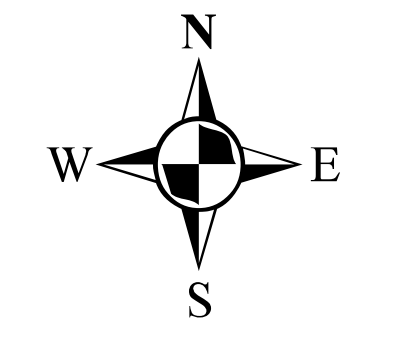
- | | | | | | |
|--|--------------------------------------|--|---|--|------------------------------------|
| | PROPOSED 24-INCH DIAMETER PIPELINE | | MINOR ALTERNATIVE 4 | | ENABLE MRT PIPELINE |
| | LINE 880 20-INCH DIAMETER RELOCATION | | MINOR ALTERNATIVE 5 | | NGPL PIPELINE |
| | MINOR ALTERNATIVE 1 | | EXISTING LINE 880 20-INCH DIAMETER PIPELINE | | MOGAS PIPELINE |
| | MINOR ALTERNATIVE 2 | | ROCKIES EXPRESS PIPELINE (REX) | | SOUTHERN STAR CENTRAL GAS PIPELINE |
| | MINOR ALTERNATIVE 3 | | PANHANDLE EASTERN | | COUNTY BOUNDARY |
| | | | | | STATE BOUNDARY |

SPIRE STL PIPELINE

MINOR ROUTE ALTERNATIVES

PROPOSED 24-INCH DIAMETER PIPELINE

SCOTT, GREENE, & JERSEY COUNTIES, ILLINOIS
AND ST. CHARLES & ST. LOUIS COUNTIES, MISSOURI



ABSOLUTE SCALE:
1:240,000

REFERENCE SCALE:
1 IN = 20,000 feet

PREPARED FOR
Spire STL Pipeline

PREPARED BY
M M
MOTT MACDONALD

DRAWN BY:	EAP 12/16/2016
CHECKED BY:	KPW 12/16/2016
ENG. APPROVAL:	DG 12/19/2016
APPROVED BY:	JW 12/19/2016
REV. DATE:	01/2017
REVISION:	1
DESC:	ISSUE FOR FERC
PAGE:	STLP-MIALT-001

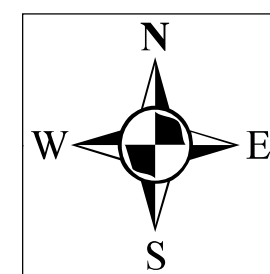
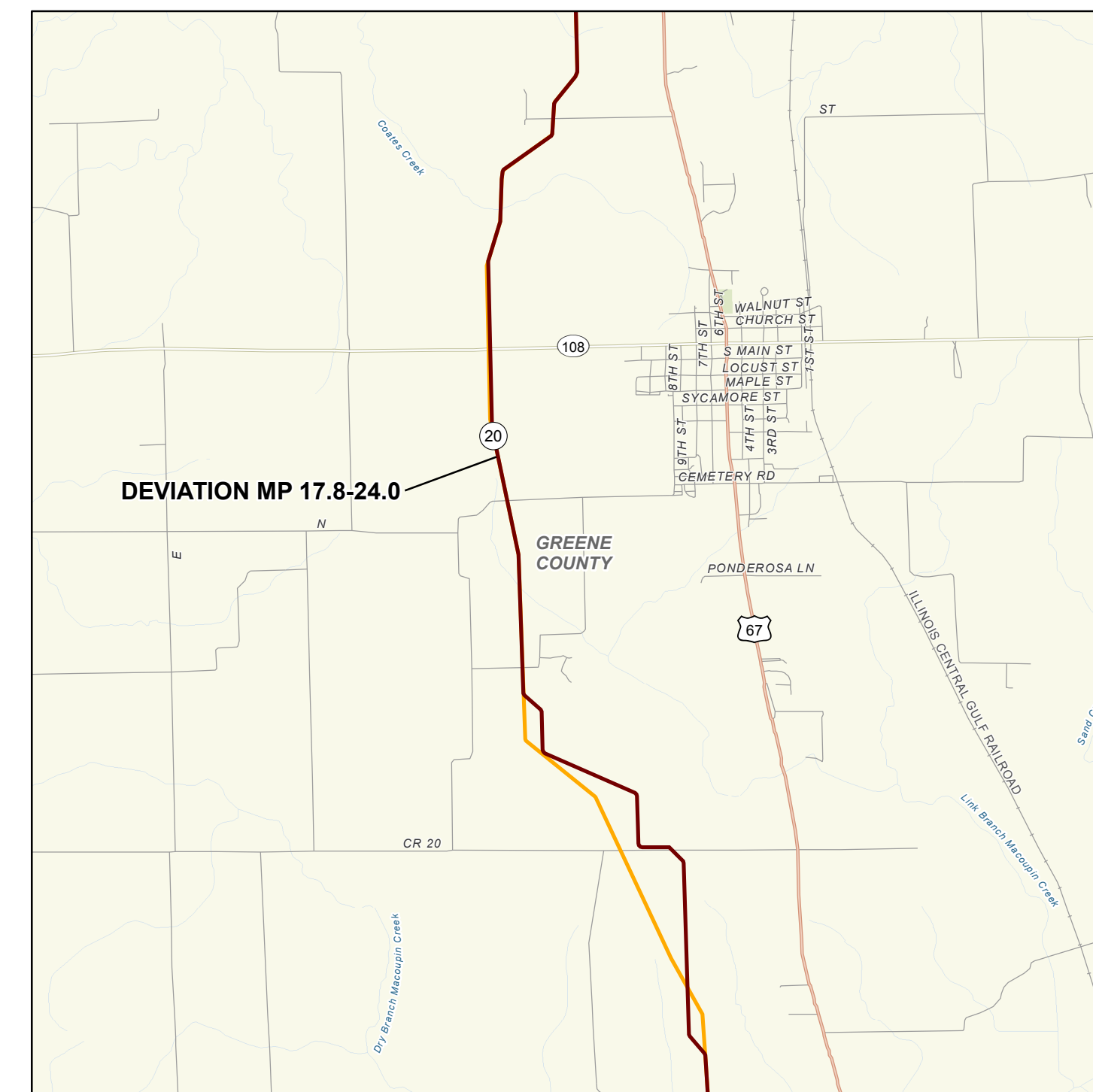
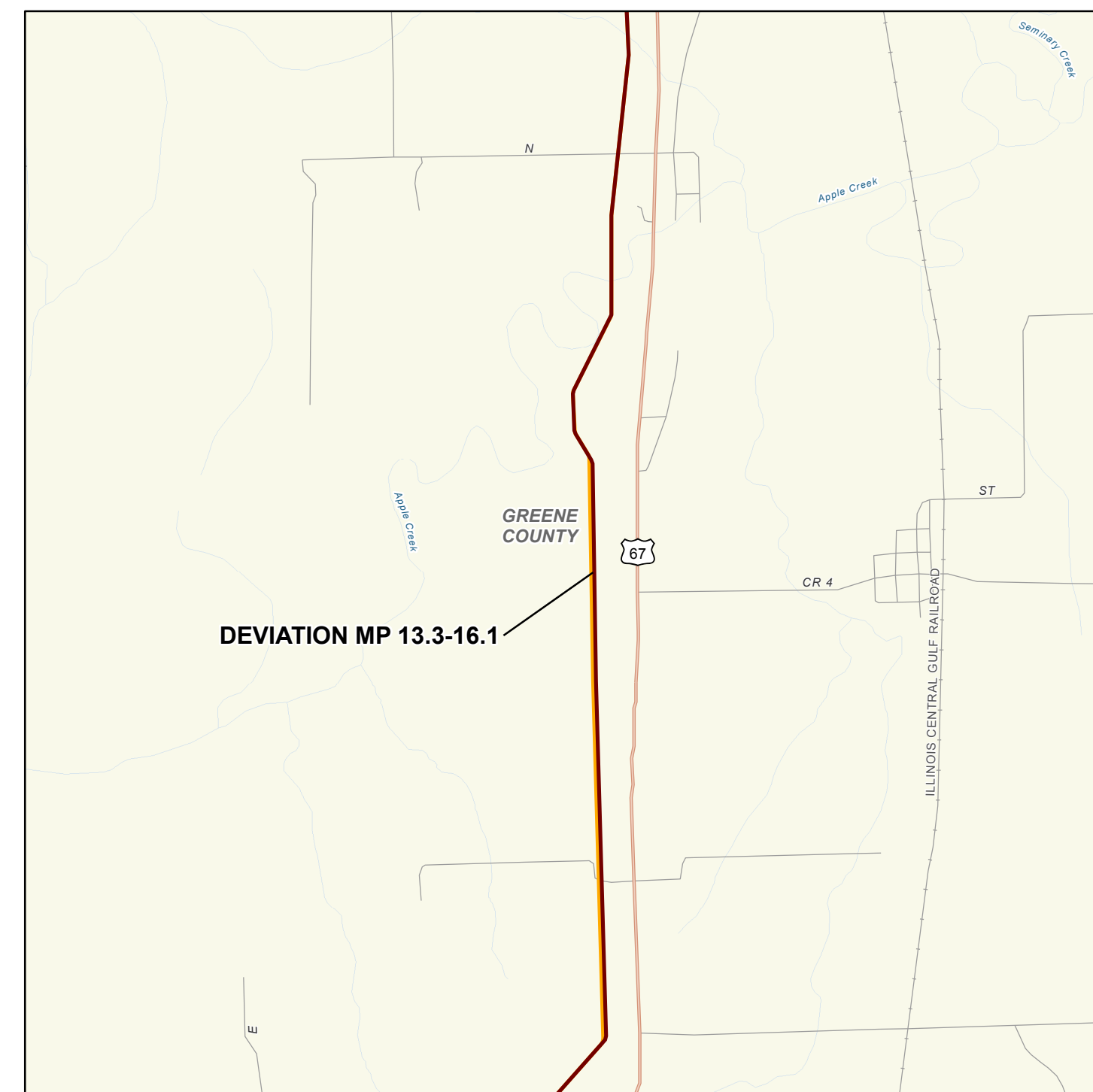
MAPS COMPILED UTILIZING ESRI TOPOGRAPHIC BASEMAP. DIGITIZED APPROXIMATE LOCATIONS OF THE FOLLOWING PIPELINE CENTERLINES: ENABLE MRT, MOGAS, NGPL, SOUTHERN STAR AND REX WERE CREATED BASED ON A PROVIDED SCREEN CAPTURE FROM THE SNL PLATFORM (12/08/2016). PANHANDLE CENTERLINE CREATED TO RUN PARALLEL TO REX CENTERLINE. FOR REPRESENTATION PURPOSES ONLY.



APPENDIX 10-D
Minor Route Deviation Maps

SPIRE STL PIPELINE PROJECT

PROPOSED 24-INCH DIAMETER PIPELINE & EXISTING LINE 880 20-INCH DIAMETER PIPELINE

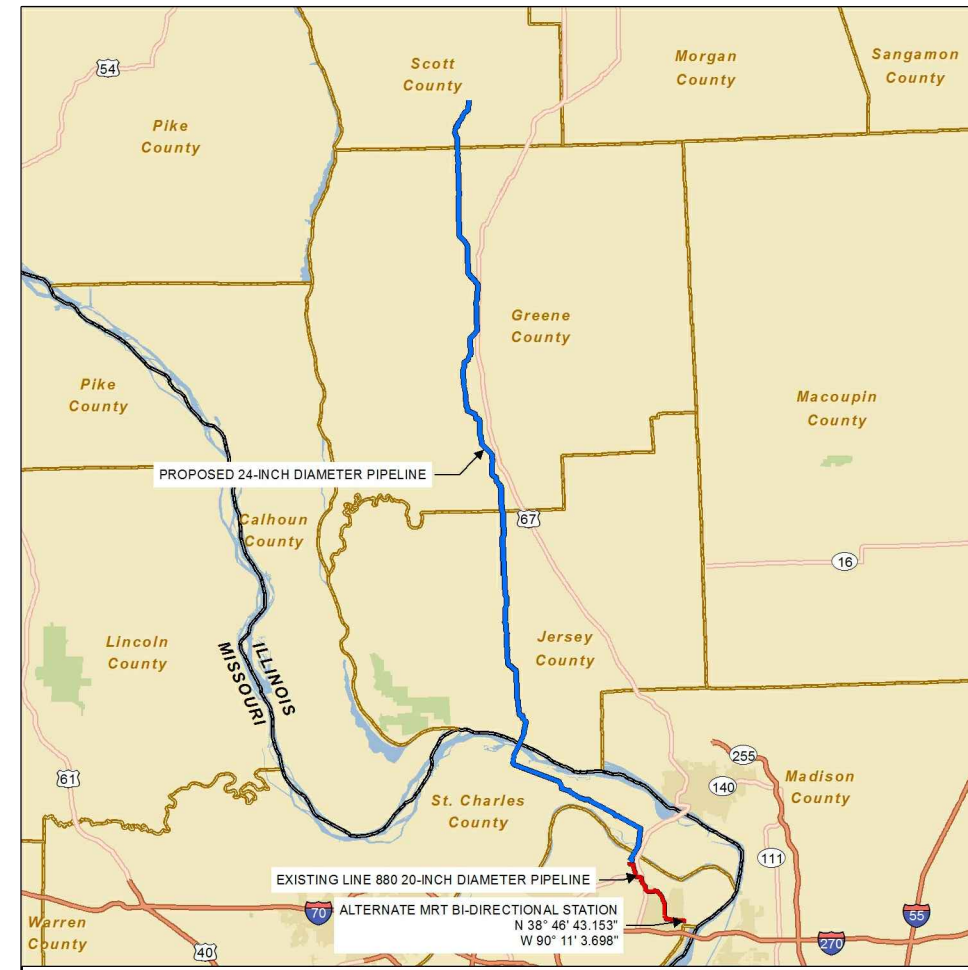


①	MILE POST	—	INTERSTATE	—	WATERBODY
①	LINE CHANGE NO.	—	HIGHWAY	—	PARK BOUNDARY
—	PROPOSED 24-INCH DIAMETER PIPELINE	—	MAJOR ROAD	—	COUNTY BOUNDARY
—	LINE 880 20-INCH DIAMETER PIPELINE	—	RAILROAD	—	STATE BOUNDARY
—	PREVIOUSLY FILED ROUTE (OCTOBER 2016)	—	CITY AREA	—	LANDMARK
—	EXISTING LINE 880 20-INCH DIAMETER PIPELINE	—		—	

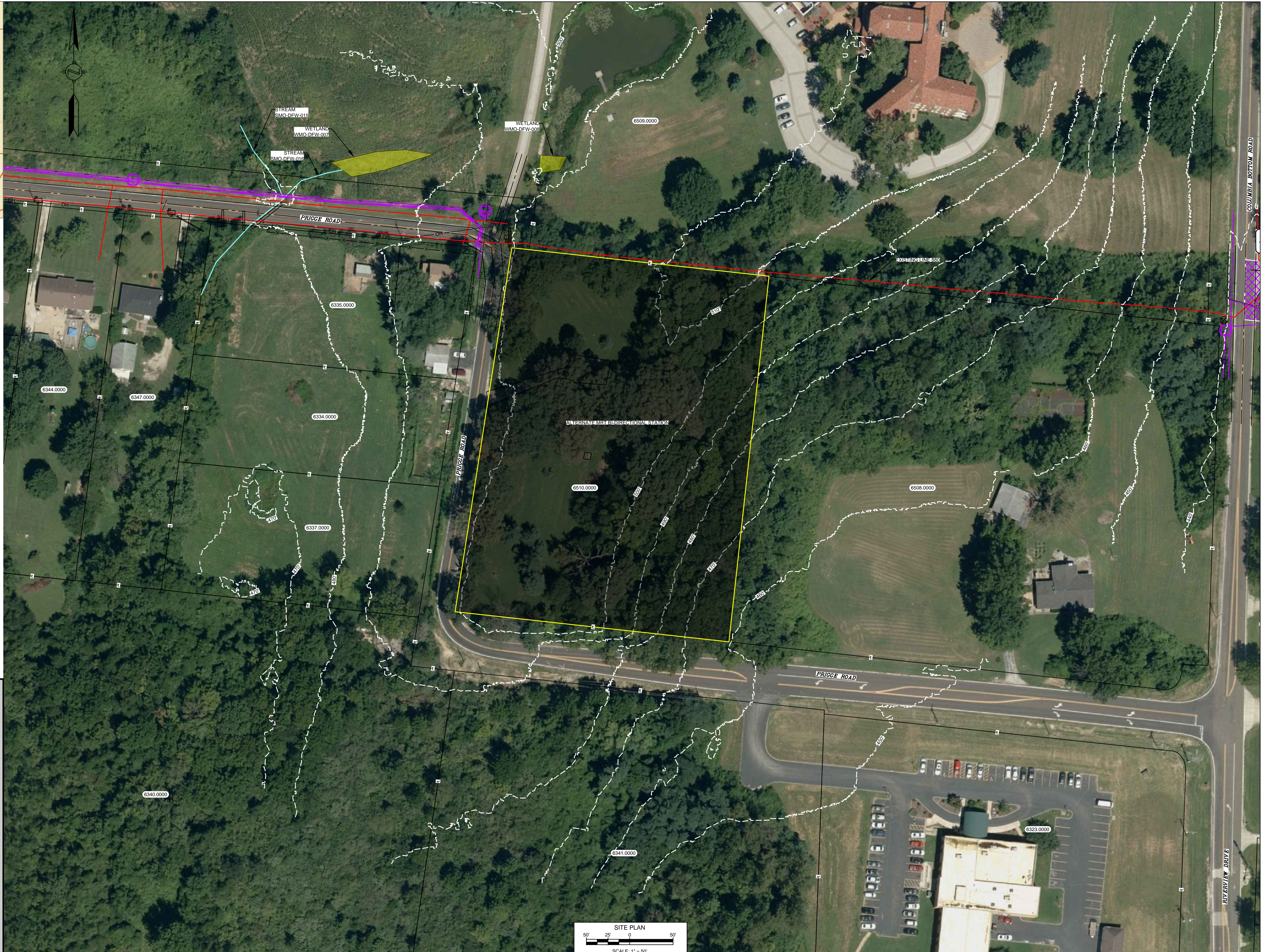
REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS						REVISIONS						APPROVALS				PREPARED FOR Spire STL Pipeline	PREPARED BY MOTT MACDONALD	SPIRE STL PIPELINE PROJECT 24" PROPOSED PIPELINE ROUTE DEVIATION OVERVIEW ILLINOIS & MISSOURI		
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	REVISIONS	DATE	DRAWN	CK	APPR	NO.	REVISIONS	DATE	DRAWN	CK	APPR	DRAWN BY	DATE	ENG. APPROVAL	DATE				CLIENT APPROVAL	DATE
STLP-DEV-001																								



APPENDIX 10-E
Alternative Site for MRT Bi-directional Station

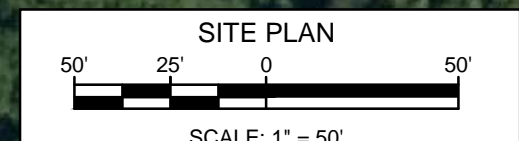


LOCATION MAP
N.T.S.



LEGEND

	EXISTING PERMANENT EASEMENT
	PROPOSED PERMANENT EASEMENT
	TEMPORARY WORKSPACE
	ADDITIONAL TEMPORARY WORKSPACE (ATWS)
	PROPOSED CONTRACTOR YARD
	ACCESS ROAD
	PROPOSED 24-INCH DIAMETER PIPELINE
	PROPOSED 20-INCH DIAMETER LINE 880 RELOCATION
	EXISTING GAS PIPELINE
	EXISTING FOREIGN PIPELINE
	OVERHEAD POWER LINE
	EXISTING FIBER OPTIC LINE
	MMID
	PROPERTY LINE
	MUNICIPAL LINE
	WETLAND (DESKTOP)
	WETLAND (DELINEATED)
	ξ OF STREAM (DESKTOP)
	ξ OF STREAM (DELINEATED)
	PROPOSED FENCE
	UTILITY POLE
	STORM SEWER



REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS				REVISIONS				APPROVALS										
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	REVISIONS	DATE	DRAWN	CK	APPR	NO.	REVISIONS	DATE	DRAWN	CK	APPR	DRAWN BY	DATE	ENG. APPROVAL	DATE	CLIENT APPROVAL	DATE	
				1	ISSUE FOR FERC	01/2017										RJR	10/2016	DGG	10/2016			
																EB	10/2016	JEV	10/2016			

PREPARED FOR
Spire STL Pipeline

PREPARED BY
MOTT MACDONALD

STLP-SS-009

Spire STL PIPELINE PROJECT
ALTERNATE MRT BI-DIRECTIONAL STATION
SITE LAYOUT
ST LOUIS COUNTY, MISSOURI