Appendix F – Detailed Alternative Descriptions
From Final (June 2011) Wisconsin CPCN Application

Information Requirements for Electric Transmission Lines and Substations

This Technical Support Document (TSD) follows the format and guidance contained in the *Application Filing Requirements for Transmission Line Projects in Wisconsin* (Part 2.00), Version 17C (Application Filing Requirements [AFR], issued by the PSCW, WDNR and DATCP (November 2009).

2.1. Engineering Information

2.1.1. Type and Location of Line Construction Required

The Applicants propose to construct a new 345 kilovolt (kV) transmission line between Hampton, Minnesota; Rochester, Minnesota: and La Crosse, Wisconsin and two new 161 kilovolt (kV) transmission lines in the Rochester area. The new facilities are needed to meet local community load serving needs in the La Crosse, Wisconsin; Winona, Minnesota; and Rochester, Minnesota areas, to maintain the reliability of the regional electrical system and to support generation outlet. More specifically, the areas in Wisconsin benefiting from the project are Buffalo, Trempealeau and La Crosse Counties, including the communities of Alma, Buffalo City, Fountain City, Arcadia, Galesville, Trempealeau, Holmen, Onalaska, La Crosse and the surrounding rural areas.

In this Application the Applicants seek approval from PSCW and WDNR to construct the 345 kV line and associated facilities that would be located in Wisconsin termed the La Crosse Project or Project. The 345 kV line is proposed from the Mississippi River crossing at Alma, Wisconsin to a new transmission substation (Briggs Road Substation located near Holmen referred to in early planning documents as a proposed North La Crosse Substation). The 345 kV transmission line would be approximately 40 to 55 miles long in Buffalo, Trempealeau and La Crosse Counties and, depending on the final route selected, be constructed in the cities of Alma, Buffalo, and Galesville; the towns of Arcadia, Belvidere, Buffalo, Caledonia, Cross, Gale, Glencoe, Holland, Lincoln, Milton, Onalaska, Trempealeau and Waumandee; and the village of Cochrane. Xcel Energy would construct all Wisconsin facilities; it is anticipated that the Applicants would jointly own the transmission line and Xcel Energy would own the Briggs Road Substation.

Three alternative routes and one route option are included in this Application. For the most part, these routes utilize existing 161 kV and 69 kV transmission corridors. In such corridors, existing transmission lines would be removed and a new double-circuit transmission line carrying the proposed 345 kV circuit and existing lower voltage circuit would be constructed. Certain distribution lines would require relocation.

The three alternative routes and one route option are identified in Figures 2 and 9 through 14 in the Introduction and Overview Section; Tables 2.1-1 through 2.1-4; and are presented in detail in the CPCN Impact Tables in Appendix A and in the Topographic Maps, General Route Maps, and Environmental Features Maps in Appendices B through D, respectively. The alternative routes included in this Application are the:

- Q1-Highway 35 Route
- Arcadia Route
- Q1-Galesville Route

The Arcadia-Alma Option is a 1.3-mile segment alternative that would replace a 1.7 mile section of the Arcadia Route near the Mississippi River and offers an alternative connection from the river crossing to the Arcadia Route.

Also, regardless of the route selected, the Project includes rerouting the existing Xcel Energy Tremval-Mayfair 161 kV line and the existing Dairyland Alma-La Crosse (Q1) 161 kV line for a short distance to the proposed Briggs Road Substation (Figures 4 and 5).

The 345 kV line would be constructed on steel, self-supporting poles on concrete foundations, except as noted below. Areas requiring alternate designs are:

- The Black River floodplain area of the Q1-Highway 35 Route that would be constructed on vibratory caisson foundations, which do not require excavation or concrete. A hollow pole section is vibrated into the earth using a crane or helicopter-mounted vibratory hammer. The construction plan for this area is included in Appendix J.
- Certain poles in hilly wooded areas of the routes may incorporate guy wires to reduce pole diameter and weight, thereby aiding constructability.
- Segment 2D of the Q1-Galesville Route would include wood poles located mid-span to carry the underbuilt 69 kV line.

2.1.1.1. Q1-Highway 35 Route

The Q1-Highway 35 Route is 43 miles, beginning at the Mississippi River crossing at Alma and ending at the proposed Briggs Road Substation site. The route configuration and ROW sharing are presented in Figures 9 and 10. Route segments are described in Table 2.1-1 based on ROW sharing. More information about this route can be found in Section 2.4.

Table 2.1-1:
Q1-Highway 35 Route Configuration and Segment Summary
(Refer to Figures 9 and 10 in the Introduction and Overview section of this Application)

Q1-Highway 35 Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161/161 kV Double-Circuit Steel Lattice Poles (Energized at 161/69 kV) Proposed 345/345/161 kV Triple-Circuit Steel Multipole (Energized at 345/161/69 kV)	1	0.9	Rebuild of existing Dairyland 161/69 kV line that would be removed and included in new 345/161/69 triple-circuit. Starts at Wisconsin state boundary in the Mississippi River and follows the existing 161 kV corridor eastward. Crosses active railroad tracks that comprise part of a Dairyland power plant coal unloading facility before crossing the Great River Road/Wisconsin Highway 35 (GRR/WI-35) and the existing 161 kV transmission corridor. .
Existing 161 kV Single-Circuit Wood H-Frame Proposed 345/345 kV Double-Circuit Steel Monopole (Energized at 345/161 kV)	2A1	0.1	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Located east of the GRR/WI-35. Parallels existing transmission line corridors. Shares a 161/69 kV transmission corridor that has been cleared and maintained adjacent to the edge of forested lands.
	2A2	0.6	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Located east of the GRR/WI-35. Parallels existing transmission line corridors. Shares a 161/69 kV transmission corridor that has been cleared and maintained adjacent to the edge of forested lands.
	2A3	1.2	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.

Q1-Highway 35 Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
			Located east of the GRR/WI-35. Parallels existing transmission line corridors. Shares a 161/69 kV transmission corridor that has been cleared and maintained adjacent to agricultural areas and the edge of forested lands.
Existing 161 kV Single-Circuit Wood H-Frame	2B	3.1	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Located west of the GRR/WI-35 and east of Burlington Northern Santa Fe (BNSF) rail line. Crosses County Road OO, Foegen Road, Herman Street Road and North Main Street, while proceeding in a generally southeast direction. Shares 161 kV transmission corridor that is adjacent to active agricultural lands and rural agricultural development.
Proposed 345/161 kV Double-Circuit Steel Monopole	2C	1.4	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses the GRR/WI-35, Bluff Street, County Road O and a golf course, while generally staying on the east side of the GRR/WI-35. Shares 161 kV transmission corridor that is adjacent to a forest and rural residential area.
Existing 69 kV Single-Circuit Wood Monopole	2D	1.8	Re-alignment to the Dairyland 69 kV corridor to reduce impacts to homes south of Cochrane and to mitigate aesthetic impacts to the GRR/WI-35. The existing Dairyland 161 kV and 69 kV lines near the GRR/WI-35 would be removed and relocated with the 345 kV line. Portions of a second 69 kV line near the GRR/WI-35 would also be removed.
Proposed 345/161/69 kV Triple-Circuit Steel Monopole			Crosses the GRR/WI-35 and BNSF rail line. Shares existing Dairyland 69 kV transmission corridor that passes through active agricultural areas.

Q1-Highway 35 Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing No Transmission 345 /161 kV Double-Circuit Steel Monopole	2E	3.1	Re-alignment on new corridor to reduce impacts to homes south of Cochrane and to mitigate aesthetic impacts to the GRR/WI-35. The existing Dairyland 161 kV and 69 kV lines near the GRR/WI-35 would be removed and relocated with the 345 kV line. Portions of a second 69 kV line near the GRR/WI-35 would also be removed.
			Parallels the BNSF rail line and an existing 69 kV transmission line corridor. Crosses the GRR/WI-35, Prairie Moon Road and Bechly Road, while crossing active agricultural areas, rural residential and small wetlands.
	2F	1.1	Connects back to existing Dairyland 161 kV corridor.
			New alignment that crosses the GRR/WI-35 and Haney Drive. Crosses active agricultural land and a wetland.
Existing 161 kV Single-Circuit Wood H-Frame and Multipole Proposed 345/161 kV Double-Circuit Steel Monopole (2 Locations Require Multipoles)	2G	6.6	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses Waumandee Creek Road, County Road G, Guenther Road, WI-95, County Road P and Rocky Ridge Road. Shares existing 161 kV transmission corridor that crosses a variety of terrain and land uses, including active agriculture, forest and open space..
Existing No Transmission Proposed 345/161 kV Double-Circuit Steel Multipole	2H	0.7	Minor reroute to aid constructability through wooded, hilly topography.
			Located southwest of existing Dairyland 161 kV transmission corridor. Does not cross any existing roads, nor is it adjacent to development. Crosses forested terrain. Existing 161 kV alignment would be removed.

Q1-Highway 35 Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wooden H-Frame (Some Wood Multipoles) Proposed 345/161 kV Double-Circuit Steel Monopole (18 Locations Require Multipoles)	2I	7.5	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Crosses Brandhorst Road, Oak Lane, County Road P, the GRR/WI-35, Klein Lane, West Prairie Road and Delaney Road. Shares existing Dairyland 161 kV transmission corridor that crosses an active agricultural area, forest, open space and rural residential areas.
	3	7.2	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Crosses Schuh Road, Lehmann Road, Canar Road, Granna Lane, Williamson Lane, Memmer Lane, GRR/WI-35, Schubert Road, County Road K and 11th Street. Shares existing Dairyland 161 kV transmission corridor that crosses an active agricultural area, open space, remnant forest and rural residential areas.
	4	0.2	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Crosses County Road M. Shares existing Dairyland 161 kV transmission corridor that crosses active agricultural areas.
Existing No Transmission Proposed 345/161 kV Double-Circuit Steel Multipole	8A	1.1	Existing Dairyland Q1 161 kV line would be removed and included in a new 345/161 kV double-circuit. Possibility of removing existing 69 kV from Seven Bridges area is under consideration and, if implemented, would result in 345/161/69 triple circuit. Parallel to and north of the GRR/WI-35. Crosses County Road M.
	8B	2.3	Existing Dairyland Q1 161 kV line would be removed and included in a new 345/161 kV double-circuit. Possibility of removing existing 69 kV from Seven Bridges area is under consideration and, if implemented, would result in 345/161/69 triple circuit. Parallel to and north of the GRR/WI-35. Crosses the Black River and forested wetlands.

Q1-Highway 35 Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
	8C	1.1	Existing Dairyland Q1 161 kV line would be removed and included in a new 345/161 kV double-circuit.
			North of and parallel to the GRR/WI-35 and crosses Amsterdam Prairie Road. Crosses the GRR/WI-35 about 0.10 miles east of Staphorst Lane. Crosses Blackwelder Place on the south side of the GRR/WI-35. Crosses active agriculture, rural residential and open space. Shares an existing Dairyland 69 kV transmission corridor for 0.25 miles.
	9	2.4	Existing Dairyland Q1 161 kV line would be removed and included in a new 345/161 kV double-circuit.
			Parallel to and west of GRR/US-53. Crosses to the east side of GRR/US-53, 0.30 miles south of Old Na Road. Crosses to the west side of GRR/US-53, 0.25 miles north of County Road MH. Passes through active and inactive agriculture, rural residential and crosses County Road MH.
Existing No Transmission	18H	0.7	Existing Dairyland Q1 161 kV line would be removed and included in a new 345/161 kV double-circuit.
Proposed 345/161 kV Steel Monopole (5 locations require Multipoles)			Parallel to and west of GRR/US-53. Passes through active agriculture. Connects with the proposed Briggs Road Substation.

2.1.1.2. Arcadia Route and Arcadia-Alma Option

The Arcadia Route is 54.8 miles, beginning at the crossing of the Mississippi River at Alma and ending at the proposed Briggs Road Substation site. The Arcadia Route follows a combination of existing Dairyland 161 kV transmission corridor, existing Dairyland 69 kV corridor, existing Xcel Energy 161 kV corridor and roadways. The route configuration and ROW sharing are presented in Figures 11 and 12. Route segments are described in Tables 2.1-2 and 2.1-3 based on ROW sharing. More information about this route can be found in Section 2.4.

There is an option for a portion of the Arcadia Route (Figures 11 and 12) that consists of a 1.3-mile 345 kV transmission line corridor comprised of Segment 10B2. The Arcadia-Alma Option would replace a 1.7 mile portion of the Arcadia Route that was selected to avoid impacts to a future residential development. Segment 10B2 does not share transmission corridor, but rejoins the existing corridor at Segment 10C.

Table 2.1-2:
Arcadia Route Configuration and Segment Summary
(Refer to Figures 11 and 12 in the Introduction and Overview section of this Application)

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161/161 kV Double-Circuit Steel Lattice (Energized at 161/69 kV) Proposed 345/345/161 kV Triple-Circuit Steel Multipole (Energized at 345/161/69 kV)	1	0.9	Rebuild of existing Dairyland 161/69 kV line that would be removed and included in new 345/161/69 kV triple-circuit. Starts at Wisconsin state boundary in the Mississippi River and follows the existing 161 kV corridor eastward. Crosses active railroad tracks that comprise part of a Dairyland power plant coal unloading facility before crossing the GRR/WI-35 and the existing 161 kV transmission corridor.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wood H-Frame Proposed 345/345 kV Double-Circuit Steel Monopole (Energized at 345/161 kV) 1 Location Requires a Steel Multipole	2A1	0.1	Rebuild of existing Dairyland 161 kV line to 345/161 kV double-circuit. The existing 161 kV line would be removed and included in a new 345/161 kV double-circuit.
			Located east of the GRR/WI-35. Shares with existing Dairyland 161 kV transmission corridor that has been partially cleared and maintained adjacent to forested woodland.
	2A2	0.6	Rebuild of existing Dairyland 161 kV line to 345/161 kV double-circuit. The existing 161 kV line would be removed and included in a new 345/161 kV double-circuit. If the Arcadia-Alma Option is selected, it would replace this segment of the Arcadia Route.
			Located east of the GRR/WI-35. Shares with existing Dairyland 161 kV transmission corridor that has been partially cleared and maintained adjacent to forested woodland.
Existing No Transmission Proposed 345 kV Single-Circuit Steel Monopole	10B1	1.1	If the Arcadia-Alma Option is selected, it would replace this segment of the Arcadia Route. Arcadia Route Segment 10B1 was selected to reduce potential impacts to future residential development along Segment 10B2 of the Arcadia-Alma Route Option.
			Follows wooded sideslope up to connect with existing 161 kV corridor. Does not cross any roads or agricultural areas, but creates a short new cross-country corridor.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wood H-Frame Proposed 345/161 kV Double-Circuit Steel Monopole (9 Locations Require Steel Multipoles)	10C	20.7	Rebuild of existing Dairyland 161 kV line to 345/161 kV double-circuit. The existing 161 kV line would be removed and included in a new 345/161 kV double-circuit. Crosses County Road N, Hickory Lane, Blank Hill Road, Belvidere Ridge Road, WI-88, Wojchik Valley Road, County Road E, Rotering Ridge Road, Bremer Ridge Road, Boland Valley Road, County Road C, Boberg Lane, Ben Slaby Lane, Rainey Valley Road, Hickory Hill Road and WI-93. Shares with existing Dairyland 161 kV transmission corridor that crosses active agriculture, forested woodlands, wetlands, Little Waumandee Creek, Waumandee Creek and the Trempealeau River.
Existing No Transmission Proposed 345 kV Single-Circuit Steel Monopole	11A	0.9	New corridor, except for last 242 feet which shares with existing 69 kV corridor and is 345/69 kV double-circuit, similar to Segment 11B. Segment selected to transition south from the Dairyland 161 kV line towards the existing Dairyland 69 kV line. East of WI-93. Does not share existing corridor for most of its length; however, the southern 242 feet shares with an existing 69 kV transmission corridor. Crosses River Valley Road, a stream, wetland and active agricultural area.
Existing 69 kV Single-Circuit Wood Monopole and Multipole Proposed 345/69 kV Double-Circuit Steel Monopole (2 Locations Require Steel Multipoles)	11B	2.0	Rebuild of existing 69 kV line to 345/69 kV double-circuit. Existing 69 kV line would be removed. Shares existing 69 kV transmission corridor as well as creates 600-foot new corridor ROW. Crosses WI-95 and active agricultural lands.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing No Transmission			New corridor. Segment selected to avoid homes to the east of the existing 69 kV corridor.
Proposed 345 kV Single-Circuit Steel Monopole	11C	0.8	Does not cross any roads. Creates a new transmission corridor along property lines, crossing active agricultural lands and forested woodlands.
Existing No Transmission			New corridor, mostly sharing road ROW. Segment selected to avoid homes on east side of Thompson Valley Road and the wetland on the southern portion of the segment.
Proposed 345 kV Single-Circuit Steel Monopole	11D	1.1	Crosses existing 69 kV transmission corridor at Thompson Valley Road and Rudy Lane. Crosses Edmund Suchla Lane.
Existing 69 kV Single-Circuit Wood Mono and Multipoles			Existing 69 kV alignment removed and combined with proposed 345 kV as 345/69 kV double-circuit. New alignment necessary for construction access.
Proposed 345/69 kV Double-Circuit Steel Monopole (1 Location Requires Steel Multipole)	11E	0.6	Crosses Thompson Valley Road and partially shares with an existing 69 kV transmission corridor. Partially located in a maintained corridor within forested woodland.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 69 kV Single-Circuit Wood Mono and Multipoles Proposed 345/69 kV Double-Circuit Steel Monopole	11F	0.4	Existing 69 kV alignment on hillside removed and combined with proposed 345 kV as 345/69 kV double-circuit. Segment selected to improve construction access and reduce related impacts since the existing 69 kV line is located on steep hillside. West of existing 69 kV transmission corridor. Creates a new corridor and crosses Thompson Valley Road, crossing open space and a forested woodland.
Existing 69 kV Single-Circuit Wood Mono and Multipoles Proposed 345/69 kV Double-Circuit (9 Locations Require Steel Multipoles)	11G	9.6	Existing 69 kV alignment removed and combined with proposed 345 kV as 345/69 kV double-circuit. For 0.4 miles, located on an existing 69 kV transmission corridor to aid construction access. Creates a new corridor in this section, crossing open space, then crossing and paralleling Thompson Valley Road. Heads south, utilizing an existing 69 kV transmission corridor. Crosses existing 69 kV transmission corridor near Fox Coulee Road and WI-93. Crosses Norway Valley Road, Amundson Lane, Holcomb Coulee Road, German Coulee Lane, Prondzinski Lane, Fox Coulee Lane, Walsky Lane, WI-93 and parallels Prondzinski and Grover Lanes. Crosses forested woodlands, active agriculture and limited rural residential areas.
Existing No Transmission	13A	1.1	Segment runs along WI-93/WI-54, jogging from south to north to reduce impacts to homes. Shares road corridor along WI-93/WI-54. Crosses WI-93/WI-54 and Wright Drive, passing through active agriculture and a rural residential area.
Proposed 345 kV Single-Circuit Steel Monopole Vertical Configuration	13B1	0.6	Segment runs along WI-93/WI-54, jogging from south to north to reduce impacts to homes. Shares road corridor along WI-93/WI-54. Crosses Beaver Creek and passes through an active agricultural area, rural residential and small-scale commercial/retail areas.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
	13B2	3.5	Segment runs along WI-93/WI-54, jogging from south to north to reduce impacts to homes. Shares road corridor along WI-93/WI-54. Crosses Dale Valley Lane, South 15th Street, West Mill Road, Hueston Street, North Main Street and Hilltop Lane, as well as WI-93/WI-54. Crosses Beaver Creek and passes through an active agricultural area, rural residential and small-scale commercial/retail areas.
	13C	0.5	Shares road corridor with WI-93. Segment located on south side of highway to reduce impacts to homes. Follows WI-93/WI-54/US-53. Crosses McKeeth Drive and Hogden Road. Passes through an edge of forested woodland and a roadside park.
	13D	0.9	Shares road corridor with WI-93/WI-54/US-53. Segment located on north side of highway to reduce impacts to homes. Follows WI-93/WI-54. Crosses WI-93/WI-54/US-54 and WI-54. Passes through active agricultural areas, forested woodlands and rural residential areas.
Existing No Transmission Proposed 345 kV Single-Circuit Steel Monopole	13E	0.7	New corridor, no sharing. Segment transitions from paralleling WI-93/US-53 eastward to intersect with existing Xcel Energy 161 kV line. Does not occupy existing transmission corridor. Poles can be spotted to minimize impacts to agriculture. Crosses County Road AA. Passes through active agricultural areas and forested woodlands.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wood H-Frame and Multipoles Proposed 345/161kV Double-Circuit (1 Location Requires Multipole)	17A	2.1	Rebuild of existing Xcel Energy 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses Pow Wow Lane, Council Bay Road and County Road T. Share existing Xcel Energy 161 kV transmission corridor that passes through forested woodland, reforested area and rural residential area.
	17B	0.4	Rebuild of existing Xcel Energy 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Segment selected to reduce impacts to homes on west side of Aspeslset Road. Xcel Energy 161 kV line on west side of the road would be removed and relocated with the 345 kV line.
			Crosses Aspeslset Road, Price Court, Castle Heights Drive, Sylvester Road and generally parallels Aspeslset Road. Shares existing Xcel Energy 161 kV transmission corridor that passes through a rural residential area.
	18A	2.6	Rebuild of existing Xcel Energy 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses Castle Mound Golf Course. Crosses Castle Mound Drive and Cliff Shade Road. Shares existing Xcel Energy 161 kV transmission corridor along a treeline that is adjacent to active agricultural areas and rural residential.
Existing No Transmission Proposed 345/161kV Double-Circuit Steel Monopole (5 Locations Require Multipoles)	18B	0.3	New alignment. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected as transition point leaving the existing Xcel Energy 161 kV corridor and heading towards WI-/93US-53, rather than continuing south along the existing corridor to avoid impacting residences and businesses near Holmen. Existing 161 kV line would be removed from this point south until crossing over WI-93/US-53.
			Crosses County Road HD and active agricultural areas.
	18C	0.6	New alignment shares corridor with County Road Hd. Existing Xcel Energy 161 kV line located to the east would be removed and included in new 345/161 kV double-circuit.
			Crosses County Road HD and Newport Drive and then is parallel to County Road HD on the west side.

Arcadia Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
			Adjacent to active agricultural areas and an area in transition from agriculture to residential.
	18D	0.3	New alignment. Existing Xcel Energy 161 kV line located to the east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			East of GRR/US-53and west of County Road Hd. Crosses Old Na Road. Crosses active agricultural areas. Poles spotting can reduce agricultural impacts.
	18E	0.3	New alignment along property lines. Existing Xcel Energy 161 kV line located to the east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impact to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			East of GRR/US-53and west of County Road Hd.
	18F	0.6	New alignment shares roadway corridors. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			Shares corridor with local roadways such as Briggs Road. Crosses Sween Drive and County Road MH and east of GRR/US-53. Adjacent to Holmen High School and low density residential areas and crosses active agricultural areas.
	18G	0.6	New alignment transitioning to US-53. Existing Xcel Energy 161 kV line located to the east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			East of GRR/US-53/County Road MH interchange. Crosses GRR/US-53 and passes through open space and a low density residential area.
	18H	0.7	345/161 kV double-circuit.
			Continues to the proposed Briggs Road Substation on the west side of GRR/US-53.. Passes through an area of active agriculture.

Table 2.1-3:
Arcadia-Alma Option Configuration and Segment Summary
(Refer to Figure 11 and 12 in the Introduction and Overview section of this Application)

Arcadia-Alma Option			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing No Transmission			Alternative alignment option replacing Segments 10A1 and 10B1. Segment selected as the most direct route to connect with existing 161 kV line.
Proposed 345 kV Single-Circuit Steel Monopole	10B2	1.3	Does not share with existing transmission corridor; however, when the segment crosses Prairie Road, it connects to an existing 161 kV transmission line. Crosses a forested woodland, an active agricultural area and rural residential.

2.1.1.3. Q1-Galesville Route

The Q1-Galesville Route is 48.4 miles, beginning at the Mississippi River crossing at Alma and ending at the proposed Briggs Road Substation site. The first part of this route follows the Q1-Highway 35 alignment. The route then connects with the Arcadia alignment to the proposed Briggs Road Substation.

The Q1-Galesville Route utilizes portions of the Q1-Highway 35 and Arcadia routes and a connector segment on new ROW north of Trempealeau. The Q1-Galesville Route is comprised of the following route segments:

- Common with Q1-Highway 35 Route: 1, 2A1, 2A2, 2A3, 2B, 2C, 2D, 2E, 2F, 2G, 2H and 2I
- Connector on new ROW: 6 and12
- Common with Arcadia Route: 13B2, 13C, 13D, 13E, 17A, 17B, 18A, 18B, 18C, 18D, 18E, 18F, 18G and 18H

The Q1-Galesville Route configuration and ROW sharing are presented in Figures 13 and 14. Route segments are described in Table 2.4-1 based on ROW sharing. More information about this route can be found in Section 2.4.

Table 2.1-4:
Q1-Galesville Route Configuration and Segment Summary
(Refer to Figures 13 and 14 in the Introduction and Overview section of this Application)

Q1-Galesville Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161/161 kV Double-Circuit Steel Lattice Poles (Energized at 161/69 kV) Proposed 345/345/161 kV Triple-Circuit Steel Multipole (Energized at 345/161/69 kV)	1	0.9	Rebuild of existing Dairyland 161/69 kV line that would be removed and included in new 345/161/69 triple-circuit. Starts at Wisconsin state boundary in the Mississippi River and follows the existing 161 kV corridor eastward. Crosses active railroad tracks that comprise part of a Dairyland power plant coal unloading facility before crossing the GRR/WI-35 and the existing 161 kV transmission corridor.
Existing 161 kV Single-Circuit Wood H-Frame Proposed 345/345 kV Double-Circuit Steel Monopole (Energized at 345/161 kV)	2A1	0.1	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Located east of the GRR/WI-35. Parallels existing transmission line corridors. Shares a transmission 161/69 kV corridor that has been cleared and maintained adjacent to the edge of forested lands.
	2A2	0.6	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Located east of the GRR/WI-35. Parallels existing transmission line corridors. Shares a transmission 161/69 kV corridor that has been cleared and maintained adjacent to the edge of forested lands.
	2A3	1.2	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Located east of the GRR/WI-35. Parallels existing transmission line corridors. Shares a transmission 161/69 kV corridor that has been cleared and maintained adjacent to agricultural areas and the edge of forested lands.

Q1-Galesville Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wood H-Frame Proposed 345/161 kV Double-Circuit Steel Monopole	2B	3.1	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Located west of the GRR/WI-35 and east of BNSF rail line. Crosses County Road OO, Foegen Road, Herman Street Road and North Main Street, while proceeding in a generally southeast direction. Shares 161 kV transmission corridor that is adjacent to active agricultural lands and rural agricultural development.
	2C	1.4	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses GRR/WI-35, Bluff Street, County Road O and a golf course, while generally staying on the east side of the GRR/WI-35. Shares 161 kV transmission corridor that is adjacent to a forest and rural residential area.
Existing 69 kV Single-Circuit Wood Monopole Proposed 345/161 kV Double-Circuit Steel Monopole	2D	1.8	Re-alignment to the Dairyland 69 kV corridor to reduce impacts to homes south of Cochrane and to mitigate aesthetic impacts to the GRR/WI-35. The existing Dairyland 161 kV and 69 kV lines near the GRR/WI-35 would be removed and relocated with the 345 kV line. Portions of a second 69 kV line near the GRR/WI-35 would also be removed.
			Crosses the GRR/WI-35, Wisconsin Street and BNSF rail line. Shares existing Dairyland 69 kV transmission corridor that passes through active agricultural areas.
Existing No Transmission 345 /161 kV Double-Circuit Steel Monopole	2E	3.1	Re-alignment on new corridor to reduce impacts to homes south of Cochrane and to mitigate aesthetic impacts to the GRR/WI-35. The existing Dairyland 161 kV and 69 kV lines near the GRR/WI-35 would be removed and relocated with the 345 kV line. Portions of a second 69 kV line near the GRR/WI-35 would also be removed.
			Parallels BNSF rail line and an existing 69 kV transmission line corridor. Crosses Prairie Moon Road and Bechly Road, while crossing active agricultural areas, rural residential and small wetlands.
	2F	1.1	Connects back to existing Dairyland 161 kV corridor.
			New alignment that crosses the GRR/WI-35 and Haney Drive. Crosses active agricultural land and a wetland.

Q1-Galesville Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wood H-Frame and Multipole Proposed 345/161 kV Double-Circuit Steel Monopole (2 Locations Require Multipoles)	2G	6.6	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Crosses Waumandee Creek Road, County Road G, Guenther Road, WI-95, County Road P and Rocky Ridge Road. Shares existing 161 kV transmission corridor that crosses a variety of terrain and land uses, including active agriculture, forest, open space and rural residential.
Existing No Transmission Proposed 345/161 kV Double-Circuit Steel Multipole	2H	0.7	Minor reroute to aid constructability through wooded, hilly topography. Located southwest of existing Dairyland 161 kV transmission corridor. Does not cross any existing roads, nor is it adjacent to development. Crosses forested terrain. Existing 161 kV alignment would be removed.
Existing 161 kV Single-Circuit Wooden H-Frame (Some Wood Multipole Structures) Proposed 345/161 kV Double-Circuit Steel Monopole (9 Locations Require Multipoles)	2I	7.5	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Crosses Brandhorst Road, Oak Lane, County Road P, the GRR/WI-35, Klein Lane, West Prairie Road and Delaney Road. Shares existing Dairyland 161 kV transmission corridor that crosses an active agricultural area, forest, open space and rural residential areas.

Q1-Galesville Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing No Transmission Proposed 345 kV Single-Circuit Steel monopole (2 Locations Require Multipoles)	6	5.4	Does not share with existing transmission corridor; however, it follows parcel and section lines. Segment selected to minimize impacts to residences. Crosses Sonsalla Road, Harris Road, the GRR/WI-35, Schubert Road and Wright Drive. Passes through areas in active agricultural production.
	12	0.9	Does not share with existing transmission corridor; however, it follows parcel and section lines. Segment selected to minimize impacts to residences. Crosses Towngale Road and passes through an active agricultural area.
Existing No Transmission Proposed 345 kV Single-Circuit Steel Monopole Vertical Configuration	13B2	3.5	Shares road corridor with WI-93. Segment follows south side of WI-93/WI-54/US-53 to reduce impacts to residences. Follows WI-93/WI-54/US-53. Crosses Engen Road, Dale Valley Lane, WI-93/WI-54/US-53, South 15th Street, West Mill Road, Hueston Street, North Main Street and Hilltop Lane. Passes through an active agricultural area, rural residential and small-scale commercial retail.
	13C	0.5	Shares road corridor with WI-93/WI-54/US-53. Segment follows south side of WI-93/WI-54/US-53 to reduce impacts to residences. Follows WI-93/WI-54/US-53. Crosses Hogden Road and McKeeth Drive. Passes through an edge of a forested woodland and roadside park.
	13D	0.9	Shares road corridor with WI-93/WI-54/US-53. Segment follows north side of WI-93/WI-54/US-53 to reduce impacts to residences. Follows WI-93/WI-54/US-53. Crosses WI-93/WI-54/US-53. Passes through active agricultural areas, forested woodlands and rural residential.
Existing No Transmission Proposed 345 kV Single-Circuit Steel Monopole	13E	0.7	New corridor, no sharing. Segment transitions from following WI-93/WI-54/US-53 eastward to intercept existing Xcel Energy 161 kV corridor. Does not occupy existing transmission line corridor. Poles can be spotted to minimize impact to agriculture. Crosses County Road AA. Passes through active agricultural areas and forested woodlands.

Q1-Galesville Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
Existing 161 kV Single-Circuit Wood H-Frame and Multipoles Proposed 345/161kV Double-Circuit (1 Location Requires a Multipoles)	17A	2.1	Rebuild of existing Dairyland 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses Pow Wow Lane, Council Bay Road and County Road T. Shares existing Dairyland 161 kV transmission corridor that passes through forested woodland, reforested area and rural residential area.
	17B	0.4	Rebuild of existing Xcel Energy 161 kV line that would be removed and included in a new 345/161 kV double-circuit. Segment selected to reduce impacts to homes on west side of Aspeslset Road. Xcel Energy 161 kV line on west side of the road would be removed and relocated with the 345 kV line.
			Crosses Aspeslset Road, Castle Heights Drive and Sylvester Road and generally parallels Aspeslset Road. Shares existing Dairyland 161 kV transmission corridor that passes through a rural residential area.
	18A	2.6	Rebuild of existing Xcel Energy 161 kV line that would be removed and included in a new 345/161 kV double-circuit.
			Crosses Castle Mound Golf Course. Crosses Castle Mound Drive and Cliff Shade Road. Shares existing Xcel Energy 161 kV transmission corridor along a treeline that is adjacent to active agricultural areas and rural residential.
Existing No Transmission Proposed 345/161 kV Double-Circuit Steel Monopole (5 Locations Require Multipoles)	18B	0.3	New alignment. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected as transition point leaving the existing Xcel Energy 161 kV corridor and heading towards WI-93/US-53, rather than continuing south along the existing corridor to avoid impacting residences and businesses near Holmen. Existing 161 kV line would be removed from this point south until crossing over WI-93/US-53.
			Crosses County Road HD and active agricultural areas.
	18C	0.6	New alignment shares corridor with County Road Hd. Existing Xcel Energy 161 kV line located to the east would be removed and included in new 345/161 kV double-circuit.
			Crosses County Road HD and Newport Road and then parallels County Road HD on the west side. Adjacent to active agricultural areas and an area in transition from agriculture to residential.
	18D	0.3	New alignment. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce

Q1-Galesville Route			
Existing/Proposed Configuration	Segment	Length (miles)	Description
			impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			East of US-53/GRR and west of County Road Hd. Crosses Old Na Road. Along property lines Crosses active agricultural areas. Poles can be spotted to minimize impacts to agriculture.
	18E	0.3	New alignment. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			East of GRR/US-53 and west of County Road Hd.
	18F	0.6	New alignment, shares roadway corridors. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			Shares corridor with local roadways, such as Briggs Road and GRR/US-53. Crosses Sween Drive and County Road MH. Adjacent to Holmen High School and low density residential areas and crosses active agricultural areas.
	18G	0.6	New alignment transitioning to US-53. Existing Xcel Energy 161 kV line located further east would be removed and included in new 345/161 kV double-circuit. Segment selected to reduce impacts to residences near Holmen. Existing Xcel Energy 161 kV line east of here would be removed and relocated with the 345 kV line.
			East of the GRR/US-53 County Road MH interchange. Crosses GRR/US-53 and passes through open space and a low density residential area.
	18H	0.7	345/161 kV double-circuit.
			Continues to the proposed Briggs Road Substation on the west side of GRR/US-53. Passes through an area of active agriculture.

2.1.1.4. Tremval-Mayfair and Dairyland Q1 161 kV Transmission Line Reroutes

As part of the La Crosse Project, the existing Xcel Energy Tremval-Mayfair 161 kV transmission line and the existing Dairyland Q1 161 kV transmission line would be rerouted to the proposed Briggs Road Substation. The reroutes are shown in Figures 4 and 5 (and are shown in more detail in Figures 3 and 4 of Appendix K).

The Applicants evaluated two potential substation sites. The Briggs Road Substation West Site was used for describing the routes in this section. Locating the substation on the Briggs Road Substation East Site is a shift of only 1,600 feet; therefore, the impacts would be essentially the same. For the East Site, the lines approaching the substation from the northwest would become approximately 1,600 feet longer, but lines entering the substation from the east would become approximately 1,600 feet shorter. Substation information is included in Appendix K.

Regardless of the route selected, Xcel Energy's Tremval-Mayfair 161 kV line and Dairyland's Q1 161 kV line must be routed into the Briggs Road Substation to connect the 345 kV line to the existing system. The longer of the reroutes is approximately 0.75 miles. These reroutes are shown in Figures 4 and 5 and are described in more detail in Section 2.6.

2.1.2. General Description of the Proposed Line

2.1.2.1. Size of Lines

2.1.2.1.1. Voltage

The Applicants propose to construct a new 345 kV circuit in Wisconsin. Existing 161 kV and 69 kV lines in the study area present themselves as routing opportunities for the 345 kV line. If overtaken by the 345 kV transmission route, the lower voltage transmission would be removed and reconstructed at their existing voltages in a double or triple-circuit with the 345 kV line.

The MPUC ordered the Minnesota sections of the Project to be constructed on poles capable of carrying a second 345 kV line if authorized at a future date (CON Order at 28-30). In its decision, the MPUC elected to maximize the potential for new 345 kV ROWs created in Minnesota by ordering the poles be constructed with the capability of adding a second circuit in the future if authorized. Adding a second circuit does not increase ROW width.

The Applicants propose this double-circuit-ready configuration be continued in Wisconsin for 1.0 to 2.8 miles depending on the route selected:

- Q1-Highway 35 Route: Segments 1, 2A1, 2A2, 2A3 (2.8 miles).
- Q1-Galesville Route: Segments 1, 2A1, 2A2, 2A3 (2.8 miles).
- Arcadia Route: Segments 1, 2A1, 2A2 (1.6 miles).
- Arcadia-Alma Option: Segments 1, 2A1 (1.0 miles).

Segment 1 (Mississippi River crossing) would be constructed as 345/345/161 kV and energized as 345/161/69 kV. Segments 2A1, 2A2 and 2A3 would be constructed as 345/345 kV and energized at 345/161 kV. These configurations have little impact on the appearance of the poles as pole geometry and spacing is governed by the 345 kV design. No additional ROW would be required.

The double circuit 345/345 kV design is proposed to end at the Dairyland ash disposal facility near Dairyland Plant Road. Continuing this double circuit capable design to this location maximizes the carrying capacity of the existing ROW in an area with very limited routing options. Once at Dairyland

Plant Road, several co-location opportunities are available for a future 345 kV single circuit line: 161 kV line route to Holmen and La Crosse (Q1); 161 kV line route to Arcadia, Blair, Jackson County and I-94; and 161 kV line route to Eau Claire. A 345/161 kV substation at the Dairyland ash facility may also provide future benefits by allowing the 345 kV line to interconnect with 161 kV lines in the area.

A second 345 kV line would require a CON in Minnesota and a CPCN in Wisconsin. See CON Order on 28-30.

2.1.2.1.2. Size of Shield Wire

All routes would use two shield wires to protect phase conductors from lightning strikes. Depending on the route, the shield wires could consist of standard 7/16-inch, seven-strand extra high strength steel (EHS) cable and/or a steel and aluminum stranded wire containing a fiber optic bundle core (generally known as optical ground wire or OPGW). OPGW allows both lightning protection and a communication path between substations. The fiber optic would be utilized only for utility communication or to replace fiber currently installed on Dairyland's system. Table 2.1-5 summarizes shield wire information.

Table 2.1-5:
Size of Shield Wire

Shield Wire #	Segments	Type	Purpose
Q1-Highway 35 Route			
1	All	OPGW 48 fiber	Lightning protection and continuous ground. Control communication between Project substations. Intra-utility communications for CapX2020 Utilities.
2	All	OPGW 36 fiber	Lightning protection and continuous ground. Replacement for existing fiber on Dairyland's Q1 (12 fibers leased to Norlight and an additional 24 fibers for Dairyland's intra-utility communication).
Arcadia Route			
1	All	7/16-inch EHS	Lightning protection and continuous ground.
2	All	OPGW 48 fiber	Lightning protection and continuous ground. Control communication between Project substations. Intra-utility communications for CapX2020 Utilities.
Q1-Galesville Route			
1	All	OPGW 48 fiber	Lightning protection and continuous ground. Control communication between Project substations. Intra-utility communications for CapX2020 Utilities.
2	1, 2	OPGW 36 fiber	Lightning protection and continuous ground. Replacement for existing fiber on Dairyland's Q1 (12 fibers leased to Norlight and an additional 24 fibers for Dairyland's intra-utility communication).

2.1.2.1.3. Size of Conductor

345 kV Circuit: The 345 kV transmission line would use two 954 kcmil 45/7 Cardinal ACSS or 954 ACSS/TW Cardinal 20/7 Type 13 conductors per phase.[5]

161 kV Circuits: All 161 kV circuits rebuilt as part of this Project would use a single 795 kcmil 26/7 Drake ACSS conductor per phase.

69 kV Circuits: All 69 kV circuits rebuilt as part of this Project would use a single 795 kcmil 26/7 Drake ACSS conductor per phase.

2.1.2.1.4. Pole Type, Height and Typical Span Length

Except where galvanized poles would be utilized to minimize visual impacts along the GRR/WI-35, the proposed transmission line would use weathering steel poles that oxidize to a dark brown color. For most of the Project, the Applicants propose to install single shaft steel poles on concrete foundations. Large angles (typically those greater than 30 degrees) would be designed as two-pole poles to reduce foundation diameters and to aid constructability. In addition, several locations in the hilly coulee region would require multipole structures for additional strength required for long spans between hilltops, to aid constructability, or to aid construction access.

Tables 2.1-6 through 2.1-9 present pole type, height and typical span lengths.

Table 2.1-6:
Q1-Highway 35 Route Pole Type, Height and Typical Span Lengths

PoleType	Figure in Appendix L	Typical Height Above Ground (feet)	Typical Span Length (feet)
345/161 kV Double-Circuit I-String Tangent	S6-1	145-165	700-950
345/161 kV Double-Circuit 1°-5° I-String	S6-2	125-155	600-800
345/161 kV Double-Circuit 5°-15° I-String	S6-3	155-175	600-1,000
345/161 kV Double-Circuit 15°-30° I-String	S6-4	145-170	600-1,000
345/161 kV Double-Circuit V-String Tangent	S6-5	140-185	700-1,300
345/161 kV Double-Circuit 1°-5° V-String	S6-6	155-170	700-1,100
345/161 kV Double-Circuit 30°-60° Deadend	S6-7A or S6-7B	135-155	700-1,000
345/161 kV Double-Circuit 60°-95° Deadend	S6-10A or S6-10B	130	800
345 kV Single-Circuit 30°-60° Deadend	S6-9	120	300
161 kV Single-Circuit 30°-60° Deadend	S6-8	70-110	300-500

[5] The conductors have equivalent capacity (1725 amps for ACSS/TW and 1716 amps for ACSS). ACSS/TW is slightly more expensive (approximately $1,500 per circuit mile) but is expected to result in overall savings from reduced structure loading and reduced risk of damage during installation. If both conductors are approved, the Applicants would make a choice after a constructability review with the construction contractor and project team.

PoleType	Figure in Appendix L	Typical Height Above Ground (feet)	Typical Span Length (feet)
345/161/69 kV Triple-Circuit Deadend	S6-13	80-199	970-1,670
345/161/69 kV Triple-Circuit Tangent	S6-12	140	900-1,200
345/161 kV 6-Pole Deadend	S6-16	160	1700-2,500
345/161 kV Double-Circuit H-Frame Deadend	S6-15	170	1200-2,000
345/161 kV Double-Circuit I-String Tangent w/ 69 kV U.B.	S6-17	160	780-790
345/161 kV Double-Circuit Wetland H-Frame	S6-11	75-95	650-1,000
69 kV Mid-Span Single-Circuit Tangent	S6-14	55	300-400
345/161 kV Double-Circuit Wetland H-Frame w/ 69 kV UB	S6-28	90-130	600-950

Table 2.1-7:
Arcadia Route Pole Type, Height and Typical Span Lengths

Pole Type	Figure in Appendix L	Typical Height Above Ground (feet)	Typical Span Length (feet)
345/161 kV Double-Circuit I-String Tangent	S6-1	130-170	700-950
345/161 kV Double-Circuit 1°-5° I-String	S6-2	140-145	800-950
345/161 kV Double-Circuit 5°-15° I-String	S6-3	135-170	700-1,200
345/161 kV Double-Circuit 15°-30° I-String	S6-4	140-160	700-1,000
345/161 kV Double-Circuit V-String Tangent	S6-5	135-195	600-1,500
345/161 kV Double-Circuit 1°-5° V-String	S6-6	160-185	800-1,200
345/161 kV Double-Circuit 30°-60° Deadend	S6-7A or S6-7B	130-165	600-1,200
345/161 kV Double-Circuit 60°-95° Deadend	S6-10A or S6-10B	130-170	800-1,000
345 kV Single-Circuit I-String Vertical Tangent	S6-18	130-160	700-900
345 kV Single-Circuit I-String 1°-5° Vertical RA	S6-20	140-165	700-950
345 kV Single-Circuit I-String 5°-15° Vertical RA	S6-22	155-165	700-950
345 kV Single-Circuit I-String 15°-30° Vertical RA	S6-24	150-165	600-950
345 kV Single-Circuit I-String Delta Tangent	S6-19	125-135	900-950
345 kV Single-Circuit I-String 1°-5° Delta RA	S6-21	130-145	700-950
345 kV Single-Circuit I-String 5°-15° Delta RA	S6-23	135-145	900-1,000
345 kV Single-Circuit I-String 15°-30° Delta RA	S6-25	130	1,000-1,400
345 kV Single-Circuit V-String Delta Tangent	S6-26	135-155	1,000-1,400
345 kV Single-Circuit V-String 1°-5° Delta RA	S6-27	140	900
345 kV Single-Circuit 30°-60° Deadend	S6-9	140-160	700-1,000
161 kV Single-Circuit 30°-60° Deadend	S6-8	70-110	300-500

Pole Type	Figure in Appendix L	Typical Height Above Ground (feet)	Typical Span Length (feet)
345/161/69 kV Triple-Circuit Deadend	S6-13	80-199	970-1,670
345/161/69 kV Triple-Circuit Tangent	S6-12	140	900-1,200
345/161 kV Double-Circuit H-Frame Deadend	S6-15	140-175	1,000-2,000

Table 2.1-8:
Arcadia-Alma Option Pole Type, Height and Typical Span Lengths

Pole Type	Figure in Appendix L	Typical Height Above Ground (feet)	Typical Span Length (feet)
345/161 kV Double-Circuit I-String Tangent	S6-1	130-170	600-950
345/161 kV Double-Circuit 1°-5° I-String	S6-2	140-145	800-950
345/161 kV Double-Circuit 5°-15° I-String	S6-3	130-170	700-1,000
345/161 kV Double-Circuit 15°-30° I-String	S6-4	140-170	700-1,000
345/161 kV Double-Circuit V-String Tangent	S6-5	140-180	900-1,500
345/161 kV Double-Circuit 1°-5° V-String	S6-6	165-175	1,000-1,500
345/161 kV Double-Circuit 30°-60° Deadend	S6-7A or S6-7B	130-165	600-1,100
345/161 kV Double-Circuit 60°-95° Deadend	S6-10A or S6-10B	130-150	900-1,200
345 kV Single-Circuit I-String Vertical Tangent	S6-18	130-160	700-900
345 kV Single-Circuit I-String 1°-5° Vertical RA	S6-20	150-165	700-900
345 kV Single-Circuit I-String 5°-15° Vertical RA	S6-22	155-165	700-1,000
345 kV Single-Circuit I-String 15°-30° Vertical RA	S6-24	150-165	700-900
345 kV Single-Circuit I-String Delta Tangent	S6-19	125-150	900-950
345 kV Single-Circuit I-String 1°-5° Delta RA	S6-21	130-145	700-950
345 kV Single-Circuit I-String 5°-15° Delta RA	S6-23	145	1,100
345 kV Single-Circuit V-String Delta Tangent	S6-26	135-155	700-1,100
345 kV Single-Circuit V-String 1°-5° Delta RA	S6-27	140	900
345 kV Single-Circuit 30°-60° Deadend	S6-9	140-160	700-1,000
161 kV Single-Circuit 30°-60° Deadend	S6-8	70-110	300-500
345/161/69 kV Triple-Circuit Deadend	S6-13	80-199	970-1,670
345/161/69 kV Triple-Circuit Tangent	S6-12	140	900-1,200
345/161 kV Double-Circuit H-Frame Deadend	S6-15	175	1,900

Table 2.1-9:
Q1–Galesville Route Pole Type, Height and Typical Span Lengths

Pole Type	Figure in Appendix L	Typical Height Above Ground (feet)	Typical Span Length (feet)
345/161 kV Double-Circuit I-String Tangent	S6-1	130-160	700-950
345/161 kV Double-Circuit 1°-5° I-String	S6-2	125-155	600-800
345/161 kV Double-Circuit 5°-15° I-String	S6-3	135-175	700-1,100
345/161 kV Double-Circuit 15°-30° I-String	S6-4	145-165	700-1,300
345/161 kV Double-Circuit V-String Tangent	S6-5	135-190	700-1,400
345/161 kV Double-Circuit 1°-5° V-String	S6-6	155-170	700-1,000
345/161 kV Double-Circuit 30°-60° Deadend	S6-7A or S6-7B	130-155	700-1,000
345/161 kV Double-Circuit 60°-95° Deadend	S6-10A or S6-10B	130-150	900-1,000
345 kV Single-Circuit I-String Vertical Tangent	S6-18	130-160	600-900
345 kV Single-Circuit I-String 1°-5° Vertical RA	S6-20	150-160	700-900
345 kV Single-Circuit I-String 5°-15° Vertical RA	S6-22	155-175	700-900
345 kV Single-Circuit I-String 15°-30° Vertical RA	S6-24	150-165	700-900
345 kV Single-Circuit I-String Delta Tangent	S6-19	115-135	700-950
345 kV Single-Circuit I-String 1°-5° Delta RA	S6-21	115	800-900
345 kV Single-Circuit V-String Delta Tangent	S6-26	135-140	800-1,100
345 kV Single-Circuit V-String 1°-5° Delta RA	S6-27	120-160	900-950
345 kV Single-Circuit 30°-60° Deadend	S6-9	125-140	1,000
161 kV Single-Circuit 30°-60° Deadend	S6-8	70-110	300-500
345/161/69 kV Triple-Circuit Deadend	S6-13	80-199	970-1,670
345/161/69 kV Triple-Circuit Tangent	S6-12	140	900-1,200
345/161 kV 6-Pole Deadend	S6-16	160	1,700-2,500
345/161 kV Double-Circuit H-Frame Deadend	S6-15	170	1,100-2,000
345/161 kV Double-Circuit I-String Tangent w/ 69kV U.B.	S6-17	160	780-790
345/161 kV Double-Circuit Wetland H-Frame	S6-11	90-110	700-1,000
69 kV Mid-Span Single-Circuit Tangent	S6-14	55	300-400