4.0 Assessment of Impacts and Mitigation

4.1 Description of Environmental Setting

The project area is located within and near the City of Redwood Falls in Redwood County. According to the Minnesota Department of Natural Resources (DNR) Ecological Classification System (ECS), the project area is located within the Minnesota River Prairie Subsection of the North Central Glaciated Plains section and the Prairie Parkland Province (DNR 2011).

The Minnesota River Prairie Subsection consists of a gently rolling ground moraine about 60-miles wide (DNR 2011). The Minnesota River valley was created by Glacial River Warren, which drained Glacial Lake Agassiz (DNR 2011). Within this subsection, loamy ground moraine is the dominant landform, with end moraines and lake plains also present (DNR 2011). The presettlement vegetation consisted primarily of tallgrass prairie with forests composed of silver maple, elm, cottonwood, and elm present along floodplains (DNR 2011).

Presently, the project area is primarily agricultural, with corn and soybeans representing the major crops. Forested areas are present along the Redwood River.

4.2 Impacts on Human Settlement

4.2.1 Property Values

The relationship between property values and proximity to transmission lines has been thoroughly researched, but no clear cause-and-effect relationship has been consistently identified. A recent literature review found little or no effect on sales prices due to proximity to transmission lines (Jackson and Pitts, 2010). In studies that identified a relationship between property values and proximity to transmission lines, the effect generally dissipated with time and distance. The effects that were found ranged from an approximately 2 to 9 percent decrease in property value. In some cases, particularly with development of vacant land, increases in property value were found (Jackson and Pitts 2010). The primary strategy to mitigate possible impacts to property values would be to avoid residences as much as possible during route selection.

4.2.2 Displacement

For electrical safety code and maintenance reasons, utilities do not generally allow residences or other buildings within the ROW easement for a high-voltage transmission line. Where the proposed project parallels existing roadways, structures would be placed 2 to 3 feet within the road ROW and an overhead easement would extend 15 feet onto private property. Residences, buildings, and tall

vegetation would not be allowed within this overhead easement area. In areas where the proposed project travels "cross-country" through private property, a 75-foot easement would be required. Where a 75-foot easement is required, tall vegetation would be removed from the easement area.

A displacement is defined by the SMMPA as any occupied structure (residence or business) located within the 15-foot overhead easement or 75-foot ROW of the proposed route.

Based on the review of aerial photographs and a subsequent field review completed in January, 2010, there are no residences located within the ROW for the proposed route. Figure 4.2.2-1 and Figure 4.2.2-2 show the number of residences and other structures located within 20, 37.5, 75, 100, 200, and 300 feet of the centerline of the proposed route. There are no occupied structures within the 15-feet overhead easement or 75-feet ROW of the proposed route, therefore no displacement would result from construction of the proposed Project. However, there are two locations on the proposed route that have wind rows around residences. These wind rows are within the proposed route ROW and may require some tree removal prior to construction of the proposed Project.

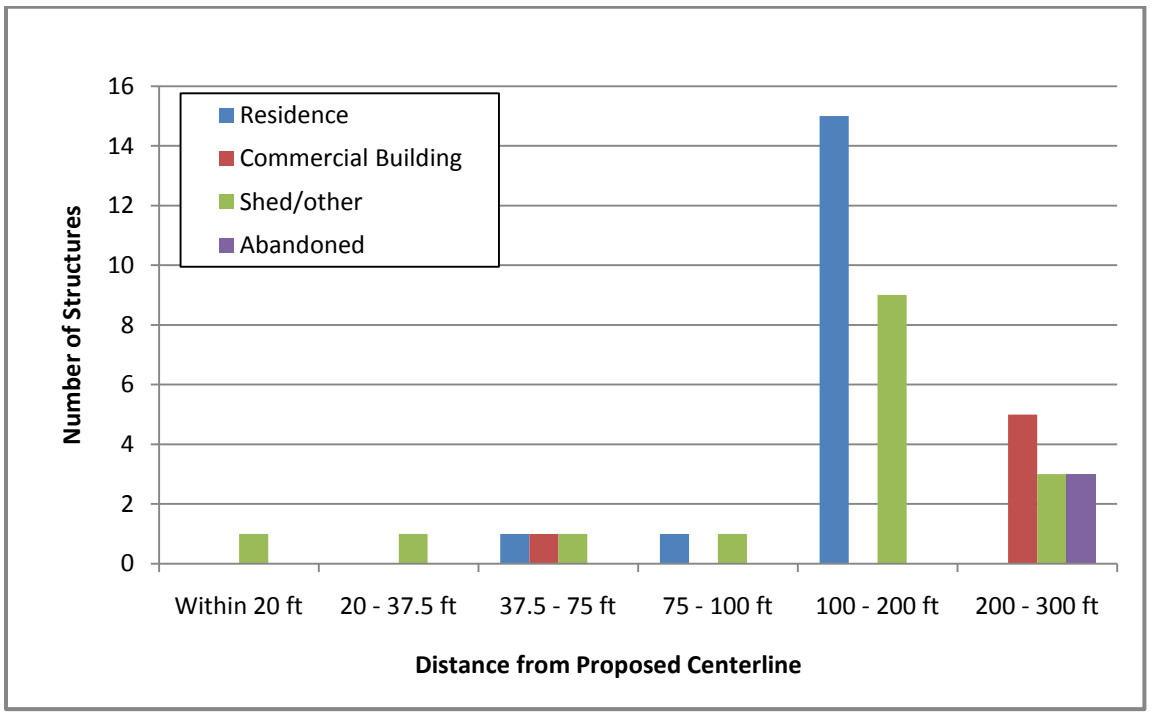
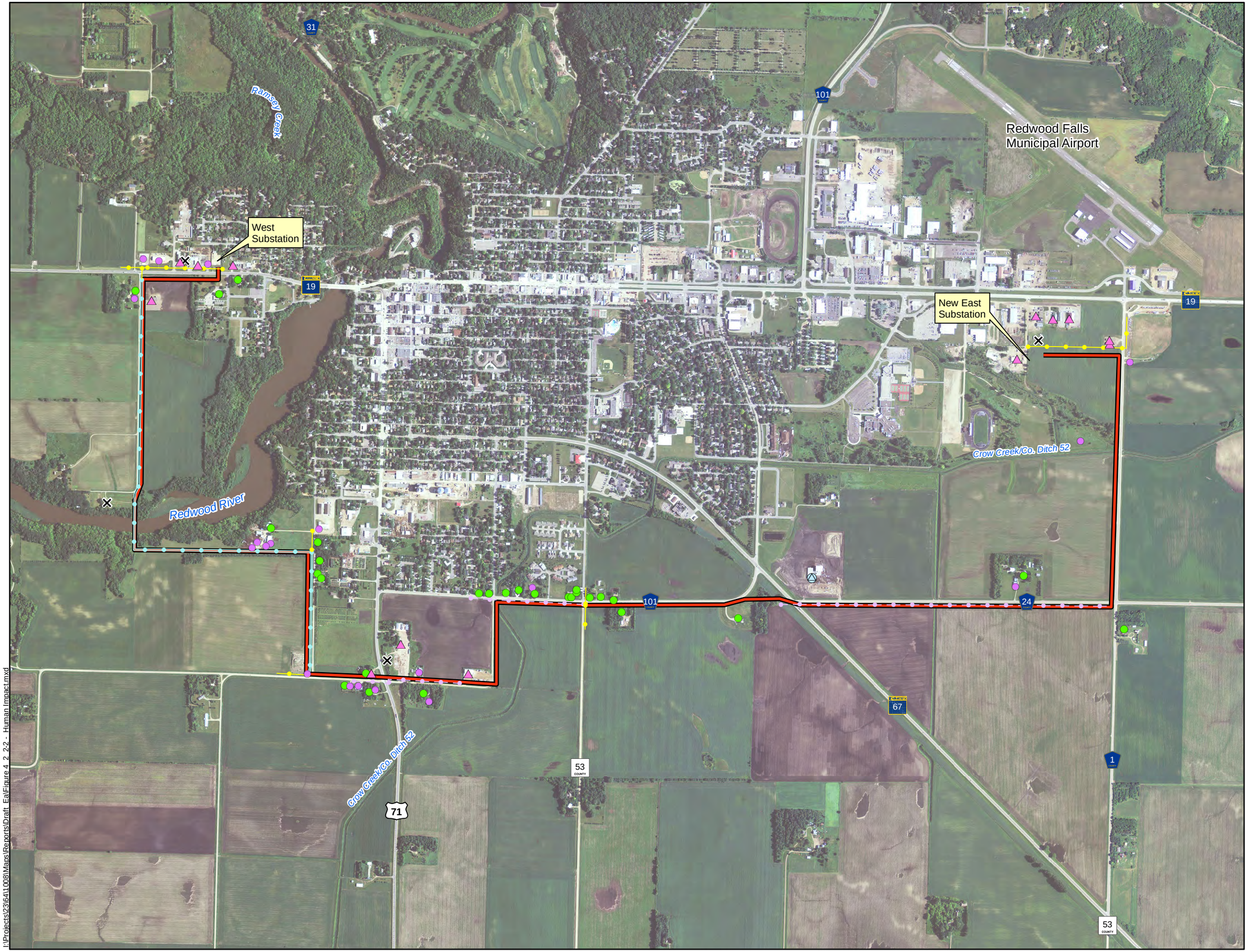


Figure 4.2.2-1 Proximity of Structures to Proposed Route Centerline



Proposed 115 kV Alignment

Existing Distribution Line

Existing Distribution Line - To Be Buried

Existing Distribution Line - To Be Double-Circuited

Residences and Buildings

- Residence
- Commercial
- Daycare
- Municipal or Other
- Abandoned

Imagery Source: FSA, 2010

N

0 0.25 0.5

Miles

Figure 4.2.2-2

Human Impact Map
SMMPA 115 kV Transmission Line Project
Redwood Falls Area
Redwood County, MN

I:\Projects\23\641\008\Maps\Reports\Draft EA\Figure 4_2_2-2 - Human Impact.mxd

4.2.3 Noise

Noise is generally defined as unwanted sound. Sound travels in mechanical wave motion and produces a sound pressure level. The sound pressure level is commonly measured in decibels (dB), representing the logarithmic increase in sound energy relative to a reference energy level. Sound measurement is further refined by using an A-weighted decibel scale (dBA) to emphasize the range of sound frequencies that are most audible to the human ear (i.e., between 1,000 and 8,000 cycles per second).

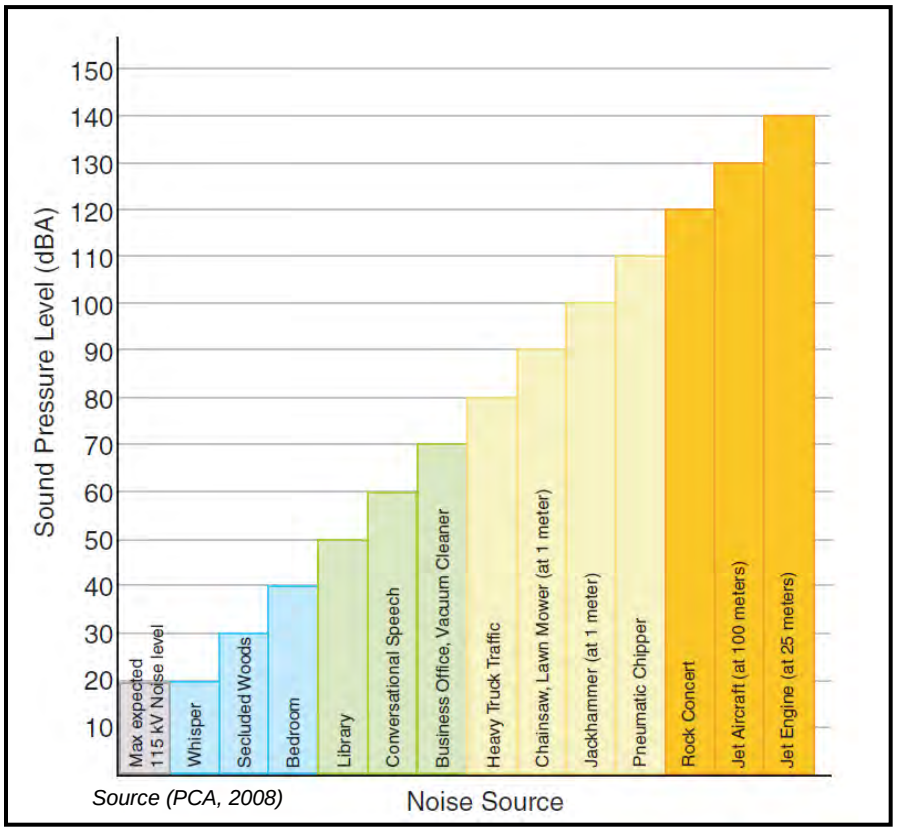


Figure 4.2.3-1 Comparison of Modeled Project Noise with Noise Levels Associated with Common, Everyday Noise Sources

Cumulative noise increases occur on a logarithmic scale. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5 dBA change in noise level, however, is clearly noticeable. A 10 dBA change in noise levels is perceived as a doubling or halving of noise loudness, while a 20 dBA change is considered a dramatic change in loudness. For cumulative increases in noise resulting from sources of different magnitudes, the rule of thumb state that if there is a difference of

greater than 10 dBA between noise sources, there will be no additive effect to the overall noise level (i.e., only the louder source would be heard and the quieter source would not contribute to noise levels). Figure 4.2.3-1 shows noise levels associated with common, everyday sources and places the magnitude of noise levels associated with the proposed project in context. Noise levels for a 115 kV transmission line typically range from 0 to 20 dBA, depending on the weather.

Transmission lines can produce noise under certain conditions. The level of noise depends on conductor conditions, voltage level, and weather conditions. In damp or rainy weather, transmission lines can create a crackling sound due to the small amount of electricity ionizing the moist air near the conductors.

During heavy rain, the background noise level of the rain is usually greater than 10 dBA louder than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain. This is confirmed by calculated levels during a heavy rain (1 inch per hour) that shows noise levels for a 115 kV line at less than 25 percent of the most sensitive state NAC (NAC 1). During light rain, dense fog, snow, and other times when there is moisture in the air, transmission lines will produce audible noise at approximately household background levels. During dry weather, audible noise from transmission lines is barely perceptible.

The Minnesota Pollution Control Agency (PCA) has established standards for the regulation of daytime and nighttime noise levels for areas of residential, commercial, and industrial land use. The primary noise-sensitive receptors in the project area are rural residences. Generally, activity-related noise levels during the operation and maintenance of transmission lines are minimal and do not exceed the PCA noise limits outside of the ROW. The PCA noise limits are shown in Table 4.2.3-1.

Table 4.2.3-1State Noise Limits

State noise limits by noise area classification (NAC)		L_{50} (dBA)	L_{10} (dBA)
NAC 1 Residential	Daytime	60	65
	Nighttime	50	55
NAC 2 Commercial	Daytime	65	70
	Nighttime		
NAC 3 Industrial	Daytime	75	80
	Nighttime		

4.2.4 Aesthetics

The scenic value or visual importance of an area is a subjective matter and depends upon the perception and philosophical and/or psychological response of the viewer. Generally, landscapes that exhibit a high degree of variety and harmony among the basic elements of form, line, color, and texture have the greatest potential for high visual and aesthetic quality. The level of impact to visual resources is also subjective and generally depends on the sensitivity and exposure of a particular viewer and can, therefore, vary greatly from one individual to the next.

The existing landscape character across the project is dominated by farmsteads and agricultural lands, with a few more developed areas where the line passes along the outskirts of the City of Redwood Falls. The landscape varies from mostly flat to rolling agricultural land.

Visual impacts would result from new transmission line structures, conductors, and new or expanded ROW. Throughout the project area, the transmission line structures would clearly be visible along roads and through private lands. The degree of these impacts depends upon the extent of corridor sharing, the degree of shielding by terrain and vegetation, and the amount of existing human modification to the landscape. While the proposed Project will introduce some aesthetic impacts, in areas where existing distribution line is buried the proposed Project will effectively eliminate any prior aesthetic impacts imposed by the distribution line. In agricultural areas along the majority of the proposed route, the structures would likely represent the tallest features of the landscape since they would be 70 to 80 feet in height. The proposed transmission line and structures would add some visual impacts to the changing landscape of the semi-rural areas near the city limits of Redwood Falls.

4.2.5 Public Services

Construction of the project is not anticipated to affect any public services or existing utilities (gas, telephone, electric, water, or sewer). SMMPA will work with landowners and the utility providers to avoid direct or indirect impacts to public utilities. If any unexpected impacts to utilities have the potential to occur, SMMPA will work with both landowners and local agencies to determine the most appropriate placement for structures. It may be necessary for SMMPA to work with other public service utilities to relocate their facilities if they conflict with the location of the proposed route. The construction of the proposed Project would include the burial of existing distribution lines within the new 115 kV corridor; this process is expected to result in limited, temporary disruption to service. No direct long-term impacts to public buildings or infrastructure are expected.

4.2.6 Transportation

The proposed route would be constructed primarily along or parallel to existing utility or road ROW. In addition, the proposed route would cross county roads in several areas. There may be temporary traffic impacts associated with equipment and material delivery and worker transportation. During construction, impacts could result from construction vehicles and safety perimeters limiting public access to roadways via temporary road closures or lane restrictions. Access required for modification of the existing substation would be from existing roads and would only cause minor and temporary disruption to traffic. In certain areas where existing distribution lines would be buried beneath public roadways, controlled lane closure would be used to allow continued use of the roadway. SMMPA will coordinate with the affected governmental units along the selected route during detailed design regarding the final placement of structures. Any required temporary lane closures would be coordinated with the local jurisdictions, and would provide for safe access of police, fire, and other rescue vehicles. Permits that will be required prior to commencing construction activities which may affect roadways are discussed in Section 5.0.

There is one public airport within ½ mile of the proposed project. The Redwood Falls Municipal Airport is located east on State Highway 71/19 and County Road 1. Categorized as a general aviation airport, the facility has a main paved runway of 4,000-feet by 100-feet wide; and a crosswind grass runway. The Federal Aviation Administration, National Weather Service operates a weather station at the airport and the airport also has an automated weather instrument system. In addition, North Memorial Ambulance operates Air Care III out of the Redwood Falls Municipal Airport.

A review of the Redwood County and City of Redwood Falls Zoning Ordinances indicated that land use is restricted in "land use safety zones" defined in Subdivision 5 of the Redwood County Zoning Ordinance Section 34: Airport Zoning Ordinance, and structures are prohibited in "airspace zones" defined in Subdivision 4 of the Redwood County Zoning Ordinance Section 34: Airport Zoning Ordinance. The proposed substation and portions of the proposed transmission line are located within land use safety zone C but do not violate any of the use restrictions of this zone. The proposed substation and transmission lines are not located within any of the airspace zones.

4.2.7 Electronic Device Interference

This section summarizes the potential impacts on electronic communication and similar devices, including radios, televisions, and Global Positioning System (GPS)-based agricultural navigation systems. Medical electronic devices are discussed in Section 4.6.1.2.

4.2.7.1 *Radios*

Corona is the breakdown and ionization of air within a few centimeters of conductors and line hardware. Corona from transmission line conductors generates electromagnetic "noise." This noise may cause broadband interference at the same frequencies that many communication and media signals are transmitted. This noise can cause interference with the reception of these signals depending on the frequency and strength of the signal. The corona can affect both amplitude modulated (AM) and frequency modulated (FM) radio receivers. AM radio frequency interference typically occurs under a transmission line and dissipates rapidly to either side.

FM radio receivers usually do not pick up interference from transmission lines because:

- Corona-generated radio frequency noise currents are quite small in the FM broadcast band (88-108 megahertz (MHz)).
- The excellent interference rejection properties inherent in FM radio systems make them virtually immune to amplitude type disturbances.
- Radio communication can also be affected by corona. Radio communication can use either AM or FM equipment. As is the case with media transmissions, AM communication can be affected by corona more so than FM radio communication.

The steel towers of a transmission line could interfere, or cause signal blocking effects, on two-way mobile radio communication if the tower(s) were directly between the two mobile units. As a person moves away from the transmission line tower, the blocking would decrease as is the case with interference that might be encountered with AM radio communication.

4.2.7.2 *Televisions*

Both digital and satellite television (TV) are expected to have little interference from corona-generated noise. Digital TV broadcast frequencies are high enough that they are relatively immune to corona-generated noise. Satellite TV is transmitted in the K_u band of radio frequencies and is likewise immune to corona-generated noise.

Both digital and satellite TV reception can be impacted by tower placement. That is, the proximity of the towers themselves, rather than any electromagnetic phenomenon, can impact reception. Compared to previously-used analog broadcasts, digital TV reception is somewhat less resistant to multipath reflections. Multipath reflections (shadowing) might be generated from towers in proximity to the receiving antenna. An outdoor antenna may be necessary to solve issues with multipath reflections. Line of sight for satellite TV users could be obstructed by a transmission line structure.

Line of sight can usually be restored by moving the consumer satellite dish to a slightly different location.

4.2.7.3 *Internet and Cellular Phones*

Wireless internet and cellular phones use frequencies in the 900 MHz ultra-high frequency (UHF) range. The specific UHF frequency used by a cellular phone would depend on the technology (global system for mobile communications (GSM), 3G, etc.) of the provider. Radio frequencies used for both cellular phones and wireless internet are high enough that the adverse impacts on communications from corona-generated noise near the transmission line would be negligible. Line of sight for wireless internet and cellular phone users could be obstructed by a transmission line structure. However, interference should typically diminish if a person moved a little so that the tower would not be in the direct line of sight.

4.2.7.4 *GPS-Based Agricultural Navigation Systems*

GPS is an electronic navigation system that collects and coordinates data from at least four satellites at any one time. As such, positioning of the four satellites, and signal strength are the key factors that determine accuracy of the GPS. In 2002, the Institute of Electronics and Electrical Engineers (IEEE) conducted a series of experiments to observe if overhead transmission lines interfere with the GPS function. One of the tests utilized a Trimble GPS receiver near a 345 kV line to determine if corona noise and gap discharge could affect the "lock" a receiver had on the satellite constellation above. The results from this experiment by IEEE are as follows:

- Generally, GPS function is very minimally affected by transmission line electromagnetic interference (EMI).
- Interference that is caused could be either due to corona noise or gap discharges.
- Rarely, transmission structures may cause a drop in accuracy due to blocking a view of at least one of the satellites from GPS. However, corona noise and gap discharges do not cause loss of a satellite signal "lock" (IEEE, 2002 as cited in Minnkota Power Cooperative, Inc., n.d.).

Based on this research, GPS signals very rarely experience interference from overhead transmission lines. On rare occasions, a transmission line structure may cause a drop in accuracy within a GPS device due to blocking a view to one satellite, but this would only occur if the receiver, tower, and satellite are in a line, which is rare. Typically, if there is any EMI present, proper GPS function is usually restored in minutes (IEEE, 2002 as cited in Minnkota Power Cooperative, Inc., n.d.).

4.2.7.5 *Electronic Device Interference Mitigation*

Potential impacts from transmission line corona could be mitigated by design and construction directed at minimizing insulation gaps and sparking that cause corona discharges. Minimizing corona minimizes impacts to radio signals.

If interference from transmission line corona occurs for an AM radio station that is within the station's primary coverage area and that had good reception before the project was built, satisfactory reception could be obtained by appropriate modification of the owner's receiving antenna.

If the steel towers of a transmission line interfere with, or cause signal blocking effects, on two-way mobile radio communication if the tower were directly between the two mobile units, moving either mobile unit so that the tower is not immediately between the two units should restore communications. This would generally require a movement of less than 50 feet by the mobile unit adjacent to a metallic tower.

Digital reception in most cases is more tolerant of noise and somewhat less resistant to multipath reflections (i.e., reflections from structures) than analog broadcasts. Although digital reception is more tolerant of radio frequency noise, it would impact digital television reception if the noise levels or reflections are great enough. In the rare occasion where the construction of the project may cause interference within a television station's primary coverage area, this problem could be corrected for affected viewers; this can usually be corrected with the addition of an outside antenna. If transmission line structures obstruct satellite dishes, the satellite dishes could be moved to a different location.

4.3 Impacts on Land-based Economies

4.3.1 Recreation and Tourism

There are several recreation areas in the vicinity of the project as well as snowmobile trails (Figure 4.3.1-1). Two parks, Tyson Park and Normandale Park, are located within ¼ mile of the proposed route centerline from the point where the route is located south of the Redwood Falls. In addition, the Redwood Falls Disc Golf Course is located south of the area where the proposed route enters the new East Substation. Construction and operation of the transmission line are not expected to inhibit recreation activities. However, the short-term presence of construction equipment and the long-term presence of structures and substation equipment may impact the view shed for visitors to these recreational areas.

Proposed 115 kV Alignment

Existing Distribution Line

Existing Distribution Line - To Be Buried

Existing Distribution Line - To Be Double-Circuited

Redwood County Snowmobile Trail

Boat Access

Local Park

Imagery Source: FSA, 2010

N

0 0.25 0.5

Miles

Figure 4.3.1-1

Recreation Resources
SMMPA 115 kV Transmission Line Project
Redwood Falls Area
Redwood County, MN

I:\Projects\23\641\008\Maps\Reports\Draft EA\Figure 4_3_1-1 - Recreation Resources.mxd

4.3.2 Agriculture

Agriculture is the primary land-based economic resource in the project area. The principal crops in the project area include corn and soybeans. In general, impacts to agricultural lands will be minimized by sharing existing road and highway ROWs to the extent possible. In areas where the proposed route parallels roadway, structures will be placed 2 to 3 feet into the road ROW and structures would not present an obstacle for farming operation. The specifics of how the proposed route would be designed to share roadway ROW are provided in Section 3.0. No center pivot irrigation operations have been identified in the agricultural areas adjacent to the proposed line, therefore, no impacts to center pivot irrigation is expected.

Construction activities could result in impacts to agricultural lands; however, disturbance will primarily occur in the area immediately surrounding the structures as described in Section 3.4. SMMPA will work closely with landowners to minimize impacts to farmland, including scheduling work to minimize impacts to crops and lands. SMMPA representatives will work directly with land owners to address crop damages or impacts to farmland. In cases where soil compaction occurs, the construction crews or a restoration contractor will work to alleviate the compaction as negotiated with landowners.

4.3.3 Mining and Forestry

There are no mining or forestry operations in the vicinity of the proposed Project.

4.4 Natural Resources

4.4.1 Air Quality

Potential air quality impacts from the operation of the transmission line would be primarily associated with the production of small amounts of ozone and oxides of nitrogen in the air surrounding transmission line conductors and the potential release of small amounts of SF_6 during operation and maintenance of certain electrical substation equipment. Operation of the proposed transmission line is not expected to create any potential for the concentration of these pollutants to exceed existing air quality standards. Minor short-term emissions associated with construction will also occur. Construction emissions will primarily be generated by mobile combustion activities and are not expected to create any potential exceedances of air quality standards.

4.4.2 Water Resources

Water resources within the vicinity of the project area are shown on Figure 4.4.2-1. The proposed route would require seven crossings of watercourses including: (1) two streams, both designated Public Waters on the DNR Public Water Inventory (PWI), (2) an unnamed ditch, (3) the Redwood River in the southwest part of the project area, (4) the Crow River (or County Ditch Number 52), designated as an altered PWI watercourse, once in the south-central portion of the project area and once in the eastern portion of the project area, and (5) an unnamed ditch in the southeast portion of the project area. The proposed route would require crossing one PWI basin, Lake Redwood, which is located along the Redwood River (Figure 4.4.2-1). This PWI basin is also listed as part of the DNR Shallow Lakes Program and on the PCA Impaired Waters list. The streams, ditches, rivers, and lakes would be spanned by the proposed Project. SMMPA would apply for a License to Cross Public Waters that would permit crossing the two PWI streams and the PWI basin by the proposed transmission line.

Floodplain resources were identified for the project area using data from the Federal Emergency Management Agency (FEMA). FEMA has mapped an approximate 480-foot wide area located adjacent to the Redwood River as a 100-year floodplain (Figure 4.4.2 1). Since the maximum span length in this area is only 445 feet, one structure would need to be placed within the mapped 100-year floodplain area.

According to the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI), there is only one wetland within 40 feet of the proposed route centerline. This wetland is adjacent and connected to Lake Redwood and would be crossed by the proposed route. The length of the wetland required to be spanned would be 190 feet, therefore, no wetland impacts are anticipated.

There is one well located within the proposed route centerline (Figure 4.4.2-1). The poles that would be used for the proposed project would be installed at a depth ranging from 9- to 12-feet deep. Installation of pier concrete foundations typically does not involve dewatering and therefore will not affect groundwater levels, groundwater availability, or the well capacity/yield of existing wells. Once installed, these foundations will have no affect on groundwater availability. Leaching of potentially hazardous constituents from concrete foundations and treated timbers is negligible. The types of materials used to treat timbers have a very low solubility and very low mobility in groundwater and therefore would not migrate more than a few feet from the foundation if leaching did take place. Impacts to groundwater resources are not anticipated from the construction or operation of the proposed Project.

Proposed 115 kV Alignment

Existing Distribution Line

Existing Distribution Line - To Be Buried

Existing Distribution Line - To Be Double-Circuited

County Well Index Locations By Use

- Unknown
- Domestic
- Irrigation
- Community Supply/Municipal
- Public Supply Non-Community
- Test Well

- Trout Streams
- Ditches/Other Flowlines
- Public Waters (Watercourses)
- Public Waters (Basins)
- Impaired Streams
- Impaired Lakes
- Shallow Lakes
- FEMA Floodways
- Wetlands (NWI)
- Wellhead Protection Area

Imagery Source: FSA, 2010

N

0 0.25 0.5

Miles

Figure 4.4.2-1

Water Resources Map
SMMPA 115 kV Transmission Line Project
Redwood Falls Area
Redwood County, MN

I:\Projects\23\641\008\Maps\Reports\Draft EA\Figure 4 4 2-1 - Water Resources Map.mxd

Construction of the proposed Project would require temporary disturbances to soil. However, BMPs would be used during and after construction in order to minimize the potential for impacts to water resources. A National Pollutant Discharge Elimination System (NPDES) storm water permit will be obtained prior to the start of construction.

4.4.3 Flora and Fauna

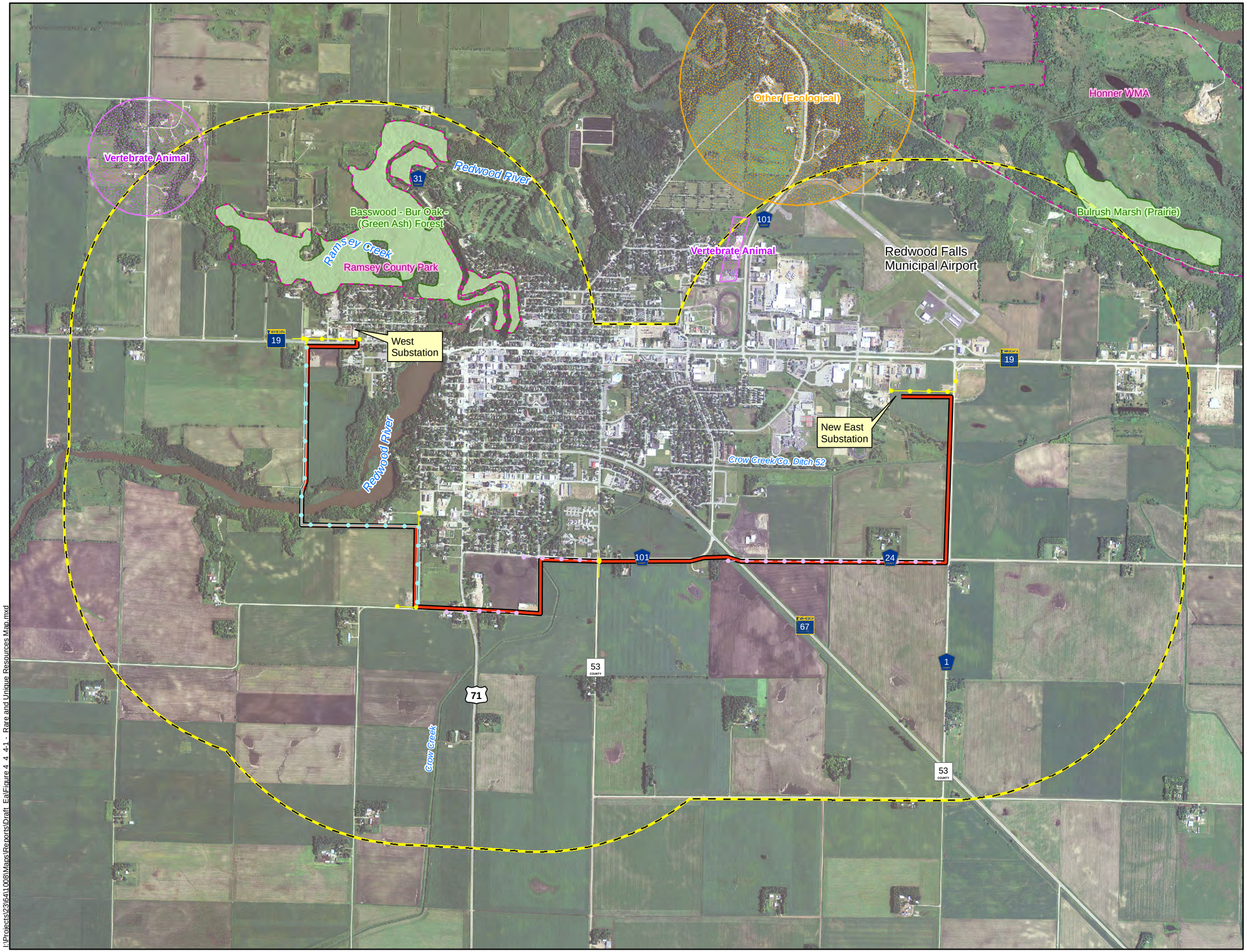
The area surrounding the project area is primarily agricultural. There is one forested area located adjacent to the Redwood River that will be crossed by the proposed route. Some tree clearing may occur within 15 feet on each side of the proposed route centerline; however, much of this area has been cleared since there is already an existing distribution line located in the proposed route.

Wildlife in the area primarily includes deer, small mammals, raptors, perching birds, and waterfowl associated with the Redwood River and Lake Redwood. Wildlife could be temporarily displaced during project construction, however, areas of comparable tree and agricultural habitat are present adjacent to the proposed Project; therefore, it is likely that wildlife would only be displaced a short distance.

There is the potential for transmission lines to cause injury or death to raptors, waterfowl, or other large bird species. Large birds, such as raptors, can potentially be electrocuted if their large wingspans come in contact with two conductors or with a conductor and a grounding device. However, because there is already an existing distribution line present along the majority of the propose route, the proposed Project is not anticipated to result in significant new avian impacts.

4.4.4 Rare and Unique Natural Resources

In order to determine whether threatened or endangered species have been documented within the vicinity of the project area, Barr reviewed the USFWS county distribution of threatened and endangered species for federally-listed species that could potentially be found in Redwood County (USFWS 2011). Barr also queried the DNR Natural Heritage Information System (NHIS) database in February, 2011. Barr maintains a license agreement with the DNR, which allows access to the locations of documented occurrences of listed species and rare biological resources (License Number LA-501). Figure 4.4.4-1 shows the locations of USFWS and DNR rare and unique resources within 1 mile of the proposed Project; however, in order to protect these rare resources, exact locations are not shown on the figure.



Proposed 115 kV Alignment

Existing Distribution Line

Existing Distribution Line - To Be Buried

Existing Distribution Line - To Be Double-Circuited

1 Mile Buffer of Proposed Alignment

MCBS Native Plant Community

MCBS Site of Bio-diversity Significance

NHIS Element Occurence Area

Other (Ecological)

Vertebrate Animal

Data Sources:
Natural Heritage Information System Rare eatures Data, Copyright 2010 State of Minnesota, Department of Natural Resources

Minnesota County Biological Survey (MCBS), Minnesota Department of Natural Resources

Imagery Source: FSA, 2010

N

0 1,000 2,000 4,000

Feet

Figure 4.4.4-1

Rare and Unique Resources Map
SMMPA 115 kV Transmission Line Project
Redwood Falls Area
Redwood County, MN

I:\Projects\23\641\008\Mapsl\Reports\Draft EaIFigure 4 4 4-1 - Rare and Unique Resources Map.mxd

The USFWS lists the prairie bush clover (*Lespedeza leptostachya*; federally threatened) as the only federally threatened or endangered species reported in Redwood County. According to the NHIS database, there are no documentations of the prairie bush clover or any other federally-listed rare species within 1 mile of the proposed Project. The prairie bush clover prefers native prairie, which is not present within the immediate vicinity of the proposed Project.

According to the NHIS database, the Henslow's sparrow (*Ammodramus henslowii*), a state-endangered bird, has been documented approximately 0.8 miles from the proposed Project. The Henslow's sparrow prefers uncultivated grasslands, which are not present within the vicinity of the project area. Because the preferred habitat for the Henslow's sparrow is not present within the project area, and because there is an existing distribution line present, impacts to the Henslow's sparrow are not anticipated from the proposed Project.

There is also one documented record of a western fox snake (*Elaphne vulpine*) located approximately 0.8 miles from the proposed Project. The western fox snake is tracked by the DNR but it is not listed as threatened or endangered; therefore there is no legal protection for it.

The NHIS database also documented two geologic features just less than 1 mile from the proposed Project. These features include a fossil plant (quaternary) and a sedimentary unit or sequence (cretaceous, quaternary). Because these rare geologic features are not within the immediate vicinity of the proposed Project, impacts to these features are not anticipated.

There are two DNR Minnesota County Biological Survey (MCBS) Sites of Biodiversity Significance (SBS) located within 1 mile of the proposed Project (Figure 4.4.4-1). Both sites are considered moderate in terms of their biodiversity significance. Because these sites are at least 0.25 miles away from the proposed Project, impacts to these sites are not anticipated.

On February 2, 2011, Barr sent a letter to Lisa Joyal at the DNR requesting review of impacts to rare and unique resources from the proposed Project. Barr has not yet received a response from the DNR.

4.5 Cultural Resources

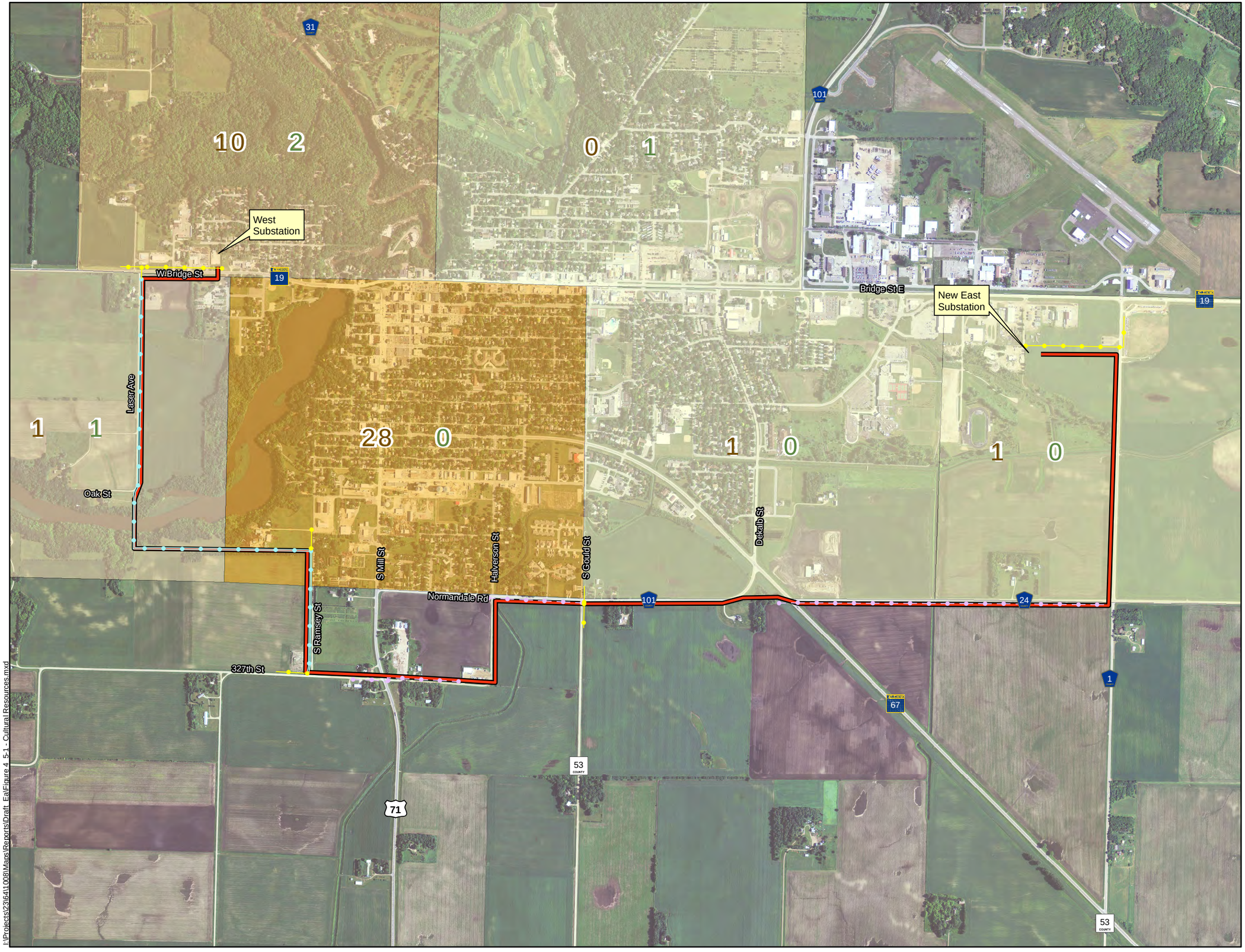
On January 6, 2011, Barr requested information from the Minnesota State Historic Preservation Office (SHPO) regarding the presence of cultural resources (archaeological and historical) within the vicinity of the proposed route. On January 7, 2011, SHPO responded with a list of archaeological and historical resources within the vicinity of the proposed route.

According to SHPO records, there are two archaeological sites and 43 historical sites present within one mile of the proposed route (Table 4.5-1, Figure 4.5-1). The two archeological sites are located more than 0.5 miles from the proposed Project; therefore, impacts to these resources are not anticipated. Of the 43 historical sites present, five are listed on the National Register of Historic Places (NRHP); these five sites are located in downtown Redwood Falls. The two historical resources sites (site numbers RW-PAX-001 and RW-RFC-015), located 400 feet and 250 feet, respectively, to the proposed Project, were not located during the field review and are assumed to have been razed (Table 4.5-1). According to the SHPO database, there are no historical resources documented within 0.2 miles of the proposed route; because of this and the presence of an existing distribution line along the majority of the proposed route, impacts to cultural resources are not anticipated from the proposed project.

Table 4.5-1Summary of Cultural Resources Present within 1 Mile of Proposed Route

Site Number	Site Type	Location (TRS)	NRHP
Archeological Sites			
21RWi	Archeological	T113 R36 S36	NA
21RW0064	Archeological	T113 R36 S36	NA
Historical Sites			
RW-PAX-001 (razed)	Theater	T112 R35 S5	
RW-RFC-001	Bank	T112 R36 S1	Yes
RW-RFC-004	Church	T112 R36 S1	
RW-RFC-005	Outdoor facility	T112 R36 S1	
RW-RFC-006	Residence	T112 R36 S1	Yes
RW-RFC-007	Church	T112 R36 S1	
RW-RFC-008	Residence	T112 R36 S1	
RW-RFC-009	Rail related	T112 R36 S1	
RW-RFC-010	Grain elevator	T112 R36 S1	
RW-RFC-011	Theater	T112 R36 S1	
RW-RFC-012	Church	T112 R36 S1	
RW-RFC-013	Meeting hall	T112 R36 S1	
RW-RFC-014	Meeting hall	T112 R36 S1	
RW-RFC-015 (razed)	Residence	T112 R36 S2	
RW-RFC-016	Sports facility	T112 R36 S6	
RW-RFC-017	Outdoor facility	T113 R36 S36	
RW-RFC-018	Bridge	T113 R36 S36	Yes
RW-RFC-019	Poor house	T113 R36 S36	
RW-RFC-020	Courthouse	T112 R36 S1	

Site Number	Site Type	Location (TRS)	NRHP
RW-RFC-021	Jail	T112 R36 S1	
RW-RFC-022	Grain elevator	T112 R36 S1	
RW-RFC-023	Hospital	T112 R36 S1	
RW-RFC-024	Library	T112 R36 S1	Yes
RW-RFC-025	Theater	T112 R36 S1	
RW-RFC-027	Service station	T112 R36 S1	Yes
RW-RFC-028	Residence	T112 R36 S1	
RW-RFC-032	Outdoor fac, retaining wall	T112 R36 S1	
RW-RFT-001	Barn	T112 R36 S10	
RW-RFC-002	Commercial building	T112 R36 S1	
RW-RFC-003	Flour mill	T113 R36 S36	
RW-RFC-026	Church	T112 R36 S1	
RW-RFC-029	Bridge	T113 R36 S36	
RW-RFC-030	Bridge	T112 R36 S1	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-031	State park	T113 R36 S36	
RW-RFC-033	Bridge	T113 R36 S36	



Proposed 115 kV Alignment

Existing Distribution Line - To Be Buried

Existing Distribution Line - To Be Double-Circuited

Existing Distribution Line

Masked Cultural Resource Location

1 Total Record

2 Total Records

12 Total Records

28 Total Records

2 **Number of Archaeological Records**

10 **Number of Historical Records**

Notes:
SHPO records are confidential and there actual locations cannot be shown on a public document. No SHPO records currently exist within 0.5 miles of the proposed route.

Data Source:
Minnesota State Historic Preservation Office, 1/6/2011

Imagery Source: FSA, 2010

N

0 0.25 0.5

Miles

Figure 4.5-1

Cultural Resources
SMMPA 115 kV Transmission Line Project
Redwood Falls Area
Redwood County, MN

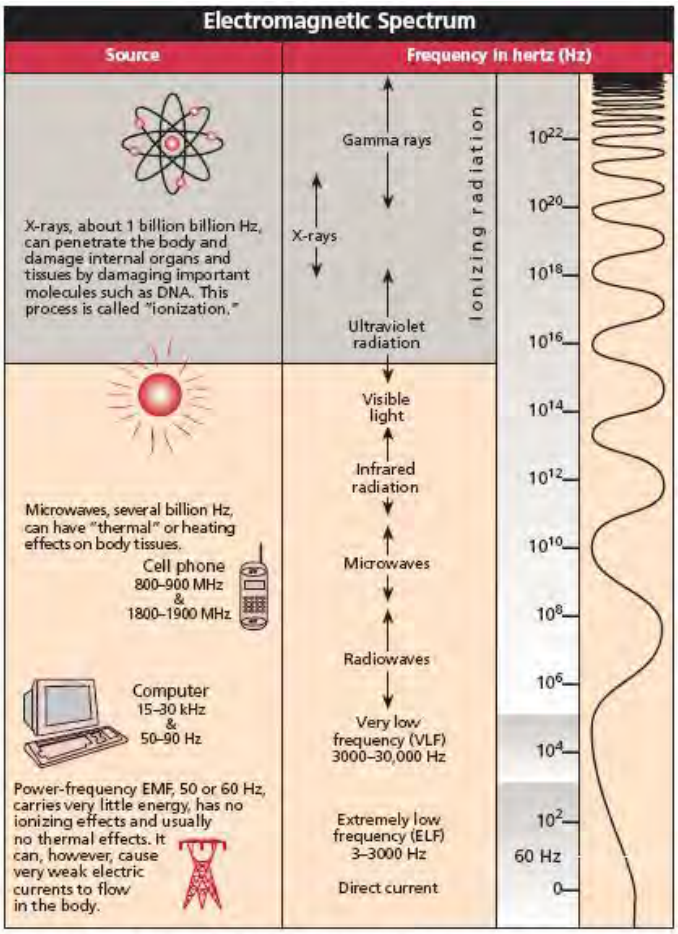
I:\Projects\23641\008\Maps\Reports\Draft_Ea\Figure 4_5-1 - Cultural Resources.mxd

4.6 Human Health and Safety

4.6.1 Electric and Magnetic Fields

Electric and Magnetic Fields (EMFs) are invisible regions of force resulting from the presence of electricity. Naturally occurring EMFs are caused by the earth's weather and geomagnetic field. Human-made EMFs are caused from any electrical device and found wherever people use electricity. EMFs are characterized and distinguished by their frequencies, which is measured by the rate at which the fields change direction each second. A table displaying the wide spectrum of EMFs is shown in Figure 4.6.1-1.

Figure 4.6.1-1 Electromagnetic Spectrum



The wavy line at the right illustrates the concept that the higher the frequency, the more rapidly the field varies. The fields do not vary at 0 Hz (direct current) and vary trillions of times per second near the top of the spectrum. Note that 10^4 means 10 x 10 x 10 x 10 or 10,000 Hz. 1 kilohertz (kHz) = 1,000 Hz. 1 megahertz (MHz) = 1,000,000 Hz.

Electric fields are created by the electric charge (i.e., voltage) on a conductor (e.g., a transmission line). Electric fields are solely dependent upon the voltage of a conductor, not the actual flow of electricity (i.e., current). Electric field strength is measured in kilovolts per meter (kV/m). The strength of an electric field decreases rapidly as the distance from the source increases. Electric fields are easily shielded or weakened by most objects and material, such as trees, buildings, and even human skin.

Although there are no federal regulations regarding allowable electric fields, the Commission has set a standard of 8 kV/m for the maximum electric field associated with a transmission line (measured at the transmission line centerline and at 1 meter above ground).

Typical electric field values for a 115 kV transmission line are shown in Table 4.6.1-1.

Table 4.6.1-1Typical Electric Field Levels for a 115 kV Transmission Line (kV/m)

Centerline (0 feet)	50 ft	100 feet	200 feet	300 feet
1.0	0.5	0.07	0.01	0.003

Electric fields from power lines are relatively stable because voltage does not change. Source National Institute of Environmental Health Services / National Institutes of Health: EMF Associated with the Use of Electric Power

Magnetic fields are created by and are solely dependent upon the electrical current in a conductor. Magnetic field strength is measured in milliGauss (mG). Similar to electric fields, the strength of a magnetic field decreases rapidly as the distance from the source increases. However, unlike electric fields, magnetic fields are not easily shielded or weakened by objects or materials.

Magnetic fields are encountered from every-day things such as radar and microwave towers, television and computer screens, motors, fluorescent lights, microwave ovens, cell phones, electric blankets, house wiring, and hundreds of other common electrical devices. The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5-4 mG (National Cancer Institute, 2009). There are no federal or state of Minnesota regulations for the permitted strength of a magnetic field related to a transmission line.

Typical magnetic field values for a 115 kV transmission line are shown in Table 4.6.1-2.

Table 4.6.1-2Typical Magnetic Field Levels for a 115 kV Transmission line (mG)

Centerline (0 feet)	50 ft	100 feet	200 feet	300 feet
30	6.5	1.7	0.4	0.2

Magnetic fields fluctuate greatly as current changes in response to changing load. Source National Institute of Environmental Health Services / National Institutes of Health: EMF Associated with the Use of Electric Power.

4.6.1.1 *Health Studies Regarding EMF*

A common concern related to EMFs is the potential of adverse health effects that exposure to EMFs may have on children, elderly, and pregnant women. The suggestion that these demographics are more susceptible to adverse health effects from EMF exposure is consistent with a large body of information showing that these demographics are more vulnerable than average adults to other exposures, such as to chemicals, diseases, and ionizing radiation.

Numerous panels of experts have convened to review research data relevant to whether or not EMFs are associated with adverse health effects. These reviews have been conducted by the National Institute of Environmental Health Sciences (NIEHS), the USEPA, the World Health Organization (WHO), and the Minnesota State Interagency Working Group (MSIWG) on EMF Issues.

In 1992, the U.S. Congress authorized the Electric and Magnetic Fields Research and Public Information Dissemination Program (EMF-RAPID Program) in the Energy Policy Act. The Congress instructed NIEHS, National Institutes of Health, and the U.S. Department of Energy (DOE) to direct and manage a program of research and analysis aimed at providing scientific evidence to clarify the potential for health risks from exposure to ELF-EMFs (NIEHS, 1999). The EMF-Rapid Program provided the following conclusions to Congress on May 4, 1999:

- *The scientific evidence suggesting that ELF-EMF exposures pose any health risk is weak.*
- *Epidemiological studies have serious limitations in their ability to demonstrate a cause and effect relationship whereas laboratory studies, by design, can clearly show that cause and effect are possible. Virtually all of the laboratory evidence in animals and humans and most of the mechanistic work done in cells fail to support a causal relationship between exposure to ELF-EMF at environmental levels and changes in biological function or disease status. The lack of consistent positive findings in animal or mechanistic studies weakens the belief that this association is actually due to ELF-EMFs, but it cannot completely discount the epidemiological findings.*
- *The NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern (NIEHS, 1999).*

Currently, the USEPA states the following viewpoint of the associated health effects of EMFs on its website (USEPA: Electric and Magnetic Fields (EMF) Radiation from Power Lines, 2009):

> *Much of the research about power lines and potential health effects is inconclusive. Despite more than two decades of research to determine whether elevated EMF exposure, principally due to magnetic fields, is related to an increased risk of childhood leukemia, there is still no definitive answer. The general scientific consensus is that, thus far, the evidence available is*

weak and is not sufficient to establish a definitive cause-effect relationship (USEPA: Electric and Magnetic Fields (EMF) Radiation from Power Lines, 2009).

Currently, the WHO states the following viewpoint of the associate health effects of EMFs on its website (WHO, 2009):

Extensive research has been conducted into possible health effects of exposure to many parts of the frequency spectrum. All reviews conducted so far have indicated that exposures below the limits recommended in the INNIRP (1998) EMF guidelines, covering the full frequency range from 0-300 GHz, do not produce any known adverse health effect. However, there are gaps in knowledge still needing to be filled before better health risk assessments can be made (WHO, 2009).

In September of 2002, the MSIWG on EMF Issues, published "A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options," referred to as the "White Paper." The MSIWG was formed to examine the potential health impacts of EMFs and to provide useful, science-based information to policy makers in Minnesota. Work Group members included representatives from the Department of Commerce, the Department of Health, the PCA, the Commission, and the EQB (MSIWG, 2002). The White Paper concluded the following findings:

- *Some epidemiological results do show a weak but consistent association between childhood leukemia and increasing exposure to EMF (see the conclusion of IARC and NIEHS). However, epidemiological studies alone are considered insufficient for concluding that a cause and effect relationship exists, and the association must be supported by data from laboratory studies. Existing laboratory studies have not substantiated this relationship (see NTP, 1999; Takebe et al., 2001), nor have scientists been able to understand the biological mechanism of how EMF could cause adverse effects. In addition, epidemiological studies of various other diseases, in both children and adults, have failed to show any consistent pattern of harm from EMF.*

- *The Minnesota Department of Health concludes that the current body of evidence is insufficient to establish a cause and effect relationship between EMF and adverse health effects. However, as with many other environmental health issues, the possibility of a health risk from EMF cannot be dismissed. Construction of new generation and transmission facilities to meet increasing electrical needs in the State is likely to increase exposure to EMF and public concern regarding potential adverse health effects.*

- *Based upon its review, the Work Group believes the most appropriate public health policy is to take a prudent avoidance approach to regulating EMF. Based upon this approach, policy recommendations of the Work Group include:*
    - *Apply low-cost EMF mitigation options in electric infrastructure construction projects;*
    - *Encourage conservation;*
    - *Encourage distributed generation;*
    - *Continue to monitor EMF research;*
    - *Encourage utilities to work with customers on household EMF issues; and*
    - *Provide public education on EMF issues (MSIWG, 2002).*

Researchers have not been able to establish a cause and effect relationship between exposure to EMFs and adverse health effects. Accordingly, there is not a magnetic field exposure-response calculation that can be performed to estimate possible adverse health impacts.

4.6.1.2 *Implantable Medical Devices*

Research has established that certain electric fields can potentially interfere with implantable medical devices, such as cardiac pacemakers, implantable cardioverter defibrillators (ICDs), neurostimulators, and insulin pumps. This interference, referred to as Electromagnetic Interference (EMI), can cause inappropriate triggering of a device or inhibit the device from responding appropriately (PSCW, 2009).

Most of the research on electromagnetic interference and medical devices is related to pacemakers. According to a 2004 Electric Power Research Institute (EPRI) report, implantable cardiac devices are more sensitive to electric fields than to magnetic fields. The earliest interference from magnetic fields in pacemakers was observed at 1,000 mG, an exposure level far greater than the magnetic fields associated with high-voltage transmission lines. Therefore, the focus of research has been on electric field impacts. Possible effects of electric fields on pacemakers are rate increase, erratic pacing, switch to asynchronous pacing or fixed-rate pacing, single beat inhibition (i.e. a single beat is missed by the pacemaker), and total inhibition.

The 2004 EPRI report states that sensitivity to electric fields was reported at levels ranging from 1.5 kV/m upwards, though some units are immune at 20 kV/m. Medtronic and Guidant, manufacturers of various implantable medical devices, have indicated that electric fields below 6 kV/m are unlikely to cause interactions affecting operation of most of their devices.

Although most modern cardiac devices are less susceptible to effects from EMFs due to engineering design, older designs can still be affected. In the event that a cardiac device is impacted, the effect is typically a temporary asynchronous pacing (i.e., fixed rate pacing) and the device would return to its normal operation when the person moves away from the source of EMFs (PSCW, 2009). No adverse health impacts or permanent impacts on implantable medical devices are anticipated as a result of the project.

4.6.1.3 *EMF Mitigation Strategies*

There are several EMF mitigation strategies which could be employed to lower public EMF exposure levels. Three primary methods to reduce EMF levels include:

Distance. Magnetic field exposure is directly related to distance from the transmission line. The strength of both the electric and magnetic fields from transmission lines is inversely proportional to the square of the distance from the source conductors.

Compaction. The configuration and distance between transmission line phases has an impact on EMF exposure. The amount of EMF exposure is reduced when the phases are compacted.

Phase cancellation. Phase cancellation significantly reduces EMF from transmission lines.

4.6.2 Stray Voltage

Stray voltage is an extraneous voltage that appears on grounded surfaces in buildings, barns, and other structures. Stray voltage and its impact is normally an issue associated with electric distribution lines and is a condition that can exist between the neutral wire of a service entrance and grounded objects in buildings. The source of stray voltage is a voltage that is developed on the grounded neutral wiring network of a building and/or the electric power distribution system. Stray voltage can result from damaged, corroded, or poorly connected wiring or damages insulation. Transmission lines do not, by themselves, create stray voltage because they do not connect to businesses or residences. The project would have no direct electrical connection to conductors originating in another system; it would not connect with the local distribution system. Transmission lines, however, can induce stray voltage on a distribution circuit that is parallel and immediately under the transmission line. Induced voltage between a transmission line and distribution circuit only occurs in the immediate vicinity of the distribution circuit and would not travel along the transmission or distribution line.

Stray voltage safety concerns are primarily associated with distribution lines. Stray voltage is not identified as a safety concern associated with the project; however, since transmission lines can induce stray voltage on distribution circuits that are parallel and immediately under a transmission

line, mitigation measures may be necessary if the project transmission line parallels or crosses distribution lines. These appropriate measures are site specific and may include, but are not limited to:

Cancellation. Arranging transmission line phase conductors in a configuration to minimize EMF levels, bonding distribution neutral and transmission shield wires together, and employing an under built transmission shield wire bonded to distribution neutral rather than a normal overhead shield wire.

Separation. Increase the distance between transmission and distribution facilities by placing across the road and/or burying the distribution facilities, or providing greater vertical distance between the transmission line phase conductor and an under built distribution line.

Enhanced Grounding. Employing bare buried counterpoises connected to the distribution neutral and/or transmission shield wire.

4.6.3 Induced Currents and Shock Hazards

The electric field from a transmission line can couple with a conductive object, such as a vehicle or a metal fence, which is in close proximity to the transmission line. This coupling would induce a voltage on the object, which is dependent on many factors, including the weather, object shape, size, orientation, and location along the ROW. Additionally, alternating magnetic fields created by transmissions lines can induce currents on conductive objects. If these objects are insulated or semi-insulated from the ground and a person touches them, a small current would pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, similar to what can occur when a person walks across a carpet and touches a grounded object or another person.

Current flow through a person to the ground is the main concern of induced voltage. Proper grounding of metal objects under the transmission line is the best method of avoiding these shocks. Most shocks from induced current are considered more of a nuisance than a danger. The PUC electric field limit of 8 kV/m was designed to prevent serious hazard from shocks due to induced voltage under transmission lines. The National Electric Safety Code has set an induced current limit of five milliamps (mA) for objects under transmission lines.

Another issue that arises when operating vehicles near power lines is whether vehicles can be safely refueled. Although the possibility of fuel ignition under a power line is remote, it is not recommended to refuel vehicles directly under or within 100 feet of a transmission line.