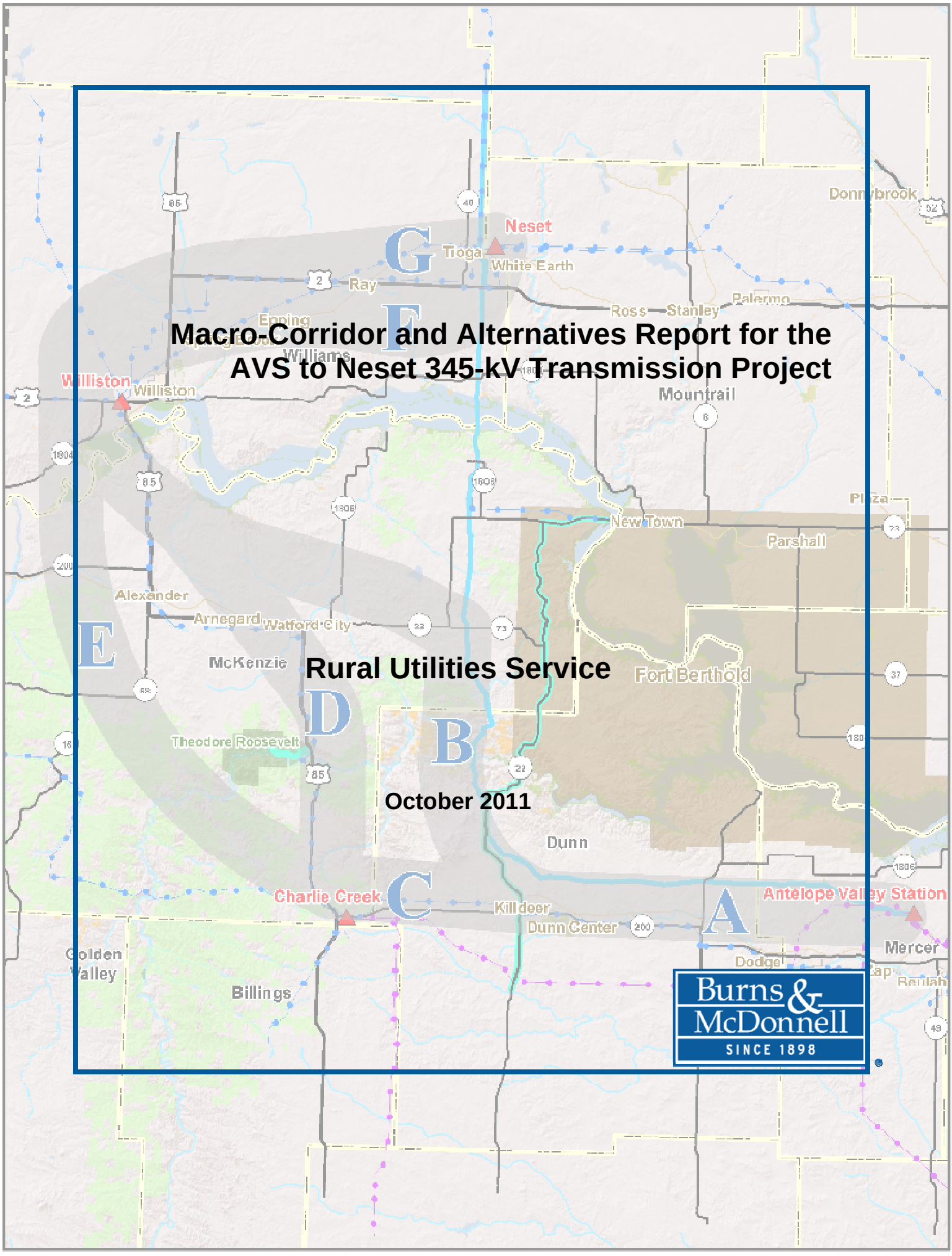


Macro-Corridor and Alternatives Report for the AVS to Neset 345-kV Transmission Project

Rural Utilities Service

October 2011

Burns & McDonnell
SINCE 1898

Macro-Corridor and Alternatives Report for the AVS to Neset 345-kV Transmission Project

prepared for

Rural Utilities Service

October 2011

Project No. 61495

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

TABLE OF CONTENTS

Page No.

1.0 INTRODUCTION 1-1
1.1 Background 1-1
1.2 Project Description and Study Area 1-1
1.2.1 Other Basin Electric Transmission Line Projects in the Area 1-4
1.2.2 Right-of-Way Considerations 1-4
1.2.3 Proposed Transmission Line Characteristics 1-5
1.3 Purpose of the Macro-Corridor Study 1-6

2.0 PURPOSE AND NEED 2-1
2.1 Need for the Project 2-1
2.1.1 Integrated System Transmission Studies 2-2

3.0 PROJECT ALTERNATIVES 3-1
3.1 Overview 3-1
3.2 Alternatives Considered 3-1
3.2.1 System Upgrades 3-1
3.2.2 Additional 115-kV Lines 3-1
3.2.3 Additional 345-kV Lines 3-2
3.2.4 Recommended System Alternative 3-3

4.0 STUDY AREA IDENTIFICATION AND MACRO-CORRIDOR COMPARISON 4-1
4.1 Basin Electric Service Area 4-1
4.2 Study Area Identification 4-1
4.3 General Description of Study Area 4-2
4.3.1 Human Resources 4-3
4.3.2 Natural Resources 4-6
4.4 Identification of Alternative Macro-Corridors 4-8
4.5 Alternative Macro-Corridors 4-10
4.6 Evaluation of Macro-Corridors 4-12

5.0 MACRO-CORRIDOR ANALYSIS 5-1
5.1 Overview 5-1
5.2 Resource Data Collection 5-1
5.3 Opportunities and Constraints 5-1
5.3.1 Land Use and Jurisdiction 5-4
5.3.2 Existing Transportation and Utility Corridors 5-6
5.3.3 Transmission Lines 5-7
5.3.4 Geology and Soils 5-8

5.3.5 Water Resources 5-8
5.3.6 Cultural Resources 5-8
5.3.7 Biological Resources 5-9
5.4 Public Scoping and Stakeholder Involvement 5-9
5.5 Field Reconnaissance and Identification of Corridor-Specific Constraints 5-10
5.6 Route Corridor Development and Comparative Analysis 5-10

6.0 REFERENCES CITED 6-1

LIST OF FIGURES

Page No.

Figure 1-1: Overall Project and Study Area 1-2
Figure 1-2: Typical Single-Circuit 345-kV Single Pole Structure 1-7
Figure 1-3: Typical Double-Circuit 230/115-kV Single Pole Structure 1-8
Figure 1-4: Typical Double-Circuit 345/115-kV Single Pole Structure 1-9
Figure 1-5: Typical Single-Circuit 230-kV Single Pole Structure 1-10
Figure 1-6: Typical Single-Circuit 345-kV H-Frame Structure 1-11
Figure 3-1: Project Alternative 1 3-4
Figure 3-2: Project Alternative 2 3-5
Figure 4-1: Macro-Corridor Alternatives 4-11
Figure 4-2: Macro-Corridors Identified 4-16
Figure 4-3: Selected Macro-Corridors 4-17
Figure 5-1: Opportunities and Constraints 5-12
Figure 5-2: Land Cover 5-15
Figure 5-3: Important Threatened and Endangered Species Habitat 5-18
Figure 5-4: Jurisdiction 5-19
Figure 5-5: Residences and Cultural Resources 5-22
Figure 5-6: Census Landmarks and Communication Facilities 5-25
Figure 5-7: Transportation and Utilities 5-28
Figure 5-8: Hydrology, Wetlands, and Slope 5-31
Figure 5-9: Important Farmland 5-34

LIST OF TABLES

Page No.

Table 1-1: Typical Transmission Structure Design Characteristics 1-5
Table 2-1: Load Forecast for Transmission Lines in the Williston/Tioga Region 2-2
Table 4-1: Study Area Population 4-3
Table 4-2: Percent Employment by County 4-3
Table 4-3: Populations of Communities in the Study Area 4-4
Table 4-4: Threatened and Endangered Species by County 4-7
Table 4-5: National Register of Historic Places (NRHP) by County 4-8
Table 4-6: Macro-Corridor Development Considerations 4-9
Table 4-7: Summary of Macro-Corridor Opportunities and Constraints 4-14
Table 5-1: Project Opportunity and Constraint Criteria 5-2

* * * * *

1.0 INTRODUCTION

1.1 BACKGROUND

Northwestern North Dakota is experiencing a rapid increase in development as a result of the activities associated with the extraction of oil from the Bakken shale. In North Dakota, Bakken shale development is currently concentrated in McKenzie, Mountrail and Williams Counties. The level of development that has occurred and is planned for the future will require an increase in electrical transmission capacity and reliability. Through studies of power supply for the region and the upper Midwest, it has been determined that a new 345-kilovolt (kV) transmission line is needed to serve the long-term needs of northwestern North Dakota.

Basin Electric Power Cooperative (Basin Electric) is the wholesale power supplier to transmission and distribution cooperatives in the region. Mountrail Williams Electric Cooperative (MWEC) is one of Basin Electric's distribution members located in northwestern North Dakota north of the Missouri River. McKenzie Electric Cooperative (MEC) is the distribution member serving McKenzie County. These two distribution members are the primary members that will be involved with this 345-kV project.

1.2 PROJECT DESCRIPTION AND STUDY AREA

To serve the region, Basin Electric has determined that approximately 190 miles of new 345-kV transmission line would need to be constructed, starting from the Antelope Valley Station electric generation facility located near Beulah with final termination at Basin Electric's existing Neset Substation near Tioga. Along the route, the proposed line will connect with Basin Electric's existing Charlie Creek Substation near Grassy Butte and Western Area Power Administration's Williston Substation. Two new substations are also proposed, one near Williston and one near the existing Neset Substation at Tioga. The study area developed for this Project encompasses parts of Mercer, Dunn, Billings, McKenzie, Williams, and Mountrail Counties in North Dakota. The overall project elements and study area are shown on Figure 1-1 and are described in more detail in Section 4.0.

The project will require upgrades to Basin Electric's existing facilities at the Antelope Valley Station 345-kV Substation, Charlie Creek 345-kV Substation, Neset 230-kV Substation and Western Area Power Administration's (Western) Williston 230-kV Substation. The proposed overall project may require the following elements.

NORTH

0 11.5

Miles

Existing Neset 230-kV Substation

Existing Williston 230-kV Substation

Existing Charlie Creek 345-kV Substation

Existing Antelope Valley Station 345-kV Substation

Williams

Mountrail

McKenzie

Fort Berthold

Dunn

McLean

Mercer

Oliver

Golden Valley

Billings

Ward

McHenry

Renville

Burlington

Minot

Williston

Tioga

Ray

White Earth

Ross

Stanley

Palermo

Berthold

Carpio

Des Lacs

Epping

Spring Brook

Lewis and Clark State Park

Fort Union Trading Post

New Town

Parshall

Plaza

Makoti

Ryder

Douglas

Max

Alexander

Arnegard

Watford City

Theodore Roosevelt

Little Missouri State Park

Garrison

Fort Stevenson State Park

Lake Sakakawea State Park

Pick City

Riverdale

Killdeer

Dunn Center

Halliday

Dodge

Golden Valley

Zap

Beulah

Hazen

Knife River Indian Villages NH

Stanton

CANADA

Montana

North Dakota

South Dakota

LEGEND

- Study Area
- Existing Substation
- Army Corps of Engineers
- National or State Park
- National Wildlife Refuge
- National Grassland
- Tribal Lands
- BLM Lands
- State Boundary
- County Boundary
- Municipal Areas
- Railroad
- DGC Pipeline
- Scenic Byway

Existing Transmission Lines

- 345-kV
- 230-kV and Below

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE

A Touchstone Energy® Cooperative

Figure 1-1
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Overall Proposed Project
and Study Area

R:\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Study_Area_11x17.mxd 9/23/2011

Source: North Dakota GIS; Esri; Basin Electric; Burns & McDonnell.

Revised September 23, 2011

- **Transmission Lines.** Approximately 130 miles of single-circuit 345-kilovolt (kV) transmission line is proposed to connect Basin Electric's Antelope Valley Station (AVS) 345-kV Substation to the existing Charlie Creek 345-kV Substation and then on to the proposed Judson 345-kV Substation. A two-mile 230-kV transmission line will connect the proposed Judson 345-kV Substation to the existing Western 230-kVSubstation near Williston. An additional 60 miles of new 345-kV transmission line is proposed to connect Basin Electric's proposed Judson 345-kV Substation to a proposed Neset 345-kV Substation. A two-mile 230-kV transmission line will connect the proposed Neset 345-kV Substation to the existing 230-kV Neset Substation.

- **AVS 345-kV Substation.** The existing AVS Substation's 345-kV switchyard would require the installation of one 345-kV power circuit breaker and associated transmission bay bus expansion, including disconnect switches, grounding switches, potential transformers, and protection and control equipment. No new land or grading is required at this Substation.

- **Charlie Creek 345-kV Substation.** Upgrades to the existing Charlie Creek 345-kV Substation would require the installation of the necessary bus, circuit breakers, disconnect switches, grounding switches, and protection and control equipment to support the addition of a 345-kV interconnection. No expansion of the substation fence is anticipated.

- **Judson 345-kV Substation.** The proposed Judson 345-kV Substation near Williston would be approximately 12 acres in size and would require the installation of a 345-kV/230-kV transformer, and the necessary bus, circuit breakers, disconnect switches, grounding switches, and protection and control equipment to support the 345-kV interconnection and the addition of the 230-kV interconnect to Western's nearby Williston 230-kV Substation.

- **Williston 230-kV Substation.** Western's existing Williston 230-kV Substation would require the installation of an additional 230-kV power circuit breaker and associated transmission bay bus expansion, including disconnect switches, grounding switches, potential transformers, and protection and control equipment all within the existing substation boundary.

- **Neset 345-kV Substation.** The proposed 12-acre Neset 345-kV Substation would require the installation of a 345-kV/230-kV transformer, and the necessary bus, disconnect switches, circuit breakers, grounding switches, and protection and control equipment to support the 345-kV connection and the connection to the nearby existing Neset 230-kV Substation.

- **Neset 230-kV Substation.** The existing Neset 230-kV Substation would require the expansion of transmission bus bay and the necessary circuit breakers, disconnect switches, grounding switches, and protection and control equipment to support the addition of the 230-kV connection. No expansion of the substation fence is anticipated.

- **Killdeer 345-kV Switchyard.** Dependent on the final corridor selection, there is a potential need for a proposed 345-kV switchyard near the town of Killdeer. The proposed 12-acre Killdeer 345-kV Switchyard would require the installation of the necessary bus, circuit breakers, disconnect switches, grounding switches, and protection and control equipment to support a 345-kV connection.

1.2.1 Other Basin Electric Transmission Line Projects in the Area

The proposed 345-kV transmission line and associated facilities transects MWEC's service territory in Mountrail and Williams Counties. MWEC currently has several distribution/transmission projects in various stages of development. Where there are opportunities to double-circuit Basin Electric's 345-kV project with MWEC's 115-kV projects, efforts will be undertaken to co-locate the lines in double circuit arrangements. These opportunities have the potential to reduce the environmental, socio-economic and land use impacts to the area.

For example, MWEC has proposed a 115-kV transmission line in the eastern portion of the project area (between Williston and Tioga). The final route and interconnection points are still in the project development stage. Approximately 30 miles of the 60-mile length of the proposed 345-kV line from Williston to Tioga could be double-circuited with MWEC's 115-kV line. Additionally, MWEC's current State Line Project interconnects with Western's Williston 115-kV Substation. This project potentially transects approximately three to four miles of its16-mile length with Basin Electric's 345-kV project and the two could be co-located for some portion of the alignment.

1.2.2 Right-of-Way Considerations

The new transmission line is proposed to be constructed within a 150-foot-wide right-of-way (ROW). Basin Electric representatives would work with the landowners along the selected route to obtain the necessary easements to allow for access, construction, operation, and maintenance of the transmission line. Landowners would retain ownership of the land with limitations on building new structures within the right-of-way. Agricultural activities would be permitted to continue within the right-of-way. Property for the proposed Judson 345-kV Substation and proposed Neset 345-kV Substation would be purchased in fee and owned by Basin Electric. Lands for substations would be converted to utility use.

1.2.3 Proposed Transmission Line Characteristics

Several structure types would be necessary to address the various voltage, terrain and connector scenarios included as part of this project. These structures are shown in Figures 1-2 through 1-6. A summary of structure characteristics is provided in Table 1-1.

Project construction and design would meet the requirements of the National Electrical Safety Code (NESC) for the Heavy Loading District, Basin Electric and USDA-RUS design criteria, and other applicable local or national building codes. The Heavy Loading District refers to those areas (including North Dakota) that are subject to severe ice and wind loading. Minimum conductor clearance is measured at the point where conductor sag is closest proximity to the ground. The proposed transmission line would be constructed with clearances that exceed standards set by NESC. Minimum conductor height would be 30 feet over agricultural land, rural roads, and paved highways. Clearance will be based on a conductor temperature of 100 degrees Celsius.

Table 1-1: Typical Transmission Structure Design Characteristics

Description of Design Component	345-kV (Fig 1-2)	230/115-kV (Fig 1-3)	345/115-kV (Fig 1-4)	230-kV (Fig 1-5)	345-kV H-Frame (Fig 1-6)
Conductor Size(inches)	1.8	1.345/1.108	1.8/1.108	1.345	1.800
Right-of-way Width (feet)	150	100	150	100	150
Typical minimum and maximum Span Distance between Structures (feet) *	650-1100	700-900	650-1000	650-950	900-1000
Average Span (feet)	900	800	800	800	1000
Minimum and Maximum Structure Height (feet)	100-130	97-127	115-145	70-110	80-100
Average Height of Structures (feet)	115	112	130	95	90
Average Number of Structures per mile	6	6.5	6.5	6.5	5.5
Temporary disturbance per Structure (acre) **	0.0003	0.0002	0.0003	0.0002	0.0004
Minimum Conductor-to-Ground Clearance to agricultural lands, rural roads and paved highways @100 deg C (feet)	30	26	30	26	30
Minimum Conductor-to-Ground Clearance to Railroads @100 deg C (feet)	As required by specific Railroad				

Description of Design Component	345-kV (Fig 1-2)	230/115-kV (Fig 1-3)	345/115-kV (Fig 1-4)	230-kV (Fig 1-5)	345-kV H-Frame (Fig 1-6)
Circuit Configuration* **	See Figure 1-2	See Figure 1-3	See Figure 1-4	See Figure 1-5	See Figure 1-6

*** Actual span distance will vary depending on topography.**

**** Angle and dead-end structures (for longitudinal stability) would be constructed with concrete foundations. Guy wires would not typically be required.**

***** Single pole tangent structures would be freestanding on concrete foundations. H-frame tangent structures would likely be directly embedded into the ground.**

1.3 PURPOSE OF THE MACRO-CORRIDOR STUDY

The U.S. Department of Agriculture's Rural Utilities Service (RUS) electric program provides capital loans to electric cooperatives for the upgrade, expansion, maintenance, and replacement of the electric infrastructure in rural areas. Basin Electric is pursuing financing from RUS for the proposed 345-kV transmission line in Mercer, Dunn, Billings, McKenzie, Williams, and Mountrail counties. As a requirement of 7 CFR Part 1794.51(c), RUS requires Basin Electric to submit a Macro-Corridor Study before formal scoping is initiated. Basin will also connect to Western's existing Williston 230-kV Substation in Williams County. RUS is the lead agency in the NEPA process. Western is serving as a cooperating agency in the review process.

* * * * *

Figure 1-2: Typical Single-Circuit 345-kV Single Pole Structure

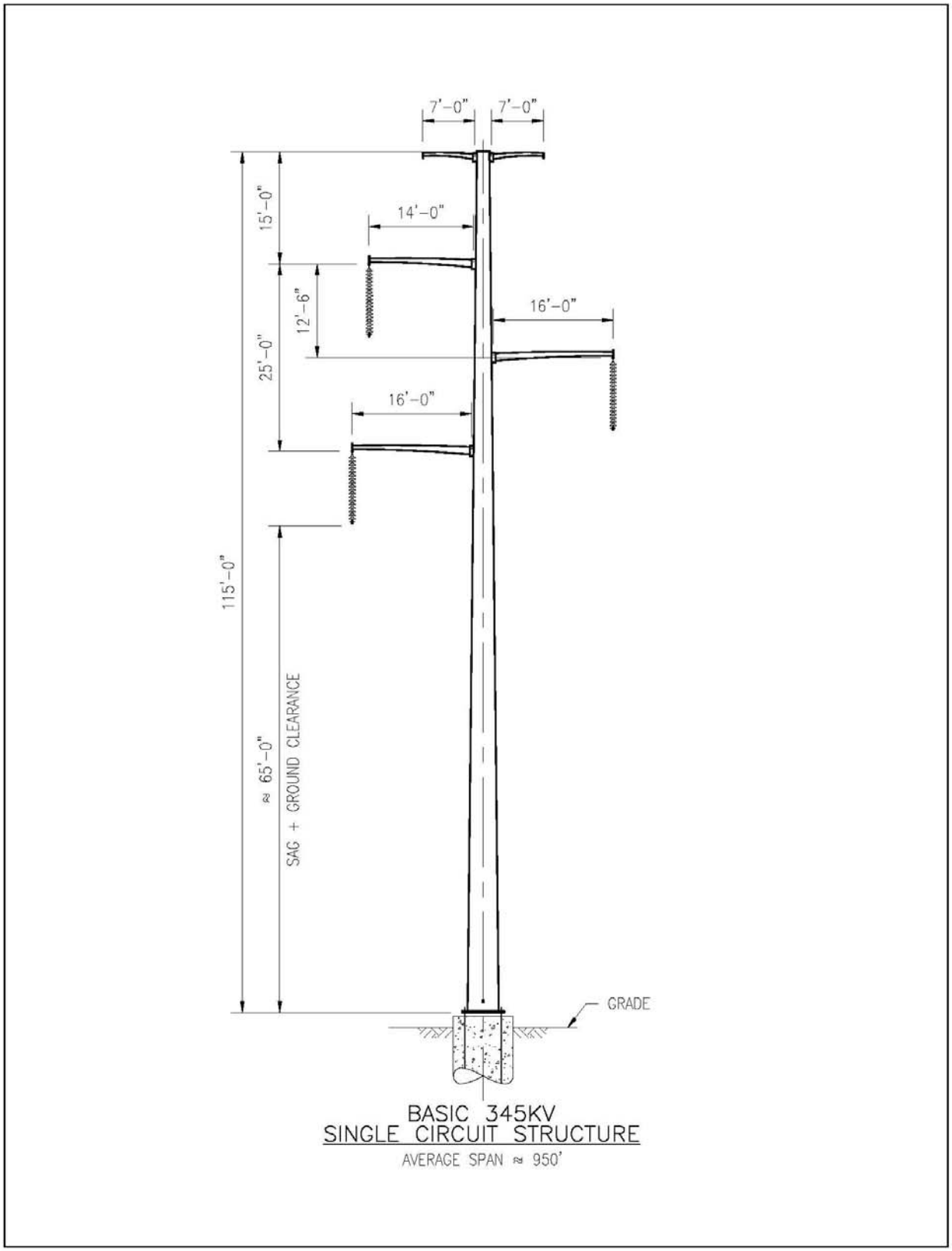


Figure 1-3: Typical Double-Circuit 230/115-kV Single Pole Structure

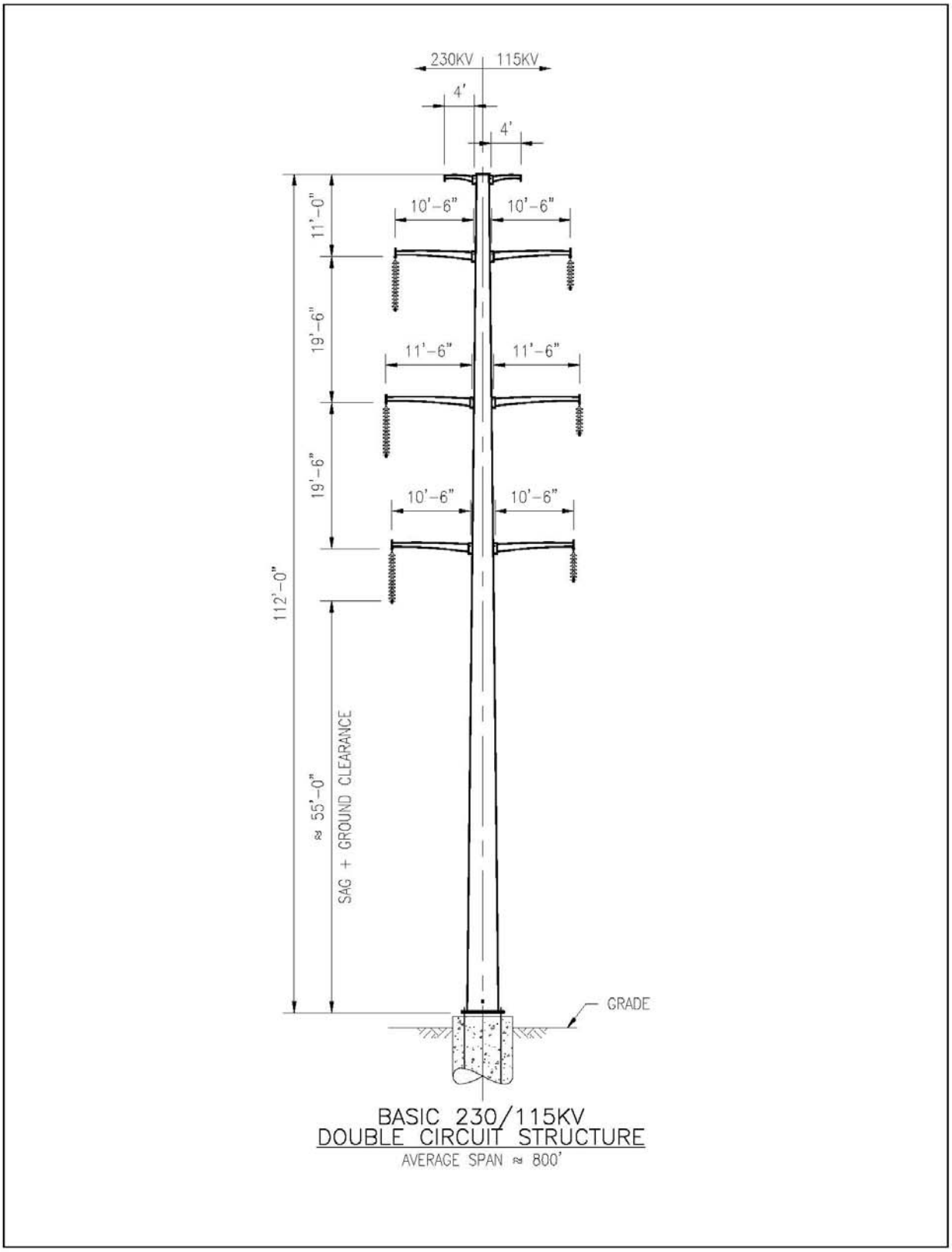


Figure 1-4: Typical Double-Circuit 345/115-kV Single Pole Structure

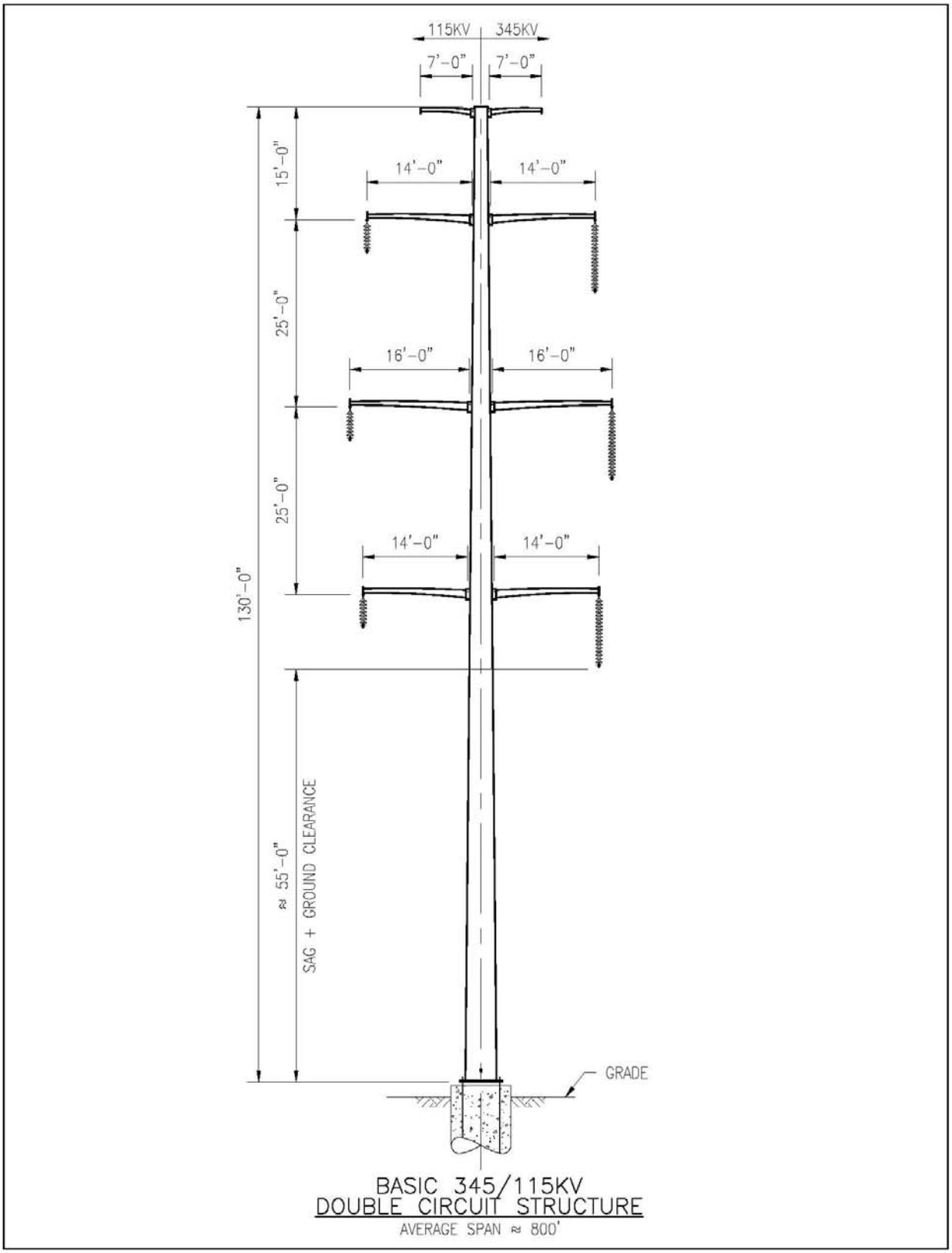


Figure 1-5: Typical Single-Circuit 230-kV Single Pole Structure

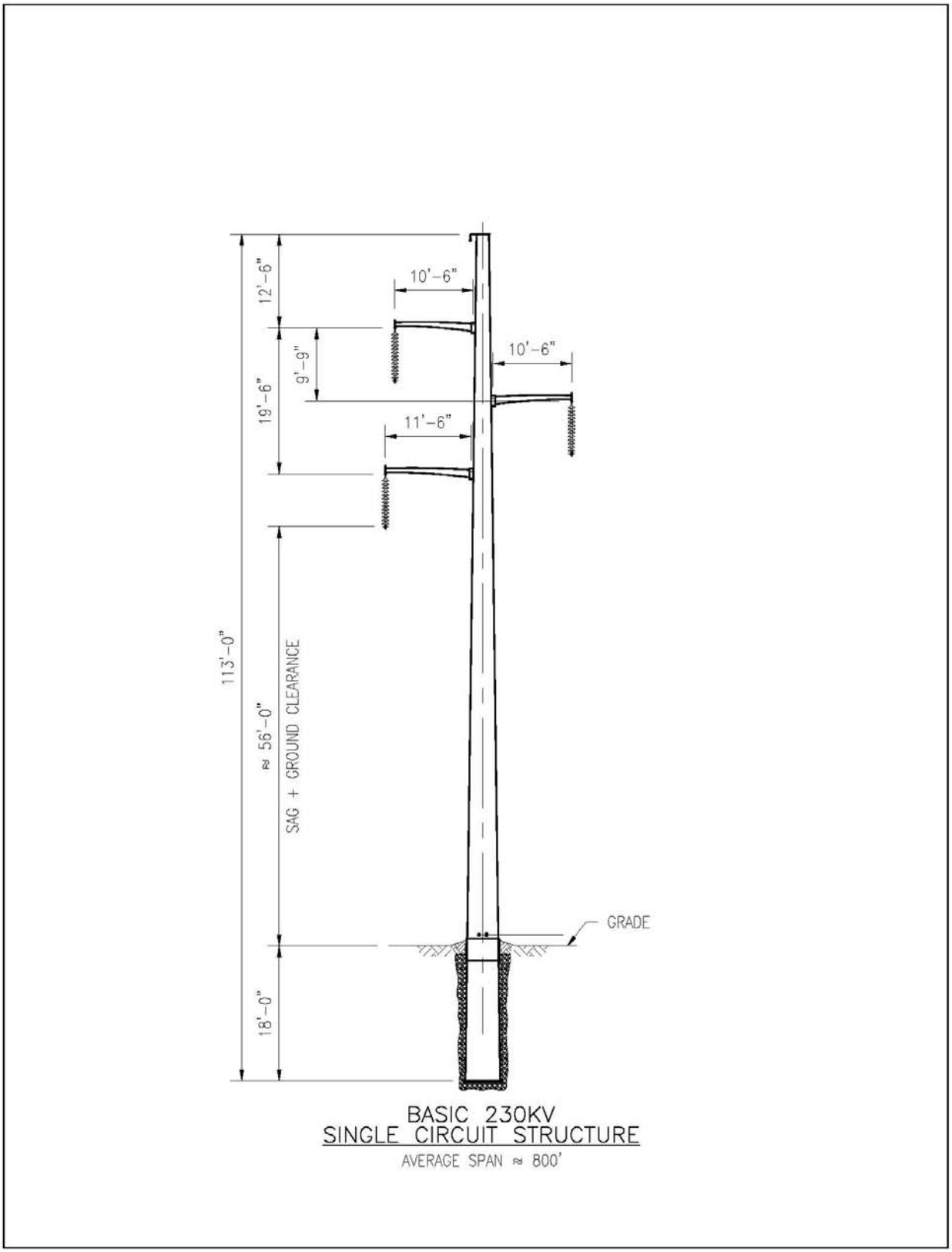
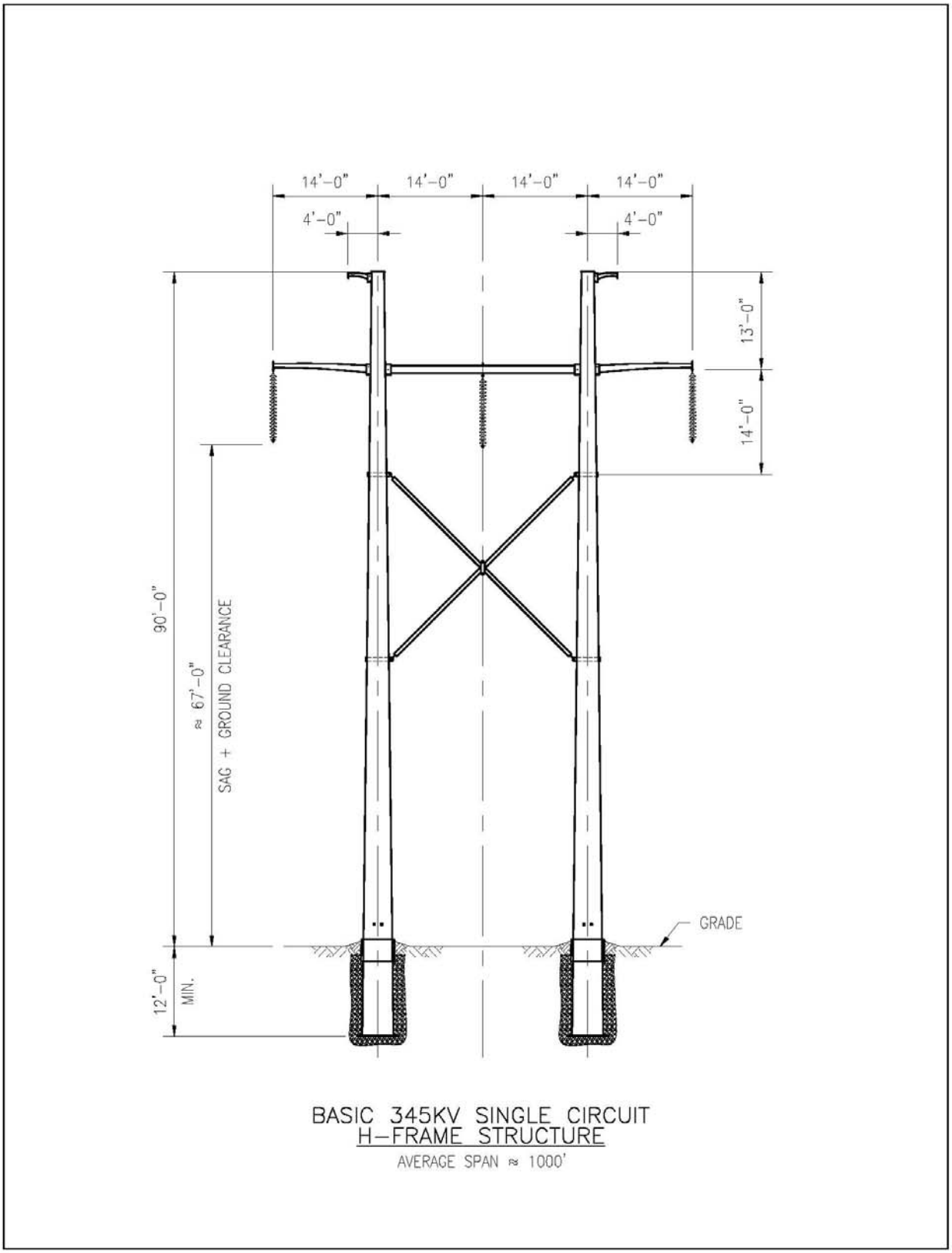


Figure 1-6: Typical Single-Circuit 345-kV H-Frame Structure



2.0 PURPOSE AND NEED

2.1 NEED FOR THE PROJECT

Load Forecast. The demand for electricity creates a stress on existing generation and transmission facilities. The August 2011 Basin Electric load forecast indicates an acceleration of growth in the northwestern North Dakota area that is mainly a result of the development related to the Bakken oil field. Much of the short-term load growth in this area is associated with provision of electrical service to support the rapid expansion of the number of facilities for oil and natural gas production as well as the supporting infrastructure and services. This relatively rapid upswing in development activity in recent years is due to new exploration and extraction technology and the potential for oil recovery from the Bakken Formation.

The Bakken Formation is a thin, widespread geologic formation consisting of oil-generating shale and sandstone layers that extends through portions of Montana, North Dakota, and the Canadian Provinces of Saskatchewan and Manitoba (USGS, 2008). While there are 17 oil-producing counties in North Dakota, all of which are located in the western third of the state, the top-producing counties in 2010 included Mountrail, McKenzie, Dunn, and Williams in northwestern North Dakota (NDPC, 2011). Oil production in North Dakota increased from 62.8 million barrels of oil in 2008 to 79.7 million barrels in 2009 (27% increase) and 113 million barrels in 2010 (40% increase) (NDPC, 2011). Production is expected to continue to increase with an estimated 1,100 to 2,700 new wells per year in western North Dakota and 26,000 new wells over the next 10 to 20 years (NDDMR, 2011).

Infrastructure development related to the expanding oil and gas industry activity in the region includes pipelines, rail, natural gas plants, homes, businesses, roads, and transmission/distribution line development. Pipeline infrastructure is being developed to transport crude oil out of the Bakken to refinery and marketing hubs, such as the U.S. Gulf Coast, as well as to transport natural gas, fracking water, and salt water. Crude oil is being transported by rail out of the Bakken oil field, and expansion of rail infrastructure and associated loading and unloading facilities is under development. Natural gas plants are expanding to process natural gas for consumer use. Local transmission lines for distribution have recently been constructed or are in development in western North Dakota to support the expanding drilling activity and supporting infrastructure.

In the Williston/Tioga region, the preliminary load forecast for northwestern North Dakota is noted in Table 2-1. It is projected that the load is increasing in the regions adjacent to Williston/Tioga in a similar manner.

Table 2-1: Load Forecast for Transmission Lines in the Williston/Tioga Region

Year	Load (MW*)	% Increase
2011	280	--
2012	390	39
2013	454	16
2014	481	6
2015	509	6
2016	538	6

*MW = mega watts

An analysis of transmission line capacity indicates by the year 2016 the load will have increased beyond the load serving capacity of the existing system for the Williston/Tioga region and a new transmission line is required to provide additional capacity. The closest strong transmission system support is associated with the electrical power generation at the Antelope Valley Station, located near Beulah. This system is operated at 345-kV and extends west, south and east from Beulah. A new 345-kV transmission line from the Beulah area to the northwest that connects directly to the 230-kV system in the Williston/Tioga area would provide an increase in the load serving capacity to accommodate the projected load growth and maintain acceptable reliability of the regional transmission system. If this new 345-kV transmission line is not added, then the load growth will be capped at the projected 2015 load level and no new load growth could be accommodated. This would limit the future potential development activities in the Bakken oil field and any other load requirements in this service region.

Reliability Issues. The existing high voltage system in the Williston/Tioga region consists of 230-kV and 115-kV systems that connect to: Saskatchewan, Canada; eastern Montana; central North Dakota; and western North Dakota. Outage of any of these paths could cause low voltage criteria violations and overload adjacent transmission lines in the Williston/Tioga region.

2.1.1 Integrated System Transmission Studies

The Integrated System (IS) is operated and administered by Western. The common use transmission system is in the eastern interconnection of the IS service area. The IS transmission reliability study group performed an evaluation study titled *Eastern Montana/Western North Dakota Load Serving Study Facility Additions Justification-August 2011*(IS Study, 2011). The recommendation of the study is the basis for this project. Project alternatives, based on the study, are discussed in the following section.

* * * * *

3.0 PROJECT ALTERNATIVES

3.1 OVERVIEW

The IS transmission reliability study group performed a study (IS Study, 2011) to assess the electrical system in the IS territory and its capacity to serve the electricity load projections within the service territory. The study investigated a number of system operation scenarios including various system facility upgrades and additions. These scenarios were evaluated based on standard system contingency considerations to determine system capacity, response, and reliability under projected load requirements. The following summarizes the study findings and recommendations.

3.2 ALTERNATIVES CONSIDERED

The IS evaluation considered a number of alternatives to address system capacity and reliability under projected load requirements. These alternatives included various system upgrades to existing facilities, the addition of new 115-kV lines, and the addition of new 345-kV lines. The results of the evaluation for each of these alternatives are summarized below.

3.2.1 System Upgrades

Numerous operating scenarios were developed and evaluated for the IS system as well as system facility upgrades which did not include new line construction. These operating scenarios were modeled with different line ratings, line carrying capacities, and system contingencies. Modeling of the facility upgrades included replacement of existing transformers with higher-capacity units and the installation of capacitors at various locations throughout the system. Under all scenarios investigated, system reliability on some lines would be only temporarily improved. However, even with implementation of all investigated upgrades, significant system failures, including considerable voltage drops or even voltage collapse, would result in numerous lines throughout the system exceeding their emergency ratings. These considerable system limitations could occur as early as 2014.

3.2.2 Additional 115-kV Lines

In order to mitigate the system limitations identified under the various system upgrade operating scenarios, construction of several new alternatives for 115-kV lines were investigated. It was anticipated by the study that these lines could be constructed and made operational by 2014 by the Basin Electric member distribution cooperatives. Generally, these lines have been identified by Basin Electric member cooperatives to serve specific loads and would not be operated as part of the overall electricity transmission network. Additional 115-kV lines considered included:

- MWEC 115-kV lines to serve the Tioga and Blaisdell areas
- Central Power 115-kV line between the Minot and Roseglen areas
- MWEC 115-kV line between Watford City and Swenson
- 115-kV line connection between Snake Creek Pumping Station and Parshall with an interconnection at Roseglen

Construction and operation by the member cooperatives of these 115-kV facilities was found to mitigate many of the system limitations identified through 2014. However, as early as 2015 many of the same system limitations would again result even with the proposed upgrades and 115-kV line constructions. Potentially as early as 2016, load forecasts for the IS territory could not be met with the evaluated system improvements.

3.2.3 Additional 345-kV Lines

The IS study included further long-term analysis to identify potential solutions to address the inability of the system to meet projected load forecasts beyond the 2014 to 2016 time period. These alternatives included construction of various 345-kV lines in addition to the 115-kV lines previously noted. Two 345-kV transmission line alternatives were considered:

- **AVS to Charlie Creek Substation to Judson to Neset alternative (Project Alternative 1)**. This alternative would include a 65-mile 345-kV line from the AVS to the existing Charlie Creek 345-kV Substation. The existing Charlie Creek 345-kV Substation would be connected by a 70-mile segment to the proposed Judson 345-kV Substation. The proposed Judson 345-kV Substation would then interconnect with the proposed Neset 345-kV Substation by a 56-mile line segment and a two-mile 230-kV transmission line would interconnect the proposed Judson 345-kV Substation to Western's existing Williston 230-kV Substation. Finally, the proposed Neset 345-kV Substation would interconnect with the existing Neset 230-kV Substation by a two-mile 230-kV line segment (Figure 3-1).

  AVS to Killdeer to Judson to Neset 345-kV line with a Charlie Creek Substation interconnection (Project Alternative 2). This alternative would include construction of approximately 40 miles of 345-kV line from AVS to a proposed 345-kV switchyard near Killdeer. An additional 85-mile 345-kV transmission line would extend from the proposed Killdeer 345-kV Switchyard to the proposed Judson 345-kV Substation and a 25-mile 345-kV line segment would extend from the proposed Killdeer 345-kV Switchyard to the existing Charlie Creek 345-kV Substation, located near Grassy Butte. The proposed Judson 345-kV Substation

would then interconnect with the proposed Neset 345-kV Substation by a 56-mile line segment and a two-mile 230-kV transmission line would interconnect the proposed Judson 345-kV Substation to Western's nearby existing Williston 230-kV Substation. Finally, the proposed Neset 345-kV Substation would interconnect with the existing Neset 230-kV Substation by a two-mile 230-kV line segment (Figure 3-2).

3.2.4 Recommended System Alternative

Based on the IS study, construction of new 345-kV transmission line facilities will be required to meet the projected load for the eastern Montana and western/central North Dakota areas, including the identified Williston Load Pocket. Construction of a 345-kV line from AVS to the Williston and Tioga areas is the only alternative identified to meet the system load capacity and reliability criteria. There was initial discussion of delivering power to the Judson/Williston/Neset Substations without a Charlie Creek 345-kV Substation connection. Future conditions evaluated with and without a Charlie Creek 345-kV Substation connection were found to maintain system reliability requirements and serve projected load forecasted through 2020. However, the condition including the Charlie Creek 345-kV Substation connection provided a more robust support of the western IS system and better supports future planning for growth in western North Dakota. Therefore, it is determined that the construction and operation of the AVS -to-Charlie Creek –to-Judson-to-Neset by a 345-kV transmission line, with associated substation interconnections, will better satisfy the Project's Purpose and Need. The IS study therefore recommends construction and operation of this 345-kV line, and associated connection to the Charlie Creek 345-kV Substation. Two system alternatives that include a connection to the existing Charlie Creek 345-kV Substation have been retained for further study and evaluation as part of the macro-corridor alternatives considered in this report.

* * * * *

NORTH

0 11.5

Miles

Existing Neset 230-kV Substation

Proposed Neset 345-kV Substation

Proposed Judson 345-kV Substation

Existing Williston 230-kV Substation

Existing Charlie Creek 345-kV Substation

Existing Antelope Valley Station 345-kV Substation

Williams

Mountrail

McHenry

Ward

McKenzie

Dunn

McLean

Mercer

Oliver

Golden Valley

Billings

Renville

Tioga

White Earth

Ray

Epping

Spring Brook

Williston

Ross

Stanley

Palermo

Donnybrook

Carpio

Berthold

Burlington

Des Lacs

Minot

New Town

Plaza

Parshall

Makoti

Ryder

Douglas

Max

Garrison

Alexander

Arnegard

Watford City

Killdeer

Dunn Center

Halliday

Dodge

Golden Valley

Zap

Beulah

Hazen

Stanton

Pick City

Riverdale

CANADA

Montana

North Dakota

South Dakota

LEGEND

- Existing Substation
- Proposed Substations and Switchyard
- Alternative Transmission Line Connection
- State Boundary
- County Boundary
- Municipal Areas
- Railroad

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 3-1
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Project Alternative 1

R:\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Overall_Project_Alternative_1_11x17.mxd 9/23/2011

Source: North Dakota GIS; Esri; Basin Electric; Burns & McDonnell.

Revised September 23, 2011

NORTH

0 11.5

Miles

Existing Neset 230-kV Substation

Proposed Neset 345-kV Substation

Proposed Judson 345-kV Substation

Existing Williston 230-kV Substation

Existing Charlie Creek 345-kV Substation

Proposed Killdeer 345-kV Switchyard

Existing Antelope Valley Station 345-kV Substation

Tioga
White Earth
Ray
Epping
Spring Brook
Williston
Ross
Stanley
Palermo
Donnybrook
Carpio
Renville
Berthold
Burlington
Des Lacs
Minot
McHenry
Ward
Mountrail
Williams
Plaza
New Town
Parshall
Makoti
Ryder
Douglas
Max
Garrison
McLean
Alexander
Arnegard
Watford City
McKenzie
Killdeer
Dunn Center
Halliday
Dodge
Golden Valley
Zap
Beulah
Hazen
Stanton
Mercer
Oliver
Pick City
Riverdale
Dunn
Golden Valley
Billings

CANADA

Montana
North Dakota
South Dakota

LEGEND

- Existing Substation
- Proposed Substations and Switchyard
- Alternative Transmission Line Connections
- State Boundary
- County Boundary
- Municipal Areas
- Railroad

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 3-2
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Project Alternative 2

R:\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Overall_Project_Alternative_2_11x17.mxd 9/23/2011

Source: North Dakota GIS; Esri; Basin Electric; Burns & McDonnell.

Revised September 23, 2011

4.0 STUDY AREA IDENTIFICATION AND MACRO-CORRIDOR COMPARISON

4.1 BASIN ELECTRIC SERVICE AREA

Basin Electric Power Cooperative (Basin Electric), established in 1961 and headquartered in Bismarck, North Dakota, is one of the largest electric generation and transmission cooperatives in the United States. Basin Electric's core business is generating and transmitting wholesale bulk electric power to customers, which primarily consist of 135 member cooperatives located in nine states. Basin Electric's service territory spans 540,000 square miles in the central United States from the Canadian border to Mexico, including parts of Colorado, Iowa, Minnesota, Montana, Nebraska, New Mexico, North Dakota, South Dakota, and Wyoming. Basin Electric's member cooperatives distribute electricity to about 2.8 million consumers. Basin Electric owns 2,093 miles and maintains 2,178 miles of high-voltage transmission lines and owns and maintains equipment in 66 switchyards and 116 telecommunications sites.

4.2 STUDY AREA IDENTIFICATION

Prior to the development of a defined study area, the large constraints in the region north of the existing Antelope Valley Station (AVS) 345-kV Substation that are located in the path towards a connection to the existing Neset 230-kV Substation near Tioga were reviewed. The two big impediments to developing a new transmission line from AVS to Tioga are the Fort Berthold Reservation and Lake Sakakawea, both north of the existing AVS 345-kV Substation. Crossing Fort Berthold was not considered a viable alternative because it would involve tribal lands, which could complicate the approval process. Crossing Lake Sakakawea was investigated at a conceptual level and it was determined that the logistics and costs associated with trying to place a submarine cable in the lake made the project infeasible. At this time, additional studies determined that a new substation and associated transmission line are needed at Williston to support the increased electrical needs in the northwestern North Dakota area. Therefore the study area was expanded to include AVS, Williston and Tioga.

A study area capable of providing geographic coverage that could include several macro-corridor options that did not include areas directly north of the existing AVS 345-kV Substation and would connect the proposed Judson 345-kV Substation, existing Charlie Creek 345-kV Substation and Neset 230-kV Substation endpoints was established. The study area consists of parts of six counties in North Dakota. The following sections provide a description of the Project study area and identify the macro-corridors developed within the study area for further investigation.

4.3 GENERAL DESCRIPTION OF STUDY AREA

The AVS to Neset study area encompasses the existing AVS 345-kV Substation, Basin Electric's existing Charlie Creek 345-kV Substation, Western's existing Williston 230-kV Substation and vicinity for construction of Basin Electric's proposed Judson 345-kV Substation, and Basin Electric's existing Neset 230-kV Substation and vicinity for Basin Electric's proposed Neset 345-kV Substation . The configuration of the study area to include these substation locations generally extends to the west from the existing AVS 345-kV Substation for approximately 50 miles before extending approximately 80 miles to the north (see Figure 1-1). The study area extends along the south side of the Fort Berthold Reservation before turning north to the west of the reservation. The western boundary of the study area extends to approximately 13 miles west of Williston, providing sufficient routing opportunities around the west side of the existing Charlie Creek 345-kV Substation and the City of Williston. The northern border of the study area is located approximately 6.5 miles north of the existing Neset 230-kV Substation, which again provides routing opportunities up to, and around, the existing Neset 230-kV Substation. Extending the study area further in any direction would unnecessarily include lands and resources not likely to be affected by the Project. The study area provides a balance between providing sufficient area for development of numerous macro-corridor options and not being so large as to encumber the analysis.

The study area includes portions of Mercer, Dunn, Billings, McKenzie, Williams, and Mountrail counties in North Dakota. The existing AVS 345-kV Substation is located in Mercer County, approximately six miles northwest of the community of Beulah. Charlie Creek Substation is located in the southern portion of McKenzie County near the intersection of U.S Highway 85 and N.D. Highway 200. The proposed Judson 345-kV Substation to be constructed in Williams County would be located in the vicinity of Western's existing Williston 230-kV Substation, west of the City of Williston north of the intersection of U.S. Highway2 and U.S. Highway 85. The proposed Neset 345-kV Substation will be located near the existing Neset 230-kV Substation which is located in Mountrail County, approximately three miles east of the community of Tioga. Dominant features in the study area are Theodore Roosevelt National Park, Lake Sakakawea, the Missouri River, Little Missouri River, and the Little Missouri National Grasslands. Larger towns within the study area include Beulah, Dodge, Killdeer, Watford City, Williston, Epping, and Tioga, along with numerous smaller towns and communities.

Burns & McDonnell conducted an investigation of the human and natural resources within the study area to identify those resources that would present issues or concerns for the routing of a transmission line. The investigation also sought to identify opportunities within the study area that could provide a corridor for a new transmission line. The goal of the analysis was to identify and define a macro-corridor, an area up to several miles in width that extends between the Project endpoints, within which the proposed

transmission line could be constructed. The substantial width of the macro-corridor will provide flexibility to identify several route corridors for the transmission line for comparison to select a corridor that minimizes impacts to important natural and human resources identified within the macro-corridor.

4.3.1 Human Resources

The AVS to Neset study area contains large expanses of rural, undeveloped area with scattered residential development and small towns and communities. General population and employment data for the counties within the Project study area are included in Tables 4-1 and 4-2. Land use within the study area consists of a mixture of grassland, cropland, and rangeland, with smaller areas of woodland and cropland around river drainages and lakes. Lake Sakakawea is a large impoundment of the Missouri River that is located through the northern portion of the study area.

Table 4-1: Study Area Population

	2000	2010	% Change
North Dakota	642,200	672,591	4.7
Billings County	888	783	-11.8
Dunn County	3,600	3,536	-1.8
McKenzie County	5,737	6,360	10.9
Mercer County	8,644	8,424	-2.5
Mountrail County	6,631	7,673	15.7
Williams County	19,761	22,398	13.3

Source: U.S. Census Bureau (2010a). 2000 and 2010 Census Data

Table 4-2: Percent Employment by County

Industry	North Dakota	Billings	Dunn	McKenzie	Mercer	Mountrail	Williams
Agriculture, forestry, fishing and hunting, and mining	8.6	35.1	30.3	27.2	21.6	16.2	22.1
Construction	7.0	6.5	8.1	5.9	7.3	4.8	3.9
Manufacturing	7.9	0.9	9.7	1.9	7.1	6.7	3.8
Wholesale trade	3.4	3.3	2.8	2.3	0.4	1.5	5.6
Retail trade	12.3	11.2	10.2	6.4	9.3	10.4	11.6
Transportation and warehousing, and utilities	5.3	3.3	4.4	3.1	17.5	3.2	6.0
Information	1.8	0.9	0.5	1.5	2.3	2.9	1.3
Finance, insurance, and real estate, and rental and leasing	6.0	1.5	2.0	3.0	1.8	4.5	4.8

Industry	North Dakota	Billings	Dunn	McKenzie	Mercer	Mountrail	Williams
Professional, scientific, management, administrative and waste management services	6.4	1.1	1.2	8.4	7.2	1.9	4.5
Educational, health, and social services	23.9	13.0	22.4	22.1	14.7	26.3	21.6
Arts, entertainment, recreation, accommodation and food services	8.0	10.0	2.9	8.6	4.6	9.9	6.9
Other services, except public administration	4.4	6.5	2.1	1.8	3.0	3.1	4.9
Public administration	5.1	6.5	3.3	7.7	3.2	8.6	3.0

Source: U.S. Census Bureau (2010b). 2005-2009 American Community Survey Data

There are numerous small towns and communities throughout the study area, with scattered rural residences and homesteads interspersed throughout. Communities located within the study area include Alexander, Arnegard, Beulah, Dodge, Dunn Center, Epping, Golden Valley, Grassy Butte, Halliday, Killdeer, Ray, Springbrook, Tioga, Watford City, White Earth, Williston, and Zap. Populations in 2010 for these communities are included in Table 4-3.

Table 4-3: Populations of Communities in the Study Area

Community	2010 Population
Alexander	223
Arnegard	115
Beulah	3,121
Dodge	87
Dunn Center	146
Epping	100
Golden Valley	182
Halliday	188
Grassy Butte	252
Killdeer	751
Ray	592
Springbrook	27
Tioga	1,230
Watford City	1,744
White Earth	80
Williston	14,716
Zap	237

Source: U.S. Census Bureau (2010a). 2010 Census Population Data

Theodore Roosevelt National Park and portions of the Little Missouri National Grasslands are located within the study area, along with two state parks (see Figure 1-1). These state parks include Lewis and Clark State Park located along Lake Sakakawea in Williams County and Little Missouri State Park located north of Dunn Center in Dunn County. North Tobacco Garden, Tobacco Garden, and Hofflund State Game Management Areas are located near Lake Sakakawea, and Killdeer Mountain State Game Management Area is located northwest of the town of Killdeer. Lake Ilo National Wildlife Refuge is located near Dunn Center in the southern part of the study area.

Primary roadways in the study area include U.S. Highway 2, U.S. Highway 85 and North Dakota State Highway 200. U.S. Highway 2 runs generally east to west through the northern portion of the study area, passing through the towns of Williston and Ray. The proposed Judson 345-kV Substation will be constructed adjacent to, or very near, U.S. Highway 2 just west of Williston and just north of U.S. Highway 85, and the existing Neset 230-kV Substation is located approximately five miles north of U.S. Highway 2 on the eastern edge of the study area. U.S. Highway 85 extends generally north to south through the western portion of the study area, and also passes through the town of Williston, as well as the towns of Alexander, Watford City and Grassy Butte. The Killdeer Mountain Four Bears Scenic Byway (North Dakota State Route 22) and the Theodore Roosevelt National Park North Unit Scenic Byway are located in the central portion of the study area. Several other paved state routes exist within the study area, along with numerous smaller paved and unpaved state and county roads. North Dakota State Highway 200 runs east to west across North Dakota and through the southern portion of the study area.

There are two active BNSF Railway Company (BNSF) rail lines providing service to customers within the Project study area. One of these lines runs generally southwest to northeast across the northern portion of the study area, passing through the towns of Williston and Tioga. Another BNSF line extends from the eastern edge of the study area and terminates at the Antelope Valley Station northwest of the town of Beulah. Several other abandoned rail lines occur within the study area.

Several transmission lines (115-kV or greater) are present within the Project study area. Basin Electric's existing Charlie Creek to Antelope Valley Station 345-kV transmission line is located in the southern portion of the study area. Basin Electric's Williston to Tioga 230-kV transmission line is located in the northern portion of the study area north and east of Williston. Western's Indian Hills to Williston, Culbertson to Williston and Charlie Creek to Williston 115-kV transmission lines also occur within the study area. Western's 115-kV line from Charlie Creek to Williston is being upgraded to 230-kV. The line is planned to be energized to 230-kV in the fall of 2011. Montana-Dakota Utilities' Williston to Genora

and Williston to Tioga 115-kV lines are present within the study area as well. Numerous smaller transmission and distribution lines occur throughout the study area to provide electrical service to residences and businesses. Distribution lines occur throughout the area, generally located along area roadways. Transmission lines more commonly extend cross-country following section, quarter-section, or fence lines.

4.3.2 Natural Resources

The Project study area includes portions of four physiographic provinces: the Missouri Coteau, the Coteau Slope, the Little Missouri Badlands, and the Missouri Plateau (USGS, 2006). Topography of the area ranges from a hummocky, glacially-modified landscape to rolling, hilly plains to rugged, deep canyons. Drainage flows are generally north and west towards the Missouri River, which flows from west to east. Much of the portion of the Missouri River in the study area contains Lake Sakakawea, which was formed by the construction of the Garrison Dam on the Missouri River near Pick City. Smaller rivers that drain into the Missouri include the Little Missouri, Little Muddy, Spring and Knife rivers (USGS, 2011b). Numerous intermittent and ephemeral stream channels are contained within the study area, with sharply defined stream channels in steeper areas, and broader, less-eroded features in areas with shallow slopes.

Vegetation within the study area consists of many different community types. These types include sparsely-to-heavily timbered canyons and draws, wooded riparian corridors, row crop agriculture, pasture/rangeland, and native mixed and short grass grasslands. Much of the study area contains thin or rocky soils, limiting the amount of row crop agriculture. In the areas with extensive grasslands, livestock grazing and hay production are common practices. Wetland communities occur in high densities within the Missouri Coteau and less so in the other regions. Wetlands in the glaciated regions tend to be more isolated with less connection to drainageways and streams.

The abundance and variety of vegetative communities provides habitat for numerous species of wildlife. Wildlife include both game species such as eagles, ringneck pheasant, mourning dove, fox squirrel, mule deer, white-tailed deer, sharp-tailed grouse, coyote, red fox, and waterfowl as well as numerous non-game species including prairie dogs, rodents, songbirds, shorebirds, and reptiles.

Preliminary investigation identified several Federally-listed species as potentially occurring in the counties included in the study area. Species associated with the Missouri River include the interior least tern, the pallid sturgeon, and the piping plover. Since the transmission line will span the river, these species are not expected to be impacted. No Federally-listed species are known to occur within the Little

Missouri River. Table 4-4 provides a complete list of the Federally-listed species potentially occurring in the Project study area.

The study area has a long history of habitation, both by prehistoric Native American groups and Euro-American settlers. In addition to several National Register of Historic Places (NRHP) sites, there are likely many prehistoric archaeological sites occurring throughout the area. There are 31 historic places registered on the NRHP in the study area. Table 4-5 summarizes the types and locations of the historical places in the study area listed on the NRHP.

Table 4-4: Threatened and Endangered Species by County

Common Name	Scientific Name	Federal Status*	Counties				
			Billings	Dunn	Mercer	McKenzie	Mountrail
Black-footed ferret	*Mustela nigripes*	E	E	E	E	E	
Dakota skipper	*Hesperia dacotae*	C		C		C	C
Gray wolf	*Canis lupus*	E	E	E	E	E	E
Greater sage-grouse	*Centrocercus urophasianus*	C					
Interior least tern	*Sterna antillarum*	E		E	E	E	E
Pallid sturgeon	*Scaphirhyncus albus*	E		E	E	E	E
Piping plover	*Charadrius melodus*	T		T, CH	T, CH	T, CH	T, CH
Sprague's pipit	*Anthus spragueii*	C	C	C	C	C	C
Western prairie fringed orchid	*Platanthera paraeclara*	C					
Whooping crane	*Grus americana*	E	E	E	E	E	E

*E – Endangered; T – Threatened; C – Candidate; CH – Critical Habitat
Source: USFWS (2010).

Table 4-5: National Register of Historic Places (NRHP) by County

Category	Billings	Dunn	Mercer	McKenzie	Mountrail
Farm/Ranch	1	1	0	0	0
Building/Structure	2	0	3	2	1
Roadway	0	0	0	0	0
Cemetery	0	0	0	0	0
Church	1	1	1	0	0
Battlefield	0	0	0	0	0
Bridge	0	0	1	1	0
Courthouse	1	1	0	0	1
Site	0	0	0	0	0
Museum	1	0	0	1	0
Conservation/Archeological	2	0	1	0	0
Village	0	0	2	0	0
Park	3	0	1	0	1
Total	**11**	**3**	**9**	**4**	**3**

Source: NRHP (2011).

4.4 IDENTIFICATION OF ALTERNATIVE MACRO-CORRIDORS

Following the establishment and investigation of the Project study area attributes, several general areas that could contain macro-corridor alternatives were evaluated to determine if they were suitable for the development of transmission line route corridor alternatives. The initial macro-corridors were evaluated with consideration of the following constraints present within the study area that were used as a high level screening tool for areas to avoid placing transmission lines and substations:

- Communities and other developed areas within the study area
- Lake Sakakawea
- Missouri River
- Theodore Roosevelt National Park
- Little Missouri National Grasslands
- Little Missouri River
- Areas of rough and steep terrain around the Missouri River and Little Missouri River

Table 4-6 summarizes the considerations for macro-corridor development.

Table 4-6: Macro-Corridor Development Considerations

Resource	Opportunity Area (Optimize Use for Routing)	Avoidance Area (Minimize Use for Routing)	Exclusion Area (Exclude When Possible)
Communities and Developed Areas	--	--	Incorporated and unincorporated municipal boundaries, residential developments
Lake Sakakawea	--	Within flood inundation zone for lake	Crossing of lake inundation area
Missouri River	Existing linear facilities crossings	Narrow adjacent areas of rough terrain and associated floodplains	Wide adjacent areas of rough terrain, extensive floodplains, and wide river crossings
Theodore Roosevelt National park	--	--	Within the park boundary
Little Missouri National Grasslands	Paralleling existing linear facilities across grassland properties	Narrow or isolated grassland parcels	Large contiguous tracts of grassland property
Little Missouri River	Existing linear facilities crossings	Narrow adjacent areas of rough terrain and associated floodplains	Wide adjacent areas of rough terrain, extensive floodplains, and wide river crossings
Rough and steep terrain	Existing linear facilities crossings	Narrow areas adjacent to area drainages	Wide areas adjacent to area drainages and associated steep draws and canyons

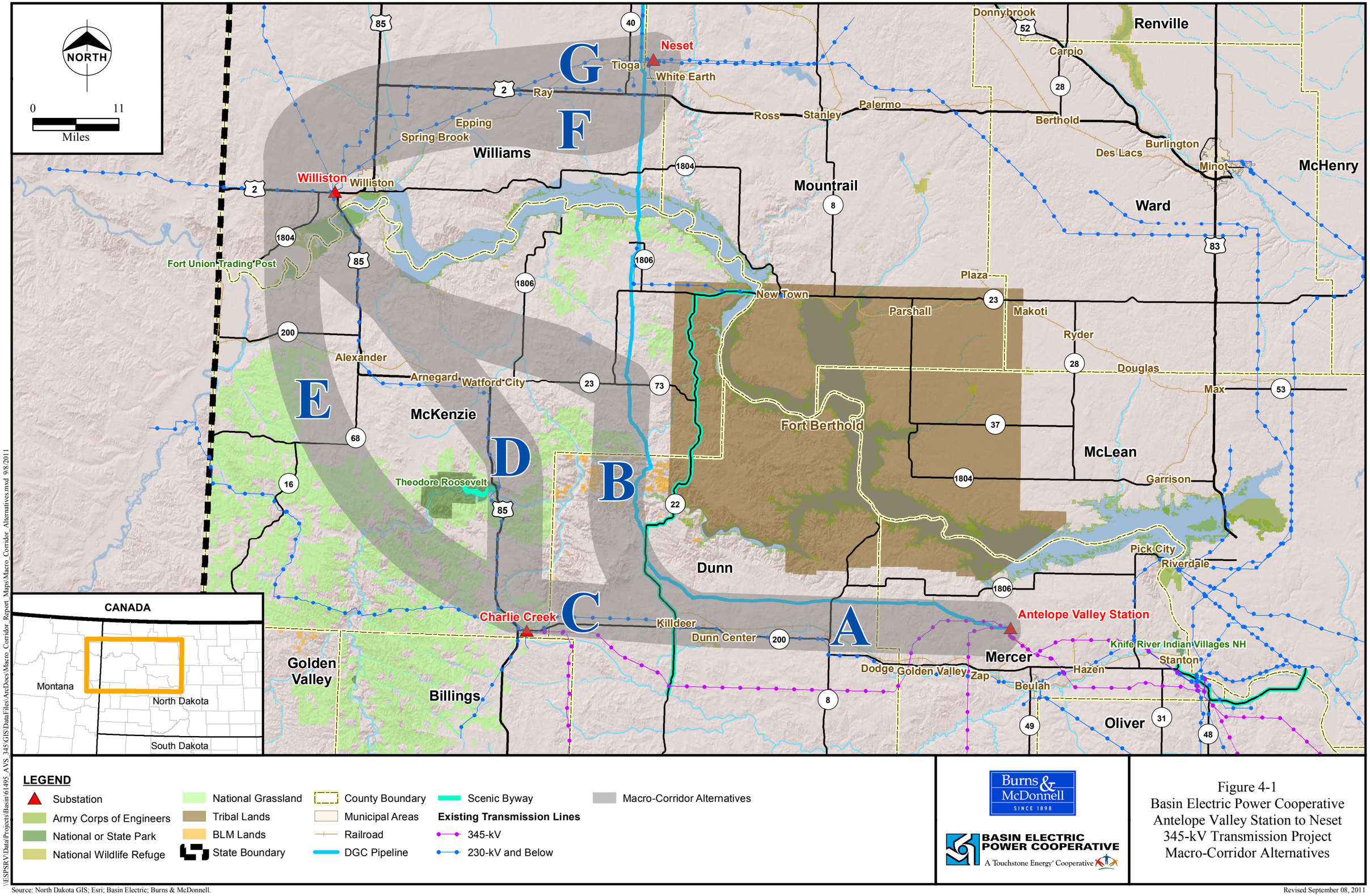
Communities occurring within the study area are generally small and can be avoided by a transmission line corridor. Theodore Roosevelt National Park is located west of U.S. Highway 85 in McKenzie County. The Little Missouri National Grasslands is comprised of many tracts spread throughout the study area; the primary area is located in the western portion of McKenzie County, which is in the western portion of the study area. Protected Federal properties such as national parks, grasslands, and historic areas are generally considered as areas to avoid when developing corridors for transmission lines. Due to the vast extent of the Federal Grasslands in certain areas of the study area it may be unavoidable in some instances. Areas of steep and rough terrain, as found near the Missouri and Little Missouri rivers, can pose engineering and construction complexities. Lake crossings also present engineering and construction challenges, as well as adding cost to the project. In a similar manner the macro-corridors considered the locations of natural and human resources within the study area and potential opportunities available for the compatible location of a new transmission line such as roadways, pipeline routes and existing transmission line corridors. A more detailed discussion and comparison of these macro-corridors is found in the following section.

4.5 ALTERNATIVE MACRO-CORRIDORS

Figure 4-1 illustrates the alternative macro-corridors and identifies individual corridor segments by letter designation A-G. Starting from the existing AVS 345-kV Substation, a corridor was developed (corridor segment A) that extends to the west across relatively undeveloped areas with favorable terrain for transmission line construction, while providing an adequate area for multiple alternative route corridors.

This corridor segment also contains within its boundaries the existing Dakota Gasification Company (DGC) CO_2 pipeline right-of-way. This corridor segment extends from the existing AVS 345-kV Substation approximately 40 miles to near the towns of Killdeer and Dunn Center, where it then splits.

Corridor segment B continues to the north, generally following the DGC pipeline right-of-way while crossing the Little Missouri River, and then turns in a northwest direction upon reaching North Dakota Highway 23. Corridor segment B then extends in a northwest direction while crossing the Missouri River at Williston using the U.S. Highway 85 corridor and terminating at the proposed Judson 345-kV Substation. Corridor segment C continues to head west from corridor segment A and terminates at the existing Charlie Creek 345-kV Substation. Corridor segment D extends north from the existing Charlie Creek 345-kV Substation and passes to the east of the Theodore Roosevelt National Park paralleling U.S. Highway 85. This corridor segment minimizes areas of rough terrain to be crossed but encounters considerable natural grasslands under Federal ownership. This corridor segment then continues to the north, eventually utilizing the same area as corridor segment B as it crosses the Missouri River near Williston, where it terminates at the proposed Judson 345-kV Substation.



Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 4-1
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Macro-Corridor Alternatives

Source: North Dakota GIS; Esri; Basin Electric; Burns & McDonnell.

Revised September 08, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Macro_Corridor_Alternatives.mxd 9/8/2011

Corridor segment E extends westward from the existing Charlie Creek 345-kV Substation and turns northwest, passing to the west of Theodore Roosevelt National Park, crossing extensive areas of Federal grasslands as it turns to the northwest. This corridor segment continues to the northwest and crosses the Missouri River west of corridor segments B and D.

Extending from the proposed Judson 345-kV Substation to the proposed Neset 345-kV Substation, two corridor segments were considered, one north of U.S. Highway 2 and one south of U.S. Highway 2. Corridor segment F extends northeastward toward the proposed Neset 345-kV Substation. This corridor segment is generally located south of U.S. Highway 2 east of Williston. The other corridor segment (corridor segment G) takes a more northerly track, generally extending north from Williston and turning east toward the proposed Neset 345-kV Substation while remaining on the north side of U.S. Highway 2. Both of these corridor segments traverse primarily agricultural areas criss-crossed by section roads, providing good access throughout the area.

4.6 EVALUATION OF MACRO-CORRIDORS

The preliminary macro-corridors discussed in the previous section reveal three distinct macro-corridors from the existing AVS 345-kV Substation to the proposed Judson 345-kV Substation near Williston. Corridor segment combinations forming these macro-corridors are corridor segments AB, corridor segments ACD and corridor segments ACE (see Figure 4-1). Additionally, there are two distinct macro-corridors from the proposed Judson 345-kV Substation to Neset. These macro-corridors are designated as corridor segment F and corridor segment G. A discussion of these macro-corridors is included below. Corridor segments AB avoid a majority of the Little Missouri National Grassland area. This macro-corridor crosses mostly rangeland with generally good access roads throughout the area with the exception of the Little Missouri Crossing north of Killdeer, North Dakota. The total length of corridor segments AB is approximately 130 miles. Corridor segment C (extending to the existing Charlie Creek 345-kV Substation) could also be used in combination with corridor segments AB if it is determined that a switchyard at Killdeer would be needed to facilitate an additional 345-kV connection to the existing Charlie Creek 345-kV Substation.

Corridor segments ACD cross extensive areas of the Little Missouri National Grassland and cross areas of rough terrain with limited access. This macro-corridor also passes in proximity to Theodore Roosevelt National Park. This macro-corridor follows a former corridor that was investigated in the 1980's by Basin Electric and Montana-Dakota Utilities Company to construct a 230-kV transmission line from existing Charlie Creek 345-kV Substation to Williston, North Dakota. The 230-kV project received input from the required Federal and State agencies and was issued Corridor and Route Certificates by the North

Dakota Public Service Commission but was never constructed. The total length of corridor segments ACD is approximately 136 miles.

Corridor segments ACE cross a substantial amount of Federally-controlled natural grasslands, pass in proximity to Theodore Roosevelt National Park without containing any major existing road or pipeline alignments to follow such as corridor segments ACD, and are located almost entirely within areas of rough terrain with limited access. Rough terrain and limited access could increase project impacts and construction costs significantly, and since this macro-corridor is approximately 136 miles in length, the use of corridor segments ACE provides no real advantages over the other corridor segment combinations under consideration. Because of the above factors, the combination of corridor segments ACE was eliminated from further evaluation for potential transmission line alternative routes.

The Little Missouri River crossing using either corridor segments AB or corridor segments ACD represents an area of rough terrain and limited access; however, the expanse of this rough terrain is generally limited to areas near the river, and special structure types and design features would be able to allow the construction of a transmission line through these unique areas. Using corridor segments ACD does have the additional layer of complexity in that it is closer to the National Park and crosses Federal grasslands. This macro-corridor also requires minimal clearing, and provides the flexibility and opportunities for development of route corridors that also minimize resource impacts. Therefore, the combination of corridor segments AB and corridor segments ACD have been retained for further evaluation for potential transmission line alternative routes from the existing AVS 345-kV Substation to the proposed Judson 345-kV Substation (Figure 4-2).

From the proposed Judson 345-kV Substation to the proposed Neset 345-kV Substation there are two distinct macro-corridors, both of which are approximately 60 miles in length. Corridor segment F extends generally south of U.S. Highway 2 and avoids rough terrain, provides good access, and provides more opportunities for the placement of a transmission line (i.e. roads, existing transmission lines) than does corridor segment G, which is located generally north of U.S. Highway 2. Therefore, corridor segment F was selected to continue as the macro-corridor to be considered for further evaluation for potential transmission line alternative routes from the proposed Judson 345-kV Substation to proposed Neset 345-kV Substation (see Figure 4-2).

After the selection of the corridor segments to be retained, more defined, six-mile-wide corridors were developed within the retained corridor segments (Figure 4-3). These selected macro-corridors generally avoid major constraints within the study area, and take advantage of opportunities present within the

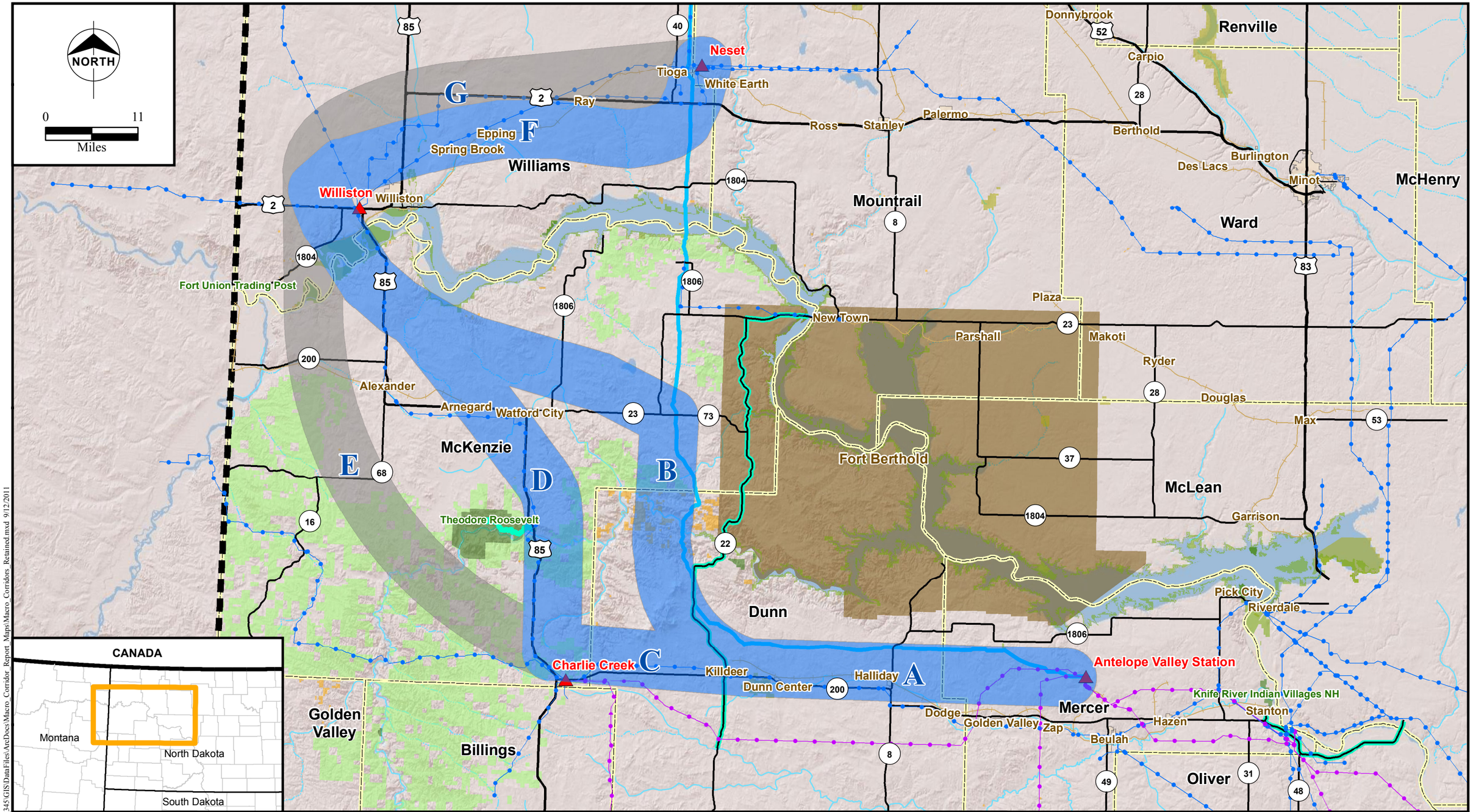
study area. Table 4-7 summarizes the opportunities and constraints within each macro-corridor. A more detailed discussion of opportunities and constraints within the retained macro-corridors is presented in the following chapter.

Table 4-7: Summary of Macro-Corridor Opportunities and Constraints

Macro-Corridor Segments	Opportunity Area (Optimize Use for Routing)	Avoidance Area (Minimize Use for Routing)	Exclusion Area (Exclude When Possible)
AVS to Judson			
AB	Undeveloped cropland and rangeland, existing utility corridors	Minimal areas of steep terrain adjacent to Little Missouri River and Missouri River, residential development along Missouri River, minimal national grassland area	Incorporated and unincorporated communities (Killdeer, Dunn Center)
AB+C	Undeveloped cropland and rangeland, existing utility corridors	Minimal areas of steep terrain adjacent to Little Missouri River and tributaries, Missouri River, residential development along Missouri River, minimal national grassland area	Incorporated and unincorporated communities (Killdeer, Dunn Center)
ACD	Undeveloped cropland and rangeland, existing utility corridors, Hwy 85 corridor	Minimal areas of steep terrain adjacent to Little Missouri River and tributaries, Missouri River, residential development along Missouri River, minimal national grassland area	Incorporated and unincorporated communities (Killdeer, Dunn Center, Watford City, Arnegard), proximity to Theodore Roosevelt National Park, more contiguous national grassland properties
ACE	Undeveloped cropland and rangeland, minimal existing utility corridors	Minimal areas of steep terrain adjacent to Little Missouri River and tributaries, Missouri River	Incorporated and unincorporated communities (Killdeer, Dunn Center), proximity to Theodore Roosevelt National Park, large contiguous national grassland properties, extensive areas of rough terrain and limited access
Judson to Neset			

Macro-Corridor Segments	Opportunity Area (Optimize Use for Routing)	Avoidance Area (Minimize Use for Routing)	Exclusion Area (Exclude When Possible)
F	Existing linear facilities and roadways	--	Incorporated and unincorporated communities (Spring Brook, Epping, Ray, Tioga, Williston), irrigated lands
G	Limited existing linear facilities	--	Incorporated and unincorporated communities (Spring Brook, Epping, Ray, Tioga, Williston), irrigated lands

* * * * *



LEGEND

- Substation
- Army Corps of Engineers
- National or State Park
- National Wildlife Refuge
- National Grassland
- Tribal Lands
- BLM Lands
- State Boundary
- County Boundary
- Municipal Areas
- Railroad
- DGC Pipeline
- Scenic Byway
- **Existing Transmission Lines**
- 345-kV
- 230-kV and Below
- Planning Corridors Retained
- Planning Corridors Considered but Eliminated

Burns & McDonnell SINCE 1898

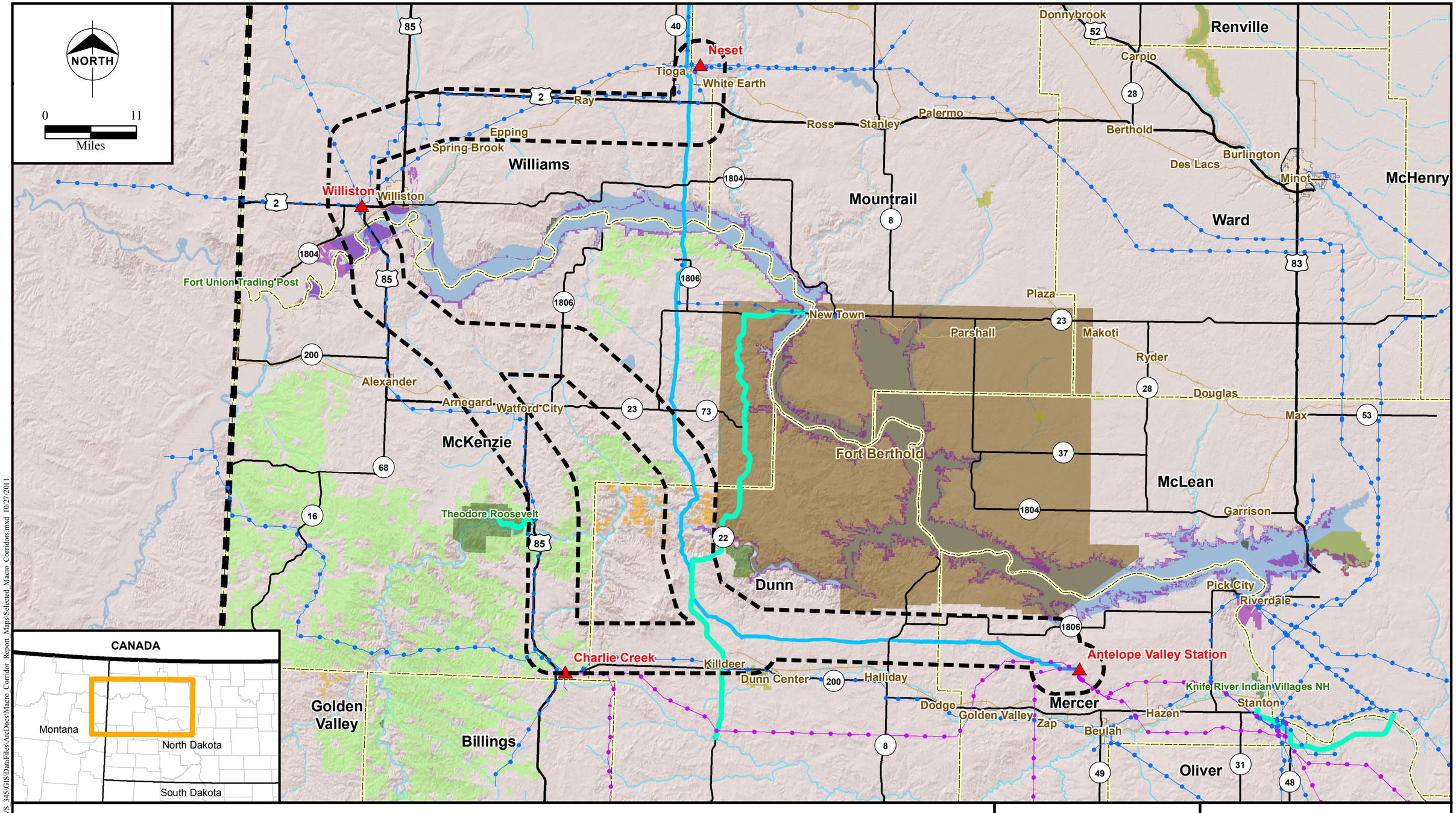
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 4-2
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Macro-Corridors Retained

Source: North Dakota GIS; Esri; Basin Electric; Burns & McDonnell.

Revised September 12, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Macro_Corridors_Retained.mxd 9/12/2011



LEGEND

- Selected Macro Corridors
- Substation
- Army Corps of Engineers
- National or State Park
- National Wildlife Refuge
- National Grassland
- Tribal Lands
- BLM Lands
- State Boundary
- County Boundary
- Municipal Areas
- Railroad
- DGC Pipeline
- Scenic Byway
- **Existing Transmission Lines**
- 345-kV
- 230-kV and Below

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 4-3
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Selected Macro Corridors

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Selected_Macro_Corridors.mxd 10/27/2011

Source: North Dakota GIS; Esri; Basin Electric; Burns & McDonnell.

Revised October 27, 2011

5.0 MACRO-CORRIDOR ANALYSIS

5.1 OVERVIEW

The purpose of identifying opportunities and constraints within the macro-corridors between the existing Antelope Valley Station (AVS) 345-kV Substation, existing Charlie Creek 345-kV Substation, proposed Judson 345-kV Substation, and proposed Neset 345-kV Substation is to identify potential constraints (natural or human resources that may not be compatible with the location of new transmission line facilities) and opportunities (locations or areas well-suited for the location of new transmission line facilities) within the identified macro-corridor alternatives to consider when developing route corridors. Resource data was collected and areas of opportunity, avoidance, and exclusion were identified within the macro-corridors. A detailed discussion of identified resource data, and the opportunities and constraints they present, is provided in the following sections.

5.2 RESOURCE DATA COLLECTION

Readily-available resource data within the study area was collected from resource management agencies, state and local governments, utility companies, and other publicly available sources. This data was used to prepare Geographic Information System (GIS) resource maps and included the following resource categories:

- Land Use and Jurisdiction;
- Existing Transportation and Utility Corridors;
- Geology and Soils;
- Water Resources;
- Cultural Resources; and
- Biological Resources

The resource data was mapped in GIS format and combined with aerial photography to validate resources within the identified macro-corridors. As described below, each environmental resource was categorized as an opportunity (suitable area), an avoidance area, or an exclusion area in the GIS opportunities and constraints inventory. The following sections describe in more detail each set of resource data that was collected as part of this inventory.

5.3 OPPORTUNITIES AND CONSTRAINTS

An opportunities and constraints inventory was developed based on resources and characteristics found within the macro-corridors that would provide desirable or undesirable attributes for the development of

route corridors within the macro-corridors. The opportunities and constraints inventory used criteria developed for resources found within the macro-corridors that provided either favorable or unfavorable attributes for the location of a proposed transmission line. The criteria classifications include opportunity, avoidance, and exclusion areas associated with each selected resource. Table 5-1 lists the opportunity and constraint criteria that were developed for the Project.

Table 5-1: Project Opportunity and Constraint Criteria

Resource	Opportunity Area (Optimize Use for Routing)	Avoidance Area (Minimize Use for Routing)	Exclusion Area (Exclude When Possible)
Land Use and Jurisdiction			
Zoning/Land Use	Rangeland or agriculture; industrial or commercial	Designated prime and unique farmlands	Incorporated and unincorporated municipal boundaries, pivot irrigation
Residential Areas	--	Within 500 feet of occupied residence or other occupied building, subdivisions	Within 100 feet of occupied buildings/residences, subdivisions
Airports	--	--	Within 5,000 feet of a public airport and 2,500 feet of a private airport
Jurisdiction	--	Corps of Engineers property, state lands	Within boundary of formally designated state lands (conservation areas, state parks, SWAs, etc.) and federal conservation areas, wilderness areas, national parks/landmarks/monuments
Communication Towers/Radio Towers	--	Within 150 feet of FCC-registered structure	transmission line 150-foot right-of-way
Oil and gas wells	--	--	transmission line 150-foot right-of-way
Public Schools, Cemeteries, Churches, Parks and Recreation Areas	--	Within ¼ mile	transmission line 150-foot right-of-way
Existing Transportation and Utility Corridors			
Roads (interstate, state, county)	Within 500 feet	--	--
Railroads	--	--	right-of-way of railroad
Transmission Lines	Within 0.50-mile of existing transmission line (230-kV, 115-kV)	--	right-of-way of existing transmission line
Natural Gas Pipelines	--	Within 500 feet	Pipeline right-of-way

Resource	Opportunity Area (Optimize Use for Routing)	Avoidance Area (Minimize Use for Routing)	Exclusion Area (Exclude When Possible)
Geology and Soils			
Slope	Less than 10%	--	--
Geological Hazards	--	Moderate	Severe hazards/Undermined areas
Buried mineral resources	--	Areas of concentrated mineral resources	--
Soils	--	soil types characterized as highly erodible	--
Water Resources			
Wetlands	--	Within wetland boundary (structure only)	--
100-year Floodplain	--	Within floodplain boundary	--
Cultural Resources			
National Registered Historic Places, Landmarks and Monuments, archaeological sites	--	Within boundary of known archaeological site	Within 1/8 mile of NRHP site (structure only)
Biological Resources			
Big Game (elk, mule deer, bighorn sheep, mountain goat, and pronghorn)	--	Within concentration and winter concentration areas, severe winter range, production areas	--
Sensitive Vegetation Communities	--	Riparian Communities or designated sensitive plant communities	Federally threatened or endangered plants-designated critical habitat
Waterfowl/wading birds	--	Concentration areas, wintering habitat	--
Threatened and Endangered Species	--	--	Within areas of documented occurrences (including active nesting, denning, burrow, or lek sites). Exclusion area will vary depending on the species.

Opportunity areas are those areas that are conducive to, or compatible with, transmission lines. Opportunity areas are generally associated with undeveloped areas, areas containing existing utility or transmission corridors, other linear infrastructure (roads, railroads, non-natural gas pipelines), or industrial areas.

Avoidance areas are sensitive areas that are likely to incur adverse environmental impacts or result in land use conflicts if directly affected by a transmission line or associated right-of-way. Avoiding these areas is preferable if there are opportunities available elsewhere for the location of a transmission line. If such an area cannot be completely avoided, impacts can be minimized through route adjustments, careful placement of the transmission structures and access roads, spanning of the sensitive resource, seasonal restrictions on construction activities, and other mitigation measures.

Exclusion areas include highly-sensitive locations, including those with regulatory or legislative designations or extreme physical constraints resulting in limited compatibility with transmission line construction and/or operation. Locating a transmission line in these areas is not recommended and could result in increased environmental impacts, significantly higher costs, and/or additional regulatory approvals.

Figure 5-1 illustrates those areas identified as opportunities, avoidance areas, and exclusion areas based on the opportunities and constraints criteria and resource data gathered. Although avoidance and exclusion areas do appear within all of the macro-corridors, it appears that sufficient space is available for the development of several alternative route corridors within the macro-corridors. The following sections describe each of the opportunities and constraints criteria in greater detail.

5.3.1 Land Use and Jurisdiction

5.3.1.1 Land Use and Land Cover

Land use and land cover data were obtained from the U.S. Geological Survey (USGS) National Land Cover Dataset (2001). Land cover describes the general categories and distribution of land uses and land cover types within the macro-corridors (Figure 5-2). Cropland and pasture, grassland, and shrub/scrub constitute the majority of the land cover within the macro-corridors. These cover types typically provide good routing opportunities for transmission lines. Several smaller areas of woodland and irrigated land also occur within the macro-corridors.

5.3.1.2 Jurisdiction

Jurisdiction and land ownership within the macro-corridors is shown in Figure 5-4. Killdeer, Watford City, Arnegard, Epping and Ray are the only communities whose municipal boundaries are located within the macro-corridors, although the communities of Williston and Tioga are just outside the macro-corridor boundaries. Data on land ownership were obtained from the North Dakota Geographic Information System (GIS) (2011). Land ownership and jurisdiction within the macro-corridors include the Bureau of Land Management (BLM), State of North Dakota, U.S. Army Corps of Engineers (USACE), United

States Forest Service (USFS), U.S. Fish & Wildlife Service (USFWS), U.S. National Park Service (NPS) and private land. Many of these private lands contain easements under the Conservation Reserve Program (CRP), Wetland Reserve Program (WRP), or other conservation-type easements administered through the USFWS or the U.S. Department of Agriculture (USDA). Additionally, these lands may contain oil or gas wells, and these have been designated as exclusion areas, meaning that these wells should not be within the transmission line right-of-way. Areas within town boundaries, BLM lands, and the boundaries of state or Federally-owned parks or areas were designated as exclusion areas. Boundaries of pivot-irrigation systems were also designated as exclusion areas.

5.3.1.3 Residences and Residential Areas

Individual residences and farmsteads have been identified using photo-interpretation to show residential development patterns within the macro-corridors. Residences and farmsteads are located throughout the macro-corridors, as shown in Figure 5-5. These residences have not been field-verified; they have been preliminarily identified through a desktop survey with the use of aerial mapping of the study area. For the opportunities and constraints inventory, areas within 100 feet of a residence or farmstead were designated as exclusion areas and areas within 500 feet of a residence or farmstead are considered avoidance areas whenever possible.

5.3.1.4 Census Landmarks

Data on the locations of schools, parks, recreation areas, cemeteries, and other census-identified landmarks were obtained from the U.S. Census Bureau (2010c). There are few census landmarks within the macro-corridors, and these are widely-scattered (Figure 5-6). For the opportunities and constraints inventory, areas within 75 feet of census landmarks were designated as exclusion areas and areas within 1/4-mile of these features were designated as avoidance areas.

5.3.1.5 Communication and Radio Towers

The locations of communication facilities within the macro-corridors were obtained from the Federal Communications Commission (2010). Communication facilities include television transmission towers, microwave towers, AM and FM towers, and cellular telephone towers. These facilities are generally scattered throughout the macro-corridors and are also shown in Figure 5-6. For the opportunities and constraints inventory, areas within 150 feet of a tower's guy wire ground anchors were designated as avoidance areas, and exclusion areas were designated as being within 75 feet of the tower, or within the transmission right-of-way.

5.3.1.6 Airports

Data on airports within the macro-corridors were obtained from the National Flight Data Center (FAA, 2011) and North Dakota GIS (2011). There are five private airstrips and two public airports located within the boundary of the macro-corridors. The Tioga Municipal Airport is located in the town of Tioga in the northeast corner of macro-corridor segment G. Weydahl Field is located northwest of the community of Killdeer in macro-corridor segment C. The Sloulin Field International Airport is located in the community of Williston, which lies just outside of the macro-corridors. Watford City Municipal Airport is located very near, but outside of, the macro-corridor boundary within the community of Watford City. For the opportunities and constraints analysis, areas within 2,500 feet of a private airport and 5,000 feet of a public airport were designated as exclusion areas. Public and private airports within the macro-corridors are shown on Figure 5-7.

5.3.2 Existing Transportation and Utility Corridors

Existing linear facilities and associated rights-of-way often provide good opportunities for routing transmission lines. For the Project, roads, railroads, transmission lines, and non-natural gas pipelines were identified and mapped as potential opportunities (Figure 5-7). This data was obtained from the North Dakota GIS and Basin Electric (2011).

Locating a transmission line along linear features may result in fewer environmental impacts because of the previous disturbance from construction and relatively easy access to the existing right-of-way. However, locating along these facilities can be difficult due to development around and adjacent to these lines. Following existing infrastructure can also limit flexibility to avoid resources along the existing infrastructure. A general description of these linear features is presented in the following sections.

5.3.2.1 Major Roads and Scenic Byways

Several opportunities are available for using existing roadways within the macro-corridors (Figure 5-7). U.S. Highway 85 south and north of Williston, along with U.S. Highway 2 from Williston to near the existing Neset 230-kV Substation, provide opportunities for transmission line location. Areas within 500 feet of a roadway were designated as opportunity areas.

The Killdeer Mountain Four Bears Scenic Byway is designated as a state scenic byway. This byway is part of State Highway 22 that traverses north and south through the town of Killdeer in Dunn County (macro-corridor segments A and B). Theodore Roosevelt National Park North Unit Scenic Byway is also designated as a state scenic byway located within macro-corridor segment D within Theodore Roosevelt National Park in McKenzie County, adjacent to U.S. Highway 85 as it passes through the park. These

sections of roadway were not considered as opportunities for routing due to their special designation in these areas. Instead, they were considered as avoidance areas.

5.3.2.2 Railroad Rights-of-Way

There are two active Burlington Northern Santa Fe (BNSF) rail lines occurring within the macro-corridors (see Figure 5-7). One of these lines runs generally southwest to northeast across macro-corridor segment F, passing through the towns of Williston and Tioga. Another BNSF line extends from the eastern edge of macro-corridor segment A and terminates a short distance away at the Antelope Valley Station northwest of the town of Beulah. There is also a section of abandoned railroad northeast of the community of Killdeer, just inside macro-corridor segment A. For the purpose of the opportunities and constraints inventory, exclusion areas were determined to include the right-of-way of an active railroad.

5.3.3 Transmission Lines

Existing transmission lines may provide opportunities for routing the proposed transmission line adjacent to an existing right-of-way. Paralleling the rights-of-way of existing transmission lines could potentially reduce environmental impacts associated with construction, operation, and maintenance of the proposed transmission line and is considered good routing practice by confining linear facilities to common corridors. However, it is not practicable for this Project to parallel existing high-voltage transmission lines (above 230-kV) for reasons of system reliability unless where multiple lines greater than 230-kV merge at common points such as the AVS and Charlie Creek substations. For the Project, Basin has indicated opportunities for placing the proposed transmission line adjacent to an existing line are limited to within 0.50 mile of existing 230-kV or lower voltage transmission lines to preserve system reliability.

Existing transmission lines within the macro-corridors are shown in Figure 5-7. Large areas within the macro-corridors are void of any high-voltage transmission lines, although distribution lines are found throughout the macro-corridors. There are two Basin Electric 345-kV transmission lines extending from the AVS Substation in the extreme eastern part of macro-corridor segment A. A Western 115-kV line, which is to be upgraded in 2012 to 230-kV, enters macro-corridor segments B and D south of Williston and generally parallels U.S. Highway 85 to the south until terminating at the existing Charlie Creek 345-kV Substation. An MDU 115-kV and Basin Electric 230-kV line extend from the existing Williston 230-kV Substation through a portion of macro-corridor segment F before connecting at the existing Neset 230-kV Substation. These lines provide some opportunities to be paralleled by the proposed project, but they do not extend in the direction necessary for this project for long distances.

5.3.4 Geology and Soils

Primary geologic hazards identified within the macro-corridors are landslide hazards. Areas along the Little Missouri River, Missouri River, and Lake Sakakawea all contain areas of steep terrain that could pose problems during the construction of a transmission line. For the opportunities and constraints inventory, areas of moderate landslide hazard have been classified as avoidance areas, while areas of high landslide hazard have been classified as exclusion areas. Areas with little or no slope are ideal for the routing of transmission lines, and areas where the slope is less than 10 percent are considered as areas of opportunity (Figure 5-8). Percent-slope was gathered using the USGS National Elevation Dataset 30-meter Digital Elevation Model (2011a).

Areas of prime farmland and farmland of statewide importance are also found throughout the macro-corridors (Figure 5-9). These prime and unique farmlands have been determined as avoidance areas for the opportunities and constraints analysis. Farmland soil data was obtained through the Natural Resource Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) database (2011). Additionally, areas within the macro-corridors containing concentrated mineral resources, or with soil types characterized as highly-erodible, have been designated as avoidance areas.

5.3.5 Water Resources

Wetlands and surface water features within the macro-corridors are shown in Figure 5-8. National Wetlands Inventory (NWI) data was used to determine locations of wetland areas within the macro-corridors (USFWS, 2011). Wetland areas not associated with the Little Missouri River or Missouri River are widely scattered within the macro-corridors, and generally consist of small pothole-type wetland areas.

For the opportunities and constraints inventory, wetland boundaries were designated as avoidance areas, meaning that transmission structures would not be placed within any wetland boundary if possible. Designated floodplain areas are also designated as avoidance areas for the Project, although these areas are generally small and occur immediately adjacent to rivers and streams. In most cases, wetlands, streams and floodplains could be easily spanned by the Project. Although these resources may occur within the right-of-way, structures could be located outside these areas.

5.3.6 Cultural Resources

There are two known National Register of Historic Places (NRHP) sites within the macro-corridors (see Figure 5-5). The Ray Opera House is located within the community of Ray in the northern portion of macro-corridor segment F. The Grassy Butte Post Office is located in Grassy Butte in the western portion

of macro-corridor segment C. These protected structures have a designated exclusion area of 1/8-mile for the opportunities and constraints inventory. The Killdeer Mountain Battlefield State Historic Site is located within macro-corridor segment C, approximately eight miles northwest of the community of Killdeer in Dunn County. Avoidance areas have also been designated to include the boundaries of any known or encountered archaeological sites. Data was obtained from the NPS NRHP database (2011).

5.3.7 Biological Resources

The macro-corridors contain areas of suitable habitat for many different species of wildlife and vegetation, including Federally-listed threatened and endangered species. The land cover types present within the macro-corridors are shown in Figure 5-2. Figure 5-3 shows important habitat areas for Federally-listed threatened and endangered species, including piping plover critical habitat, least tern and pallid sturgeon habitat, and whooping crane migration corridor. For the opportunities and constraints inventory, those areas suitable as winter concentration areas and production areas for big game species such as elk, mule deer, and bighorn sheep are designated as avoidance areas, where possible. Breeding habitat and other concentration areas for waterfowl and wading birds are also designated as avoidance areas within the macro-corridors. Riparian communities and areas designated as sensitive plant communities are designated as avoidance areas as well. Exclusion areas have been designated for Federally-threatened or endangered plant and animal species critical habitat or documented occurrences, or for nesting, denning, or lek sites. Specific areas of avoidance and exclusion will be determined after further field studies within the macro-corridors.

5.4 PUBLIC SCOPING AND STAKEHOLDER INVOLVEMENT

Involvement with the general public and stakeholders within the Project area will be integral to the evaluation of the alternative route corridors within the macro-corridors, and ultimately the selection of a preferred route corridor to be carried forward for a more detailed environmental analysis.

The public involvement process will include public scoping meetings that will occur at the beginning of the formal NEPA process. At these meetings, the macro-corridors and alternative route corridors will be presented to the public for solicitation of input regarding the route corridors. Public input received will help in refining the alternative route corridors as well as determine the appropriate levels of study necessary to address issues of concern.

Stakeholders are those people and organizations that may be affected or have some interest in the Project. Potential stakeholders for this Project include the following:

- Property owners, business owners, or residents within the macro-corridors or route corridors;

- Towns or small communities located within or near the macro-corridors
- State and local elected officials;
- North Dakota Game & Fish Department;
- North Dakota Department of Transportation;
- Native American tribes with interests in the area;
- Bureau of Indian Affairs;
- Bureau of Land Management;
- U.S. Army Corps of Engineers;
- U.S. Forest Service;
- U.S. Fish & Wildlife Service; and
- National Park Service.

Two public scoping meetings are planned within the macro-corridors, one meeting in Williston and the other meeting in Killdeer. Notices advertising the scoping meetings will be published in local newspapers and broadcast on local radio stations prior to the meetings, anticipated to be in mid-November, 2011.

5.5 FIELD RECONNAISSANCE AND IDENTIFICATION OF CORRIDOR-SPECIFIC CONSTRAINTS

Initial field reconnaissance of the study area occurred during the spring and summer of 2011, as part of developing the macro-corridors. Field reconnaissance will be used to ground-truth collected data, and will also be used to identify additional corridor-specific constraints not previously discovered. Field observations may include determining the extent of floodplains and wetlands, verification of threatened or endangered species habitat, verification of occupied residences within the route corridors, and identifying other visible constraints that could influence routing decisions. The results of the field reconnaissance will be used to further develop the route corridors and to provide relevant data for comparison between corridors.

5.6 ROUTE CORRIDOR DEVELOPMENT AND COMPARATIVE ANALYSIS

The opportunities and constraints inventory was used to identify those areas within the identified macro-corridors that may be suitable for the location of a transmission line, and also those areas that are not suitable for the location of a transmission line. Focusing on these suitable areas, specific alternative route corridors will be developed, attempting to minimize avoidance and exclusion areas within the route corridor. A comparative analysis between alternative route corridors will involve assessing the environmental consequences that are expected as a result of implementation of the Project. Issues and

additional constraints or opportunities identified during this comparison, along with information from the public and resource agencies, may determine which alternative route corridors need to be adjusted or eliminated. The comparative analysis between alternative route corridors is meant to quantify impacts associated with each corridor, and to ultimately select a route corridor that maximizes opportunities, minimizes constraints and resource impacts, and is suitable for transmission line construction, operation, and maintenance.

* * * * *

McLean County

McKenzie County

Dunn County

Billings County

Mercer County

Missouri River

Knife River

Charlie Creek

Killdeer

Dunn Center

Halliday

Dodge

Golden Valley

Zap

Beulah

Antelope Valley Station

22

85

1806

8

200

NORTH

4.5 2.25 0 4.5

Miles

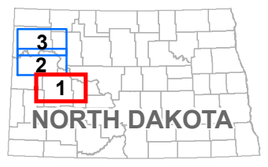
LEGEND

- Project Study Area
- Existing Substation
- Existing 115-kV & 230-kV Transmission Lines
- Existing 345-kV Transmission Lines
- Municipal Boundary
- County Boundary
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Public Airport
- Private Airport

Opportunities and Constraints

- Higher Opportunity Area
- Lower Opportunity Area
- Avoidance Area
- Exclusion Area

Map Sheet Index



Burns & McDonnell
SINCE 1898

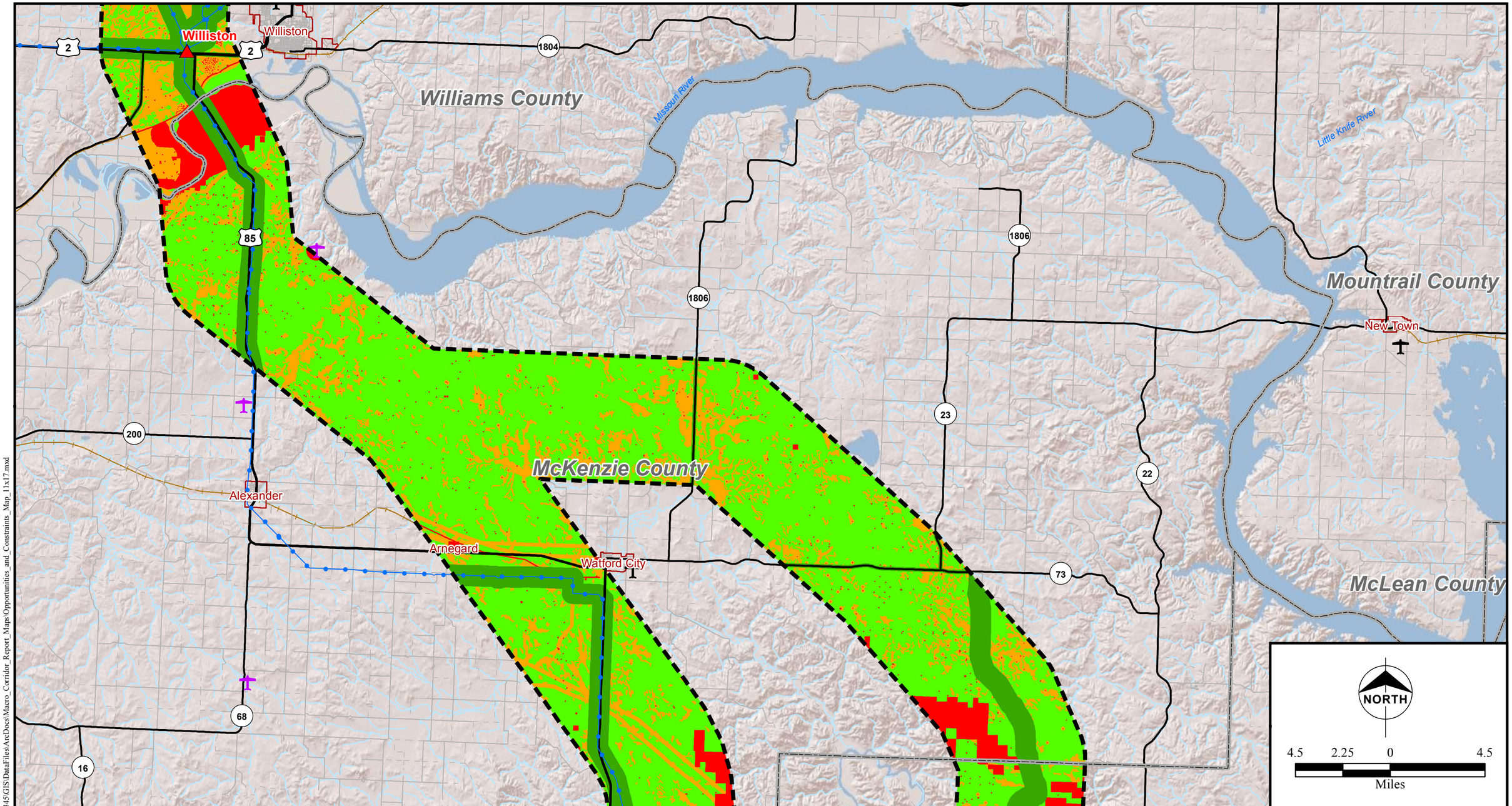
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-1
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Opportunities and Constraints
Sheet 1 of 3

Source: North Dakota GIS, Esri, National Flight Data Center, USDA, USGS, USFWS, FCC, FEMA, US Census, Basin Electric, Burns & McDonnell.

Revised October 25, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Opportunities_and_Constraints_Map_11x17.mxd



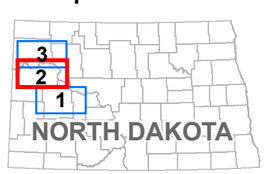
LEGEND

- Project Study Area
- Existing Substation
- Existing 115-kV & 230-kV Transmission Lines
- Existing 345-kV Transmission Lines
- Municipal Boundary
- County Boundary
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Public Airport
- Private Airport

Opportunities and Constraints

- Higher Opportunity Area
- Lower Opportunity Area
- Avoidance Area
- Exclusion Area

Map Sheet Index



Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-1
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Opportunities and Constraints
Sheet 2 of 3

Source: North Dakota GIS, Esri, National Flight Data Center, USDA, USGS, USFWS, FCC, FEMA, US Census, Basin Electric, Burns & McDonnell.

Revised October 25, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Opportunities_and_Constraints_Map_11x17.mxd

Burke County

Williams County

McKenzie County

McKenzie County

Mountrail County

Neset

Tioga

White Earth

Ray

Epping

Spring Brook

Williston

Williston

Stanley

Little Muddy River

Missouri River

85

2

40

8

1804

1806

1806

NORTH

4.5 2.25 0 4.5

Miles

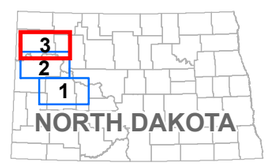
LEGEND

- Project Study Area
- Existing Substation
- Existing 115-kV & 230-kV Transmission Lines
- Existing 345-kV Transmission Lines
- Municipal Boundary
- County Boundary
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Public Airport
- Private Airport

Opportunities and Constraints

- Higher Opportunity Area
- Lower Opportunity Area
- Avoidance Area
- Exclusion Area

Map Sheet Index



Burns & McDonnell
SINCE 1898

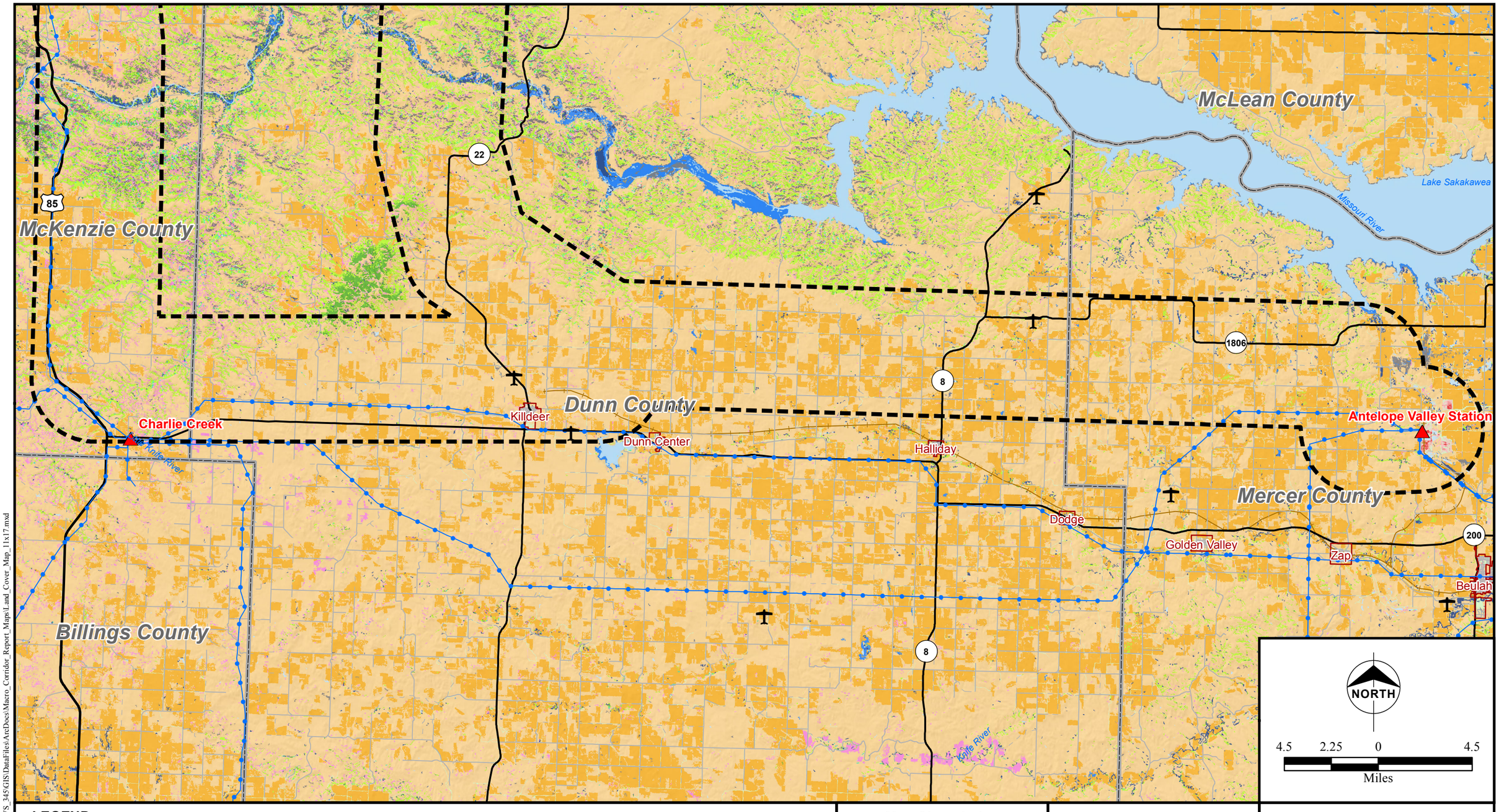
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-1
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Opportunities and Constraints
Sheet 3 of 3

Source: North Dakota GIS, Esri, National Flight Data Center, USDA, USGS, USFWS, FCC, FEMA, US Census, Basin Electric, Burns & McDonnell.

Revised October 25, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Maero_Corridor_Report_Maps\Opportunities_and_Constraints_Map_11x17.mxd



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Land Cover

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland
- Cropland and Pasture
- Forested Wetlands
- Non-Forested Wetlands

Map Sheet Index

Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-2
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Land Cover
Sheet 1 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Land_Cover_Map_11x17.mxd

Source: North Dakota GIS, Esri, National Flight Data Center, USGS National Land Cover; Basin Electric, Burns & McDonnell.

Revised October 25, 2011

Williston
Williston
Williams County
Missouri River
Lake Sakakawea
Little Knife River
Mountrail County
New Town
McKenzie County
Alexander
Arnegard
Watford City
McLean County
2
2
1804
85
1806
1806
23
22
200
73
68
16

NORTH

4.5 2.25 0 4.5

Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Land Cover

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland
- Cropland and Pasture
- Forested Wetlands
- Non-Forested Wetlands

Map Sheet Index

3
2
1
NORTH DAKOTA

Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-2
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Land Cover
Sheet 2 of 3

Source: North Dakota GIS, Esri, National Flight Data Center, USGS National Land Cover; Basin Electric, Burns & McDonnell.

Revised October 25, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Land_Cover_Map_11x17.mxd

Burke County

Williams County

McKenzie County

McKenzie County

Mountrail County

Neset

Tioga

White Earth

Ray

Epping

Spring Brook

Williston

Williston

Stanley

Lake Sakakawea

Missouri River

85

40

8

2

2

1804

85

1806

1806

NORTH

4.5 2.25 0 4.5

Miles

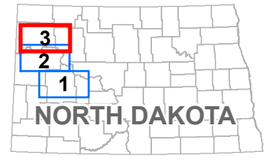
LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Land Cover

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland
- Cropland and Pasture
- Forested Wetlands
- Non-Forested Wetlands

Map Sheet Index



Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-2
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Land Cover
Sheet 3 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Land_Cover_Map_11x17.mxd

Source: North Dakota GIS, Esri, National Flight Data Center, USGS National Land Cover; Basin Electric, Burns & McDonnell.

Revised October 25, 2011

NORTH

0 11

Miles

Neset
Tioga
White Earth
Ray
Epping
Spring Brook
Williams
Williston
Williston
Lewis and Clark State Park
Fort Union Trading Post
Alexander
Arnegard
Watford City
McKenzie
Theodore Roosevelt National Park
Little Missouri State Park
Dunn
Charlie Creek
Killdeer
Dunn Center
Halliday
Golden Valley
Billings
Mountrail
New Town
Parshall
Plaza
Fort Berthold
Ross
Stanley
Palermo
Donnybrook
Renville
Carpio
Berthold
Burlington
Des Lacs
Minot
McHenry
Ward
Makoti
Ryder
Douglas
Max
McLean
Garrison
Fort Stevenson State Park
Pick City
Riverdale
Antelope Valley Station
Knife River Indian Villages NH
Stanton
Mercer
Dodge
Golden Valley
Zap
Beulah
Hazen
Oliver
North Dakota

LEGEND

- Selected Macro Corridors
- Substation
- Army Corps of Engineers
- National or State Park
- National Wildlife Refuge
- National Grassland
- Tribal Lands
- BLM Lands
- State Boundary
- County Boundary
- Municipal Areas
- Railroad

Existing Transmission Lines

- 345-kV
- 230-kV and Below

- Piping Plover Critical Habitat
- Whooping Crane Migration Corridor in North Dakota
- Interior Least Tern Habitat
- Pallid Sturgeon Habitat

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-3
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Important Threatened and Endangered Species Habitat

Source: North Dakota GIS; USFWS Map; Esri; Basin Electric; Burns & McDonnell.

Revised October 27, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Important_T_and_E_Species_Habitats_Map_11x17.mxd 10/27/2011

Theodore Roosevelt

McLean County

Fort Berthold

Lake Sakakawea

Missouri River

McKenzie County

Dunn County

Killdeer

Charlie Creek

Little Knife River

Dunn Center

Halliday

Antelope Valley Station

Mercer County

Dodge

Golden Valley

Zap

Beulah

Billings County

Knife River

22

85

1806

8

200

NORTH

4.5 2.25 0 4.5

Miles

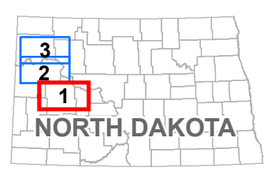
LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- Airport
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Municipal Boundary
- County Boundary
- Gas Plants
- Oil Rigs
- Oil Wells

Jurisdiction

- North Dakota - State Lands
- SLD - State-Owned School Lands
- BIA - Indian Reservation
- DOD - Army Corps of Engineers
- USFS - National Grassland
- NPS - National Park
- BLM - Public Lands
- USFWS - National Wildlife Refuge
- USFWS - Waterfowl Production Areas

Map Sheet Index



Burns & McDonnell
SINCE 1898

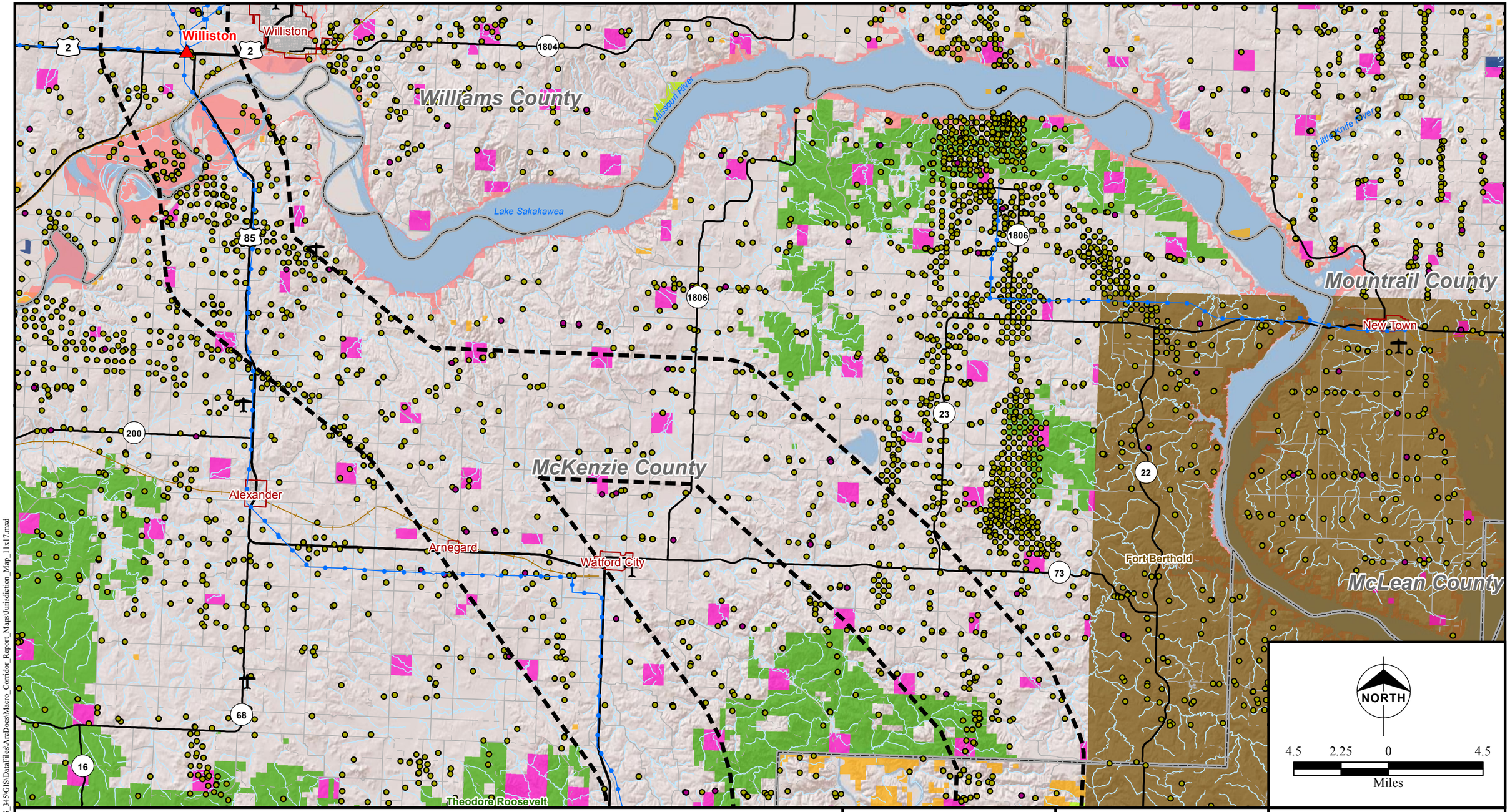
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-4
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Jurisdiction
Sheet 1 of 3

Source: North Dakota GIS; North Dakota State Land Department; Esri; National Flight Data Center; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Jurisdiction_Map_11x17.mxd



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- Airport
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Municipal Boundary
- County Boundary
- Gas Plants
- Oil Rigs
- Oil Wells

Jurisdiction

- North Dakota - State Lands
- SLD - State-Owned School Lands
- BIA - Indian Reservation
- DOD - Army Corps of Engineers
- USFS - National Grassland
- NPS - National Park
- BLM - Public Lands
- USFWS - National Wildlife Refuge
- USFWS - Waterfowl Production Areas

Map Sheet Index

Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-4
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Jurisdiction
Sheet 2 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Maero_Corridor_Report_Maps\Jurisdiction_Map_11x17.mxd

Source: North Dakota GIS; North Dakota State Land Department; Esri; National Flight Data Center; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

Burke County

Williams County

Mountrail County

McKenzie County

McKenzie County

Neset

Tioga

White Earth

Ray

Epping

Spring Brook

Williston

Williston

Stanley

Lake Sakakawea

Missouri River

Little Muddy River

85

85

2

2

40

8

1804

1806

1806

NORTH

4.5 2.25 0 4.5

Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- Airport
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Municipal Boundary
- County Boundary
- Gas Plants
- Oil Rigs
- Oil Wells

Jurisdiction

- North Dakota - State Lands
- SLD - State-Owned School Lands
- BIA - Indian Reservation
- DOD - Army Corps of Engineers
- USFS - National Grassland
- NPS - National Park
- BLM - Public Lands
- USFWS - National Wildlife Refuge
- USFWS - Waterfowl Production Areas

Map Sheet Index

3
2
1
NORTH DAKOTA

Burns & McDonnell
SINCE 1898

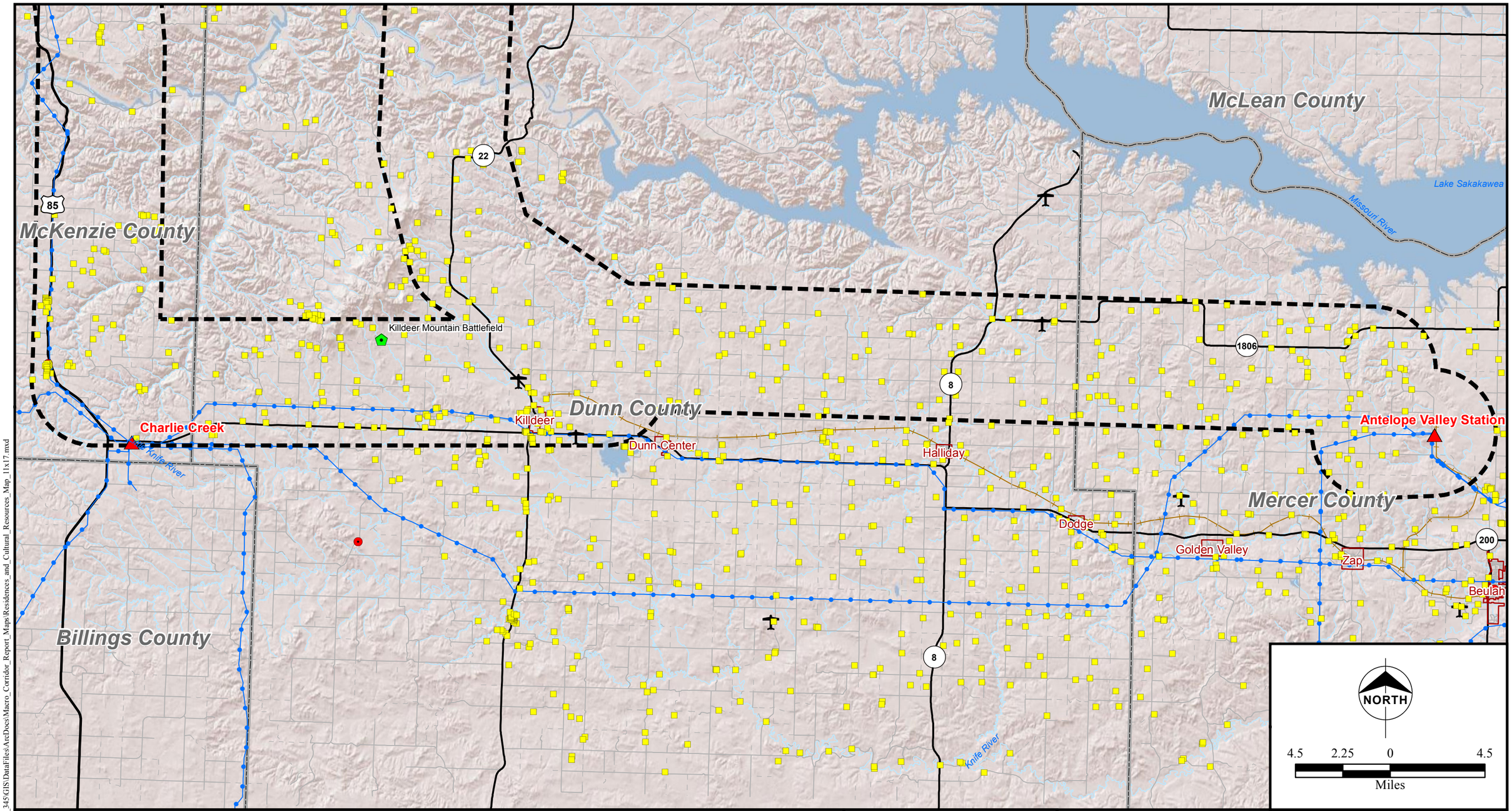
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-4
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Jurisdiction
Sheet 3 of 3

Source: North Dakota GIS; North Dakota State Land Department; Esri; National Flight Data Center; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Jurisdiction_Map_11x17.mxd



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary
- Farmstead/Residence*

* Not field verified.

Cultural Resource

- NRHP Structure
- NRHP Bridge
- State Historical Site

Map Sheet Index

Burns & McDonnell SINCE 1898

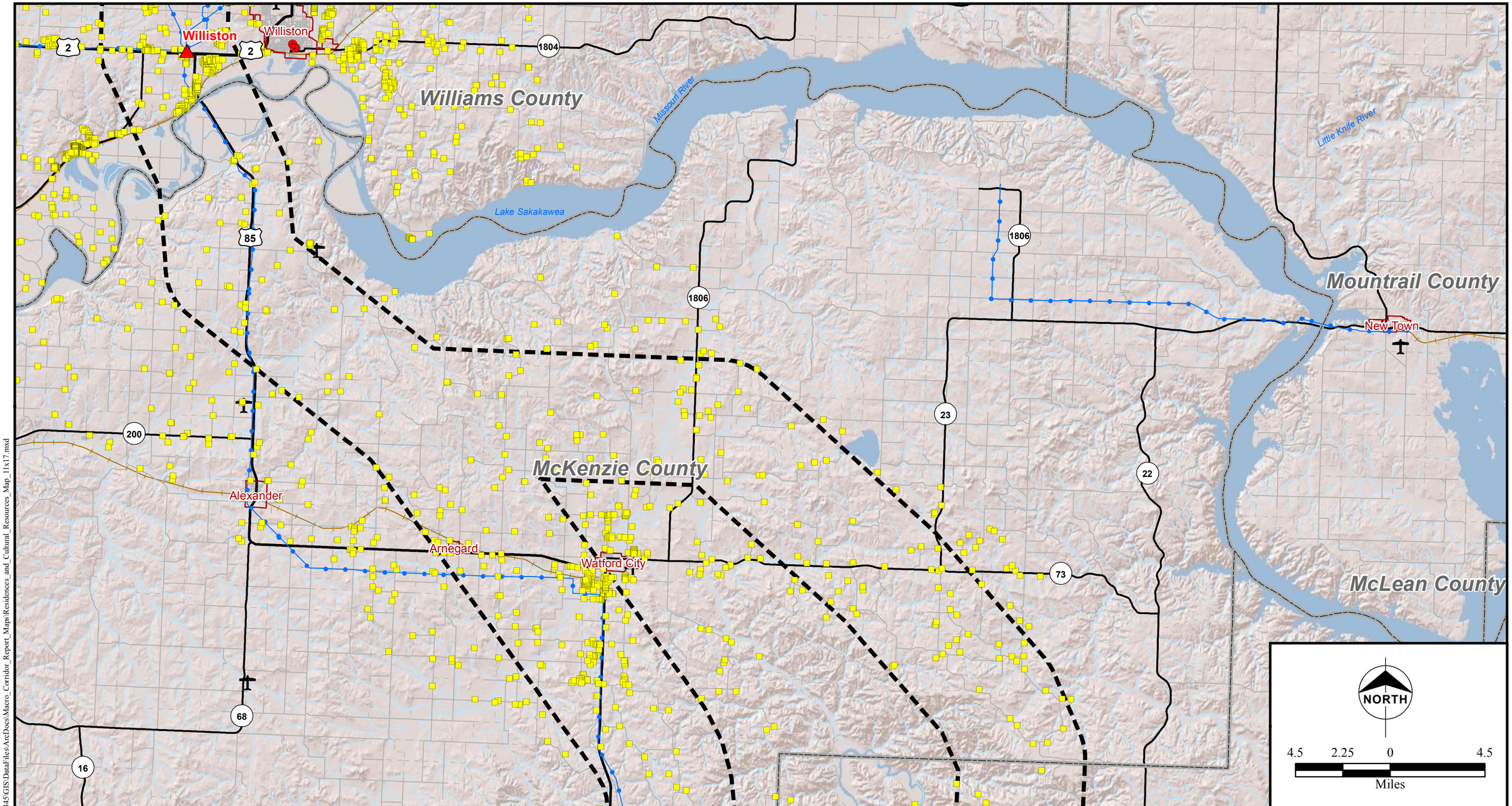
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-5
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Residences & Cultural Resources
Sheet 1 of 3

Source: North Dakota GIS; Esri; National Flight Data Center; NPS NRHP data; North Dakota State Historical Society; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Residences_and_Cultural_Resources_Map_11x17.mxd



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary
- Farmstead/Residence*

* Not field verified.

Cultural Resource

- NRHP Structure
- NRHP Bridge
- State Historical Site

Map Sheet Index

Burns & McDonnell
SINCE 1898

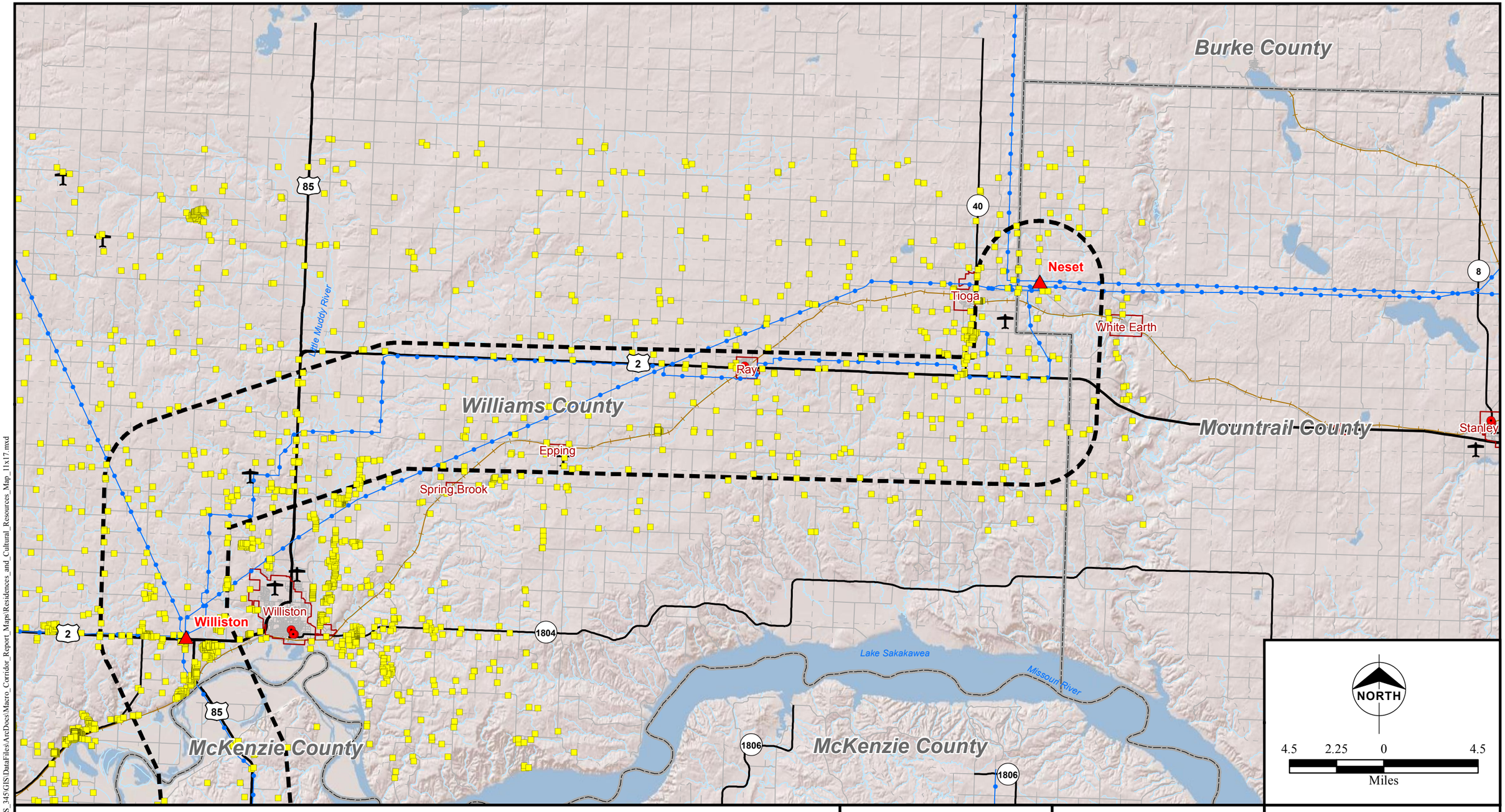
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-5
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Residences & Cultural Resources
Sheet 2 of 3

Source: North Dakota GIS; Esri; National Flight Data Center; NPS NRHP data; North Dakota State Historical Society; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Residences_and_Cultural_Resources_Map_11x17.mxd



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary
- Farmstead/Residence*

* Not field verified.

Cultural Resource

- NRHP Structure
- NRHP Bridge
- State Historical Site

Map Sheet Index

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-5
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Residences & Cultural Resources
Sheet 3 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Residences_and_Cultural_Resources_Map_11x17.mxd

Source: North Dakota GIS; Esri; National Flight Data Center; NPS NRHP data; North Dakota State Historical Society; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

McLean County
McKenzie County
Billings County
Dunn County
Mercer County
Lake Sakakawea
Missouri River
Knife River
Charlie Creek
Killdeer
Dunn Center
Halliday
Dodge
Golden Valley
Zap
Beulah
Antelope Valley Station
22
85
1806
8
200

NORTH
4.5 2.25 0 4.5
Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- Railroad
- Municipal Boundary
- County Boundary

Census Landmarks

- Cemetery
- Hospital/Hospice
- Park
- Place of Worship
- School
- Golf Course
- Landmark Area

Communication Structures

- AM
- FM
- Antenna Structure Registration (ASR)
- BRS/EBS
- Cellular
- Land Mobile - Broadcast
- Land Mobile - Commercial
- Land Mobile - Private
- TV - NTSC
- TV - Digital
- Microwave

Map Sheet Index

Burns & McDonnell
SINCE 1898

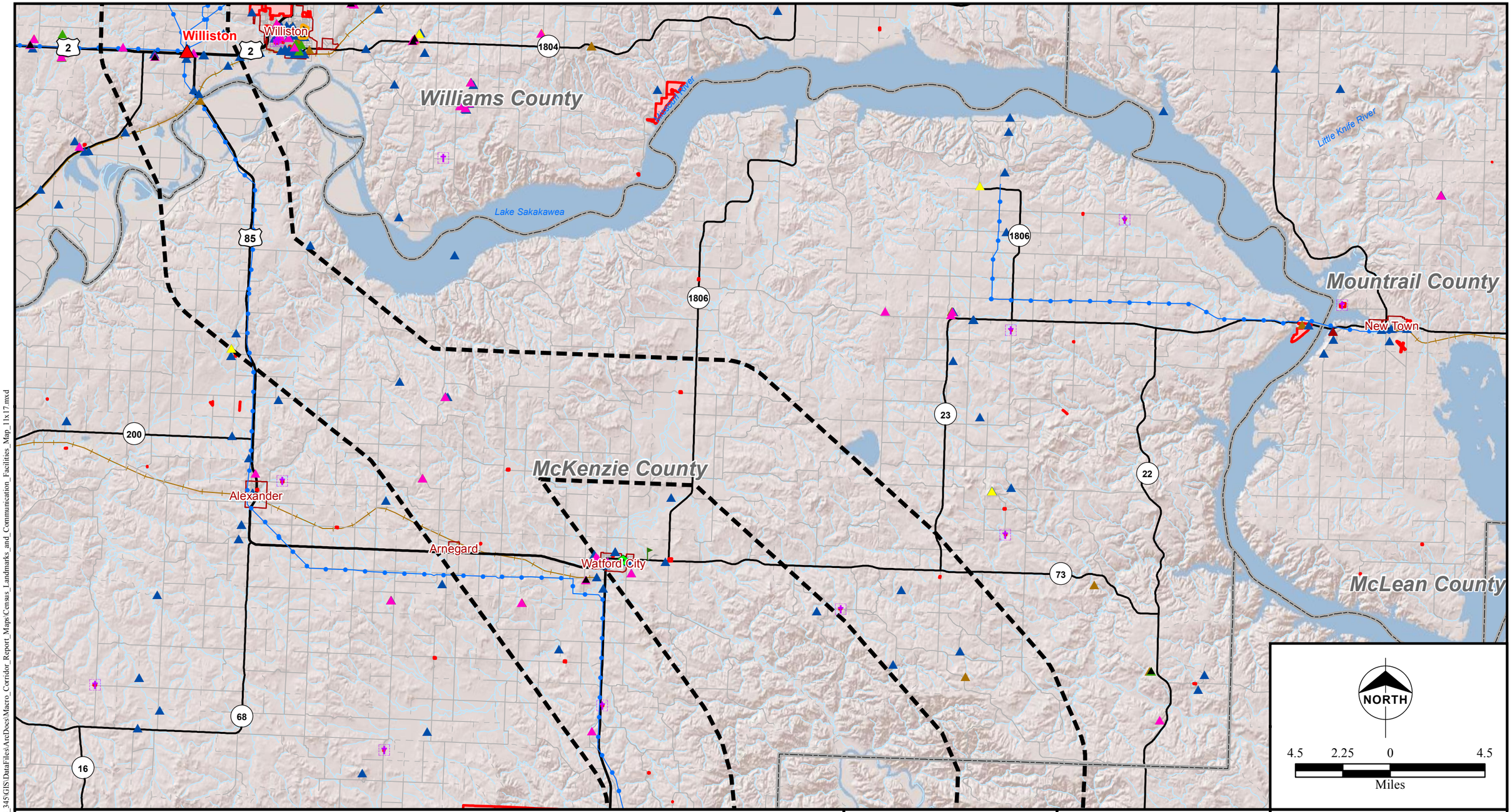
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-6
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Census Landmarks &
Communication Facilities
Sheet 1 of 3

Source: North Dakota GIS; US Census TIGER files; FCC; Esri; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Census_Landmarks_and_Communication_Facilities_Map_11x17.mxd



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- Railroad
- Municipal Boundary
- County Boundary

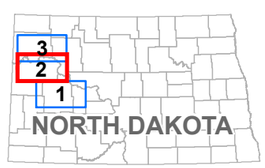
Census Landmarks

- Cemetery
- Hospital/Hospice
- Park
- Place of Worship
- School
- Golf Course
- Landmark Area

Communication Structures

- AM
- FM
- Antenna Structure Registration (ASR)
- BRS/EBS
- Cellular
- Land Mobile - Broadcast
- Land Mobile - Commercial
- Land Mobile - Private
- TV - NTSC
- TV - Digital
- Microwave

Map Sheet Index



Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-6
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Census Landmarks &
Communication Facilities
Sheet 2 of 3

Source: North Dakota GIS; US Census TIGER files; FCC; Esri; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Census_Landmarks_and_Communication_Facilities_Map_11x17.mxd

Burke County

Williams County

Mountrail County

McKenzie County

McKenzie County

Neset

Tioga

White Earth

Ray

Epping

Spring Brook

Stanley

Williston

Williston

Little Muddy River

Lake Sakakawea

Missouri River

85

40

8

2

2

1804

85

1806

1806

NORTH

4.5 2.25 0 4.5

Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- Railroad
- Municipal Boundary
- County Boundary

Census Landmarks

- Cemetery
- Hospital/Hospice
- Park
- Place of Worship
- School
- Golf Course

- Landmark Area

Communication Structures

- AM
- FM
- Antenna Structure Registration (ASR)
- BRS/EBS
- Cellular
- Land Mobile - Broadcast
- Land Mobile - Commercial
- Land Mobile - Private
- TV - NTSC
- TV - Digital
- Microwave

Map Sheet Index

Burns & McDonnell
SINCE 1898

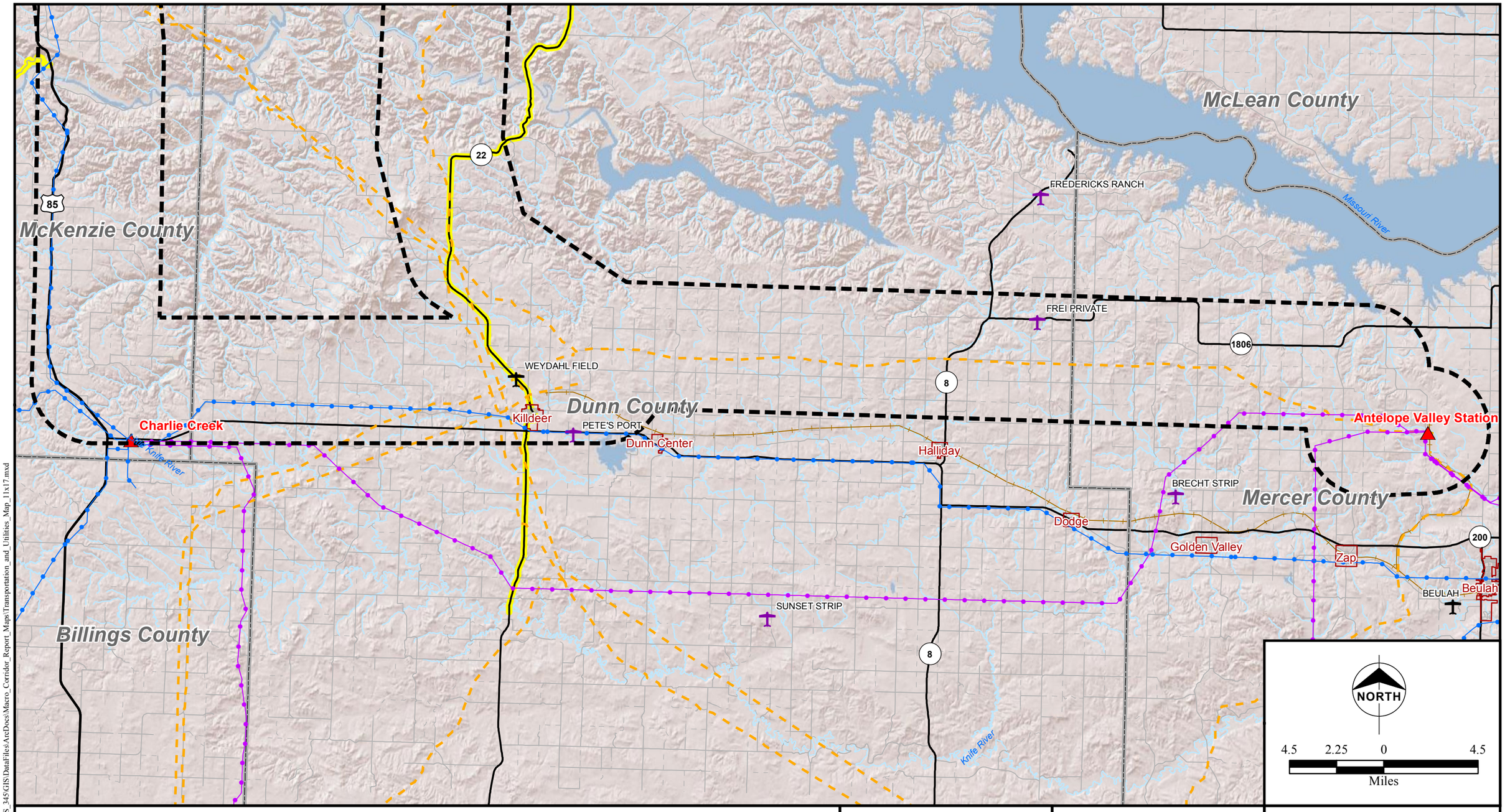
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-6
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Census Landmarks &
Communication Facilities
Sheet 3 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Census_Landmarks_and_Communication_Facilities_M

Source: North Dakota GIS; US Census TIGER files; FCC; Esri; Basin Electric; Burns & McDonnell.

Revised October 26, 2011



LEGEND

- Project Study Area
- Municipal Boundary
- County Boundary

Transportation

- US Highway
- State Highway
- Other Road
- Trail
- Scenic Byway
- Railroad
- Public Airport
- Private Airport

Utility System

- Existing Substation
- Existing 345-kV Transmission Lines
- Existing 230-kV and Below Transmission Lines
- Pipeline

Map Sheet Index

Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-7
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Transportation & Utilities
Sheet 1 of 3

Source: North Dakota GIS, Esri, National Flight Data Center, Basin Electric, Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Transportation_and_Utilities_Map_11x17.mxd

Williston
Williston
2
2
1804
Williams County
Missouri River
Little Knife River
85
LINDVIG AIRSTRIP
1806
1806
Mountrail County
New Town
NEW TOWN MUNI
23
GAJEWSKI FLD
200
McKenzie County
22
Alexander
Arnegard
Watford City
WATFORD CITY MUNI
73
McLean County
CHITWOOD AIRSTRIP
68
16

NORTH

4.5 2.25 0 4.5

Miles

LEGEND

- Project Study Area
- Municipal Boundary
- County Boundary

Transportation

- US Highway
- State Highway
- Other Road
- Trail
- Scenic Byway
- Railroad
- Public Airport
- Private Airport

Utility System

- Existing Substation
- Existing 345-kV Transmission Lines
- Existing 230-kV and Below Transmission Lines
- Pipeline

Map Sheet Index

Burns & McDonnell
SINCE 1898

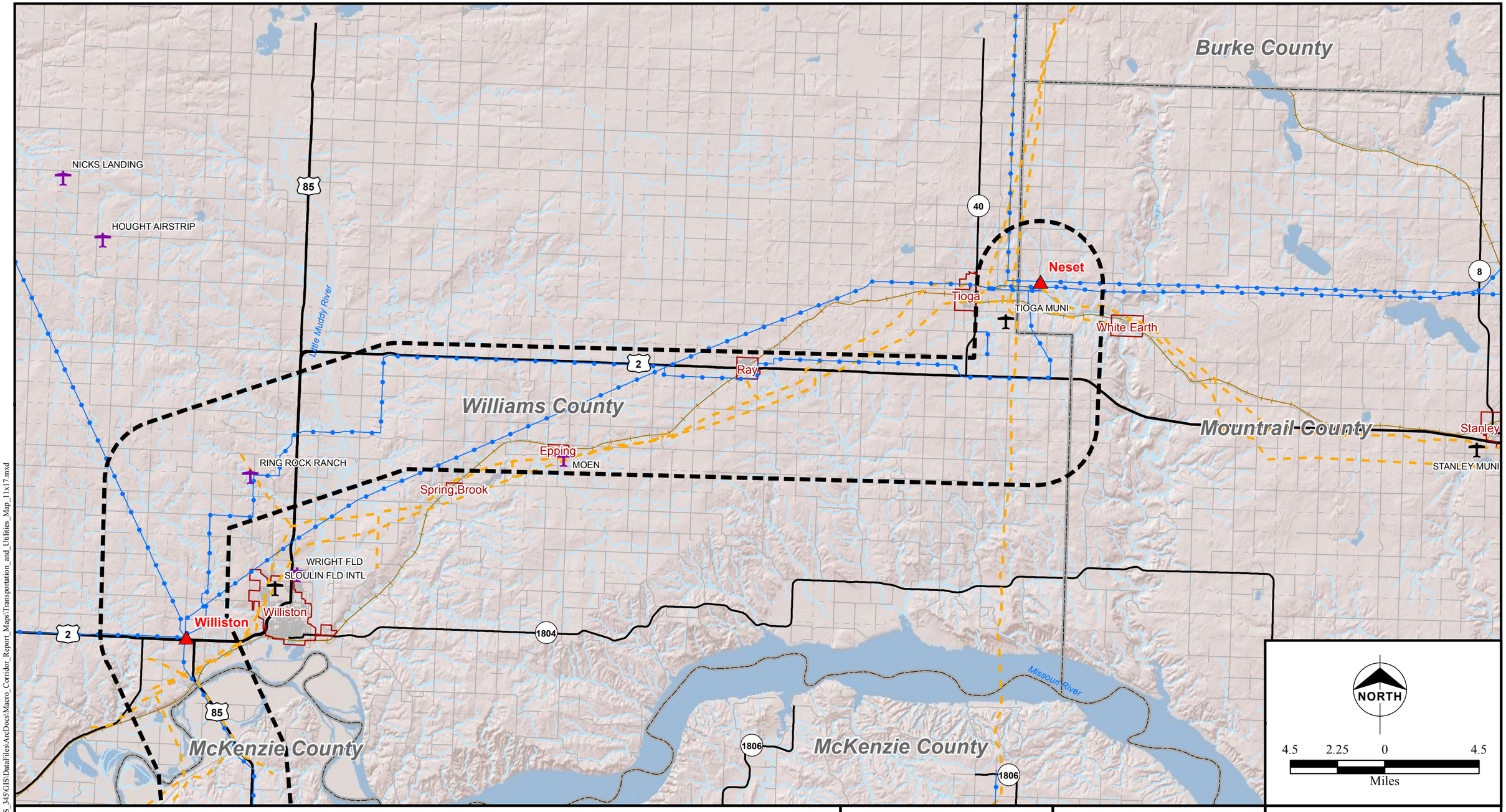
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-7
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Transportation & Utilities
Sheet 2 of 3

Source: North Dakota GIS, Esri, National Flight Data Center, Basin Electric, Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV1\Data\Projects\Basin\61495_AVS_345GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Transportation_and_Utilities_Map_11x17.mxd



LEGEND

- Project Study Area
- Municipal Boundary
- County Boundary

Transportation

- US Highway
- State Highway
- Other Road
- Trail
- Scenic Byway
- Railroad
- Public Airport
- Private Airport

Utility System

- Existing Substation
- Existing 345-kV Transmission Lines
- Existing 230-kV and Below Transmission Lines
- Pipeline

Map Sheet Index

Burns & McDonnell SINCE 1898

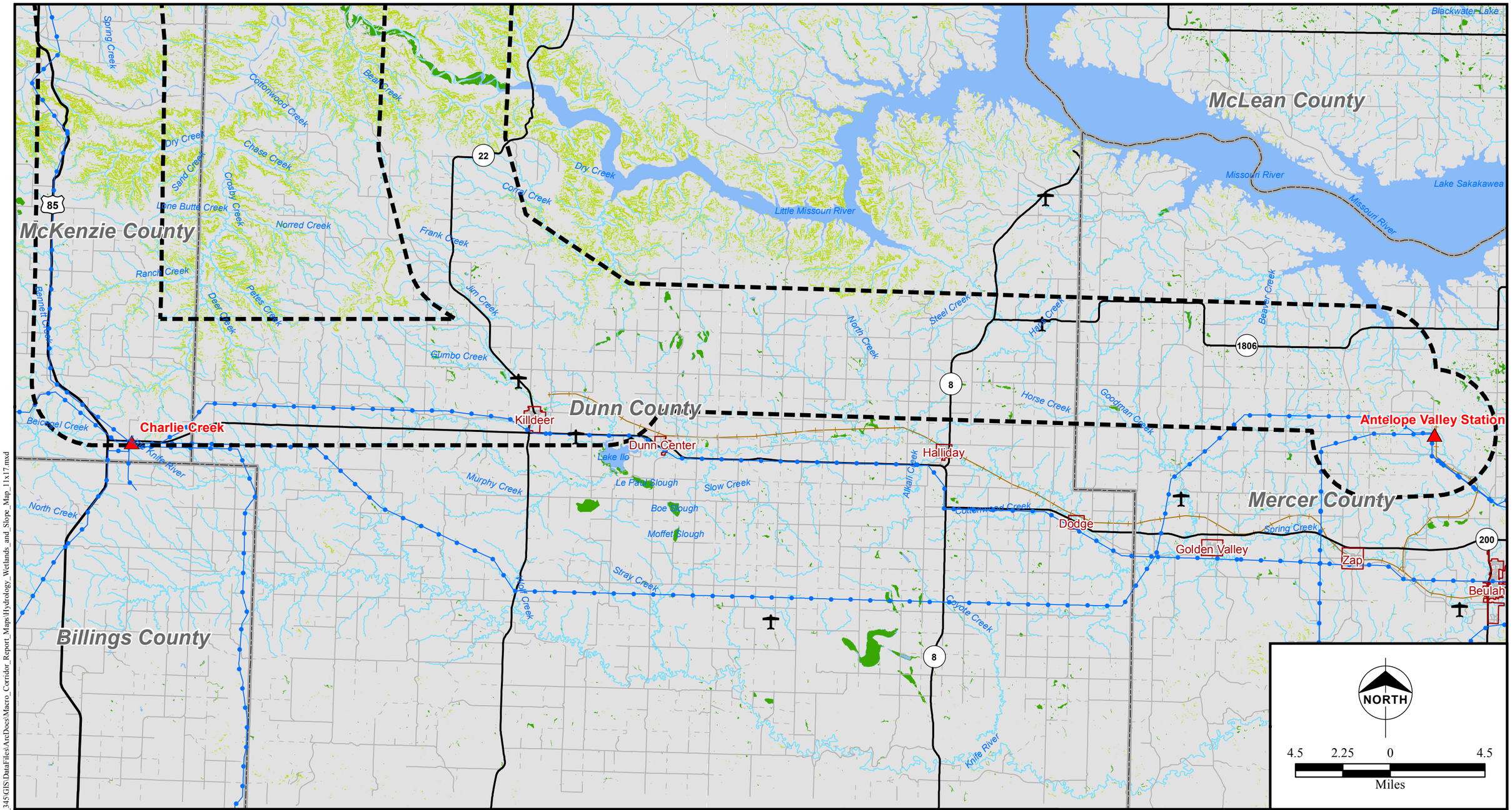
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-7
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Transportation & Utilities
Sheet 3 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Transportation_and_Utilities_Map_11x17.mxd

Source: North Dakota GIS, Esri, National Flight Data Center, Basin Electric, Burns & McDonnell.

Revised October 26, 2011



NORTH

4.5 2.25 0 4.5

Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Hydrology & Wetlands

- Stream/River
- Waterbody
- NWI Wetlands

Percent Slope

- 0 - 10%
- 10 - 20%
- 20 - 30%
- >30%

Map Sheet Index

Burns & McDonnell
SINCE 1898

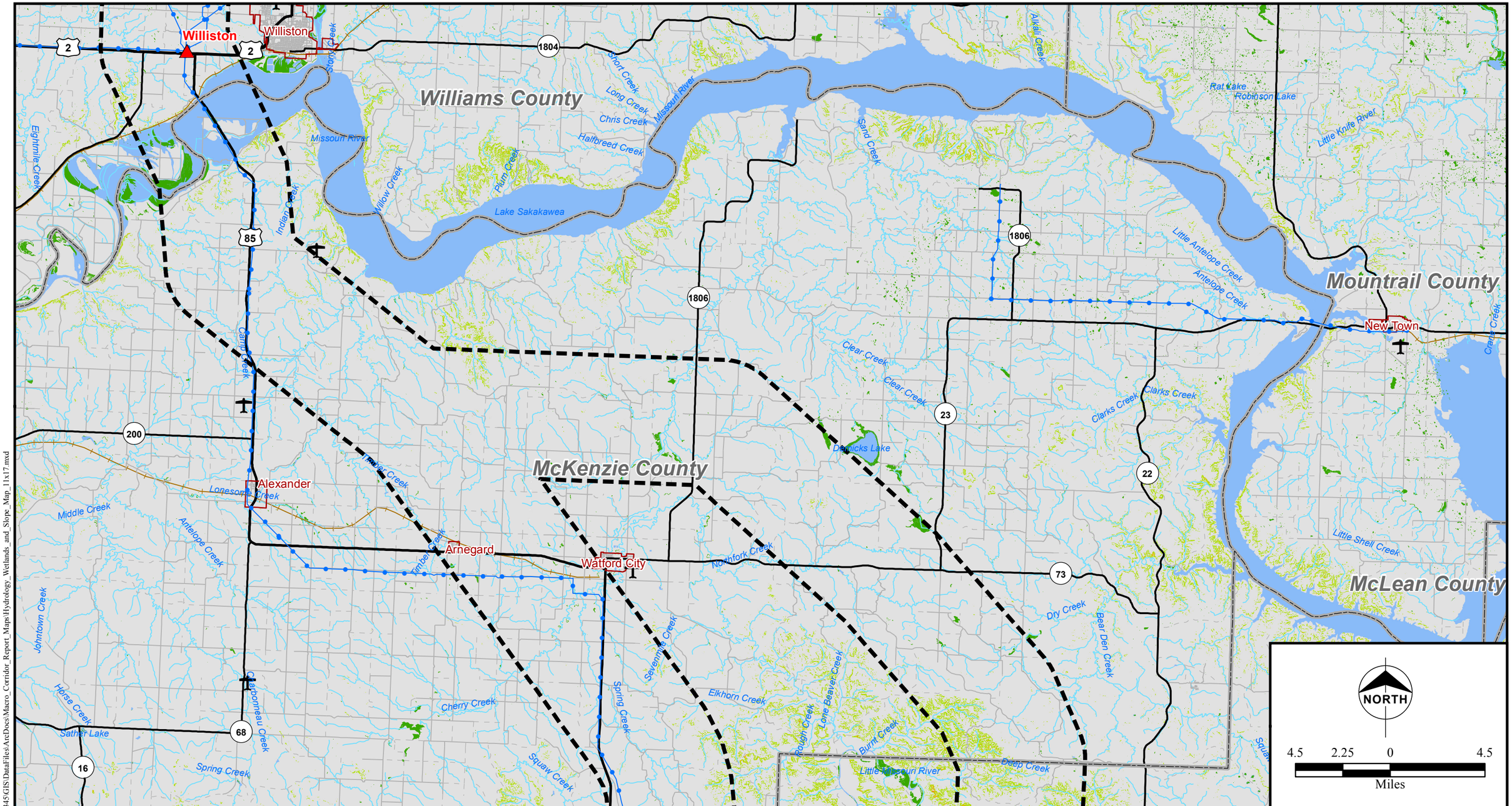
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-8
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Hydrology, Wetlands, & Slope
Sheet 1 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Hydrology_Wetlands_and_Slope_Map_11x17.mxd

Source: North Dakota GIS; Esri; National Flight Data Center; USFWS NWI Wetlands; USGS DEM Data; Basin Electric; Burns & McDonnell.

Revised October 26, 2011



LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Hydrology & Wetlands

- Stream/River
- Waterbody
- NWI Wetlands

Percent Slope

- 0 - 10%
- 10 - 20%
- 20 - 30%
- >30%

Map Sheet Index

Burns & McDonnell
SINCE 1898

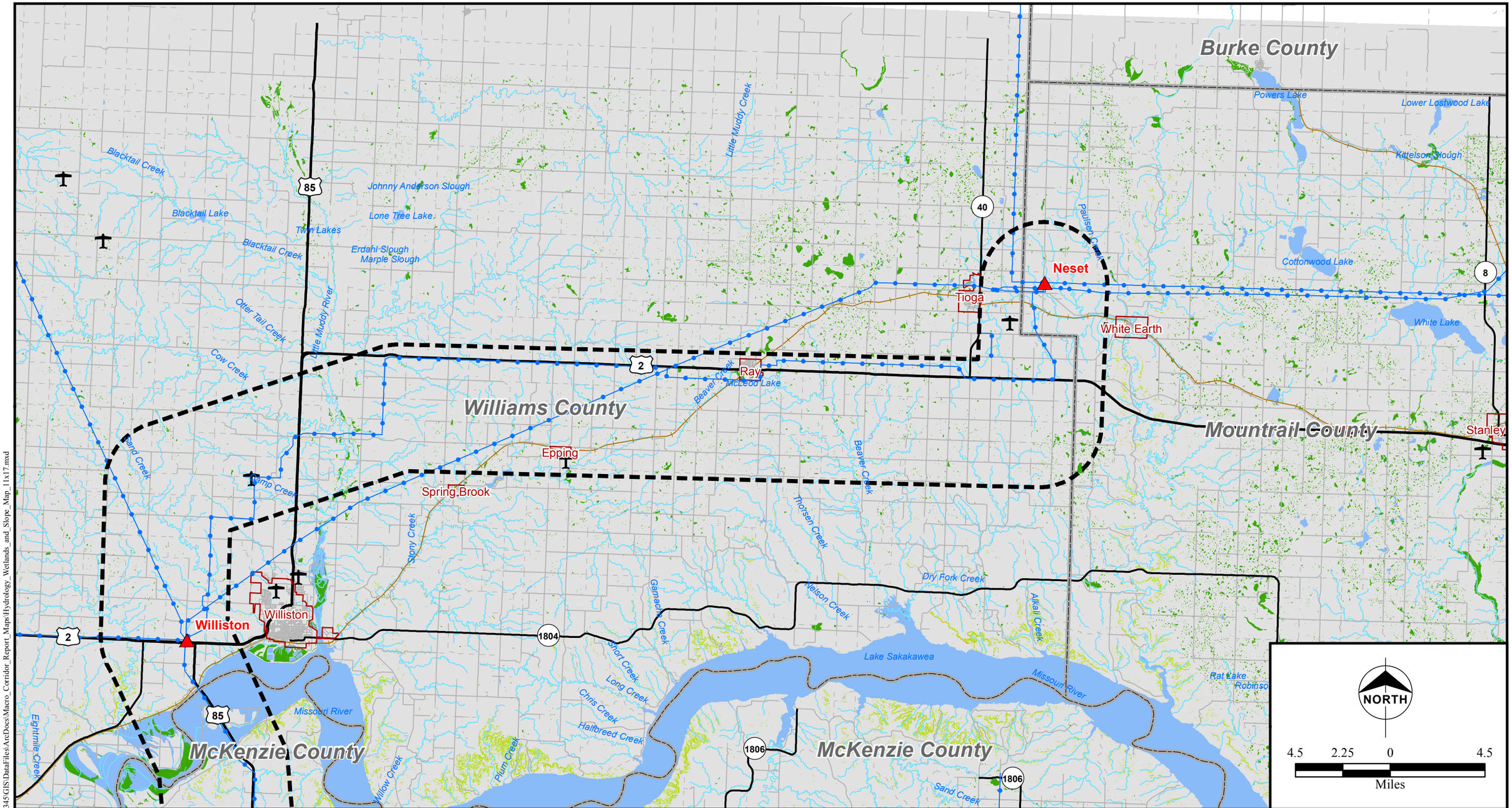
BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-8
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Hydrology, Wetlands, & Slope
Sheet 2 of 3

Source: North Dakota GIS; Esri; National Flight Data Center; USFWS NWI Wetlands; USGS DEM Data; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV1\Data\Projects\Basin\61495_AVS_345GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Hydrology_Wetlands_and_Slope_Map_11x17.mxd



\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Hydrology_Wetlands_and_Slope_Map_11x17.mxd

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

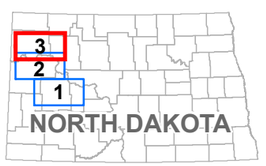
Hydrology & Wetlands

- Stream/River
- Waterbody
- NWI Wetlands

Percent Slope

- 0 - 10%
- 10 - 20%
- 20 - 30%
- >30%

Map Sheet Index



Burns & McDonnell SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-8
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Hydrology, Wetlands, & Slope
Sheet 3 of 3

Source: North Dakota GIS; Esri; National Flight Data Center; USFWS NWI Wetlands; USGS DEM Data; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

McLean County
Lake Sakakawea
Missouri River
McKenzie County
Dunn County
Killdeer
Dunn Center
Halliday
Charlie Creek
Knife River
Antelope Valley Station
Mercer County
Dodge
Golden Valley
Zap
Beulah
Billings County
Little Missouri River
22
85
8
1806
200

NORTH
4.5 2.25 0 4.5
Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Important Farmland

- Prime Farmland
- Farmland of Statewide Importance
- Prime Farmland if Drained
- Prime Farmland if Irrigated

Map Sheet Index

Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-9
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Important Farmland
Sheet 1 of 3

Source: North Dakota GIS; Esri; National Flight Data Center; USDA NRCS SSURGO Soils; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Important_Farmland_Map_11x17.mxd

Williston
Williston
Williams County
Missouri River
Lake Sakakawea
Little Knife River
Mountrail County
New Town
McKenzie County
Alexander
Arnegard
Watford City
McLean County
2
2
1804
85
1806
1806
200
23
22
73
68
16
NORTH
4.5 2.25 0 4.5
Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Important Farmland

- Prime Farmland
- Farmland of Statewide Importance
- Prime Farmland if Drained
- Prime Farmland if Irrigated

Map Sheet Index

3
2
1
NORTH DAKOTA

Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-9
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Important Farmland
Sheet 2 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Macro_Corridor_Report_Maps\Important_Farmland_Map_11x17.mxd

Source: North Dakota GIS; Esri; National Flight Data Center; USDA NRCS SSURGO Soils; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

Burke County

Williams County

McKenzie County

McKenzie County

Mountrail County

Neset

Tioga

White Earth

Ray

Epping

Spring Brook

Williston

Williston

Stanley

Lake Sakakawea

Missouri River

Little Muddy Creek

85

85

2

2

40

8

1804

1806

1806

NORTH

4.5 2.25 0 4.5

Miles

LEGEND

- Project Study Area
- Existing Substation
- Existing Transmission Line
- US Highway
- State Highway
- Other Road
- Trail
- Railroad
- Airport
- Municipal Boundary
- County Boundary

Important Farmland

- Prime Farmland
- Farmland of Statewide Importance
- Prime Farmland if Drained
- Prime Farmland if Irrigated

Map Sheet Index

3
2
1
NORTH DAKOTA

Burns & McDonnell
SINCE 1898

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

Figure 5-9
Basin Electric Power Cooperative
Antelope Valley Station to Neset
345-kV Transmission Project
Important Farmland
Sheet 3 of 3

\\ESPSRV\Data\Projects\Basin\61495_AVS_345\GIS\DataFiles\ArcDocs\Maero_Corridor_Report_Maps\Important_Farmland_Map_11x17.mxd

Source: North Dakota GIS; Esri; National Flight Data Center; USDA NRCS SSURGO Soils; Basin Electric; Burns & McDonnell.

Revised October 26, 2011

6.0 REFERENCES CITED

Basin Electric (Basin Electric Power Cooperative). 2011. GIS files for locations of Basin Electric-owned transmission lines.

FAA (Federal Aviation Administration). 2011. National Flight Data Center. Accessed July 2011 at: www.faa.gov/airport_safety/airportdata_5010/menu/index.cfm

FCC (Federal Communications Commission). 2010. Communications facilities data. Accessed May 2011 at: http://wireless.fcc.gov/geographic/index.htm?job=licensing_database_extracts

Integrated System (IS). 2011. "Eastern Montana/Western North Dakota Load Serving Study Facility Additions Justification-August 2011". Unpublished.

North Dakota Department of Mineral Resources (NDDMR). 2011. Presentation to Basin Board

North Dakota Geographic Information System (2011). Data files for North Dakota resources. Accessed May 2011 at: www.nd.gov/gis/mapsdata/data/

North Dakota Petroleum Council (NDPC). 2011. North Dakota Oil and Gas Industry Facts & Figures, 2011 Edition. Available at: http://www.ndoil.org/image/cache/Facts_and_Figures_2011_-_online.pdf (Accessed July 2011).

NPS (National Park Service), 2011. Data on the location of properties listed on the National Register of Historic Places. Accessed July 2011 at: http://www.nps.gov/nr/research/

NRCS (Natural Resources Conservation Service). 2011. SSURGO soils data. Accessed May 2011 at: http://soildatamart.nrcs.usda.gov/

NRHP (National Register of Historic Places). 2011. State Listings. Accessed July 2011 at: www.nationalregisterofhistoricplaces.com

U.S. Census Bureau, 2010a. Data from 2000 and 2010 census. Accessed July 2011 at: www.census.gov

U.S. Census Bureau. 2010b. Data from 2005-2009 American Community Survey. Accessed July 2011 at: www.census.gov

U.S. Census Bureau. 2010c. TIGER database. Accessed May 2011 at: http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp201.html

USFWS (U.S. Fish and Wildlife Service). 2010. County Occurrence of Endangered, Threatened and Candidate Species and Designated Critical Habitat in North Dakota. Accessed July 2011 at: www.fws.gov/northdakotafieldoffice/county_list.htm

USFWS (U.S. Fish and Wildlife Service), 2011. Data on the location of wetlands in the National Wetlands Inventory. Accessed May 2011 at: http://www.fws.gov/wetlands/Data/DataDownload.html

USGS (U.S. Geological Survey). 2001. National Land Cover Dataset. Accessed May 2011 at: http://seamless.usgs.gov/index.php

USGS (U.S. Geological Survey). 2006. Ecoregions of North Dakota and South Dakota. Accessed July 2011 at: www.npwrc.usgs.gov/resource/habitat/ndsdeco/nodak.htm

USGS (U.S. Geological Survey). 2011a. National Elevation Dataset. Accessed May 2011 at: www.seamless.usgs.gov

USGS (U.S. Geological Survey). 2011b. National Hydrography dataset. Accessed May 2011 at: http://nhd.usgs.gov/

U.S. Geological Survey (USGS). 2008. National Assessment of Oil and Gas Fact Sheet: Assessment of Undiscovered Oil Resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, 2008. Available at: http://pubs.usgs.gov/fs/2008/3021/pdf/FS08-3021_508.pdf (Accessed July 2011).

* * * * *