DOE/EA-1812

DRAFT
ENVIRONMENTAL ASSESSMENT

FOR

HAXTUN WIND ENERGY PROJECT LOGAN AND PHILLIPS COUNTIES, COLORADO

U. S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office

and

U.S. Department of Energy
Rocky Mountain Region

OCTOBER 2011

DOE/EA-1812

DRAFT
ENVIRONMENTAL ASSESSMENT

FOR

HAXTUN WIND ENERGY PROJECT LOGAN AND PHILLIPS COUNTIES, COLORADO

U. S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office

and

U.S. Department of Energy
Rocky Mountain Region

OCTOBER 2011

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy

TITLE: *Draft Environmental Assessment for Haxtun Wind Energy Project, Logan and Phillips Counties, Colorado* (DOE/EA-1812)

CONTACT: For additional copies or more information on this Environmental Assessment (EA), please contact:

Melissa Rossiter
NEPA Document Manager
Golden Field Office
U.S. Department of Energy
1617 Cole Blvd.
Golden, CO 80401-3305
Desk Phone: 720-356-1566
Blackberry: 720-291-1602
Email: Melissa.Rossiter@go.doe.gov

ABSTRACT: The U.S. Department of Energy (DOE) is proposing to authorize the expenditure of Federal funding through the Community Renewable Energy Deployment (CRED) Program to Phillips County for the design, permitting, and construction of an approximately 30-megawatt wind energy project, known as the Haxtun Wind Project, within Phillips and Logan counties in northeastern Colorado. The proposed project consists of 18 wind turbines that would interconnect to the Highline Electric Cooperative equipment inside Western Area Power Administration's Haxtun substation just south of the Town of Haxtun.

DOE would award Phillips County a $2.55 million CRED grant to facilitate and partially fund the design, permitting, and construction of the Haxtun Wind Project. The majority of the funds required to construct the proposed project would come from private tax and equity investors. DOE has authorized the County to use a percentage of its Federal funding for preliminary activities, which include preliminary design, environmental studies, preparation of the EA, and permitting. Prior to full authorization to use the grant funds, DOE must first complete review under the *National Environmental Policy Act* (NEPA). This Draft EA analyzes the foreseeable environmental impacts of the proposed project and the alternative of not implementing this project (the No-Action Alternative).

To prepare this EA, DOE notified potentially interested local stakeholders, and State and Federal agencies—including the office of the Governor of Colorado—of a 15-day scoping period and the availability of a scoping letter for this EA on its website. DOE also solicited input from 14 Indian tribes.

PUBLIC INVOLVEMENT: The public is provided with an opportunity to comment on this Draft EA, and to ensure DOE's compliance with the *National Historic Preservation Act*, by providing comments related to historic resources. All comments should be submitted via email, mail, or fax marked to the attention of the NEPA Document Manager listed above. Envelopes and the subject line of emails and faxes should be labeled "Haxtun Wind Project Draft EA Comments." Letters should be postmarked no later than November 3, 2011. Use of email or fax to submit comments will avoid processing delays associated with delivery of mail to Federal agencies. Email comments to the DOE NEPA document manager, Melissa.Rossiter@go.doe.gov, or fax them to 720-356-1560. DOE will consider all submitted comments in preparing the Final EA. After completion of the Final EA, DOE will determine whether to issue a Finding of No Significant Impact or prepare an Environmental Impact Statement.

AVAILABILITY: This EA is available for review on the DOE Golden Field Office Reading Room website, http://www.eere.emergy.gov/golden/Reading_Room.aspx.

ACRONYMS AND ABBREVIATIONS

AM	Amplitude Modulated
APE	Area of Potential Effect
CDOW	Colorado Division of Wildlife
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CNHP	Colorado Natural Heritage Program
CRED	Community Renewable Energy Deployment (grant)
CRP	Conservation Reserve Program
dB	Decibel
dBA	decibel on an A-weighted scale, used to approximate the human ear's response to sound
DOE	U.S. Department of Energy
EA	Environmental Assessment
EMF	Electromagnetic field
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FM	Frequency modulated
GE	General Electric
GIS	Geographical Information Systems
Hz	hertz, cycles per second
kV	Kilovolt(s)
kV/m	Kilovolts per meter
Ldn	A decibel value that corrects for background day and night ambient noise
mG	milligauss
NEMA	National Electrical Manufacturer's Association
NEPA	*National Environmental Policy Act*
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
OAHP	Office of Archaeology and Historic Preservation
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
PCA(s)	Project Construction Agreement(s)
SCADA	Supervisory control and data acquisition
SHPO	State Historic Preservation Office(r)
SPCC	Spill Prevention, Control and Countermeasures Plan
SSURGO2	Soil Survey Geographic Database
SWA	State Wildlife Area
SWMP	Storm Water Management Plan
USFWS	U.S. Fish and Wildlife Service
Western	Western Area Power Administration

CONTENTS

Section Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

LIST OF APPENDICES

1. INTRODUCTION

1.1 National Environmental Policy Act

The *National Environmental Policy Act* [42 *United States Code* (U.S.C.) 4321 *et seq*.; NEPA], the Council on Environmental Quality (CEQ) NEPA regulations [40 *Code of Federal Regulations* (CFR), Parts 1500 to 1508], and the U.S. Department of Energy (DOE) NEPA implementing procedures (10 CFR Part 1021) require that DOE consider the potential environmental impacts of a Proposed Action before making a decision to implement that Action. This requirement applies to decisions about whether to provide Federal financial assistance to government and private entities.

In compliance with these regulations, this Environmental Assessment (EA):

- Examines the potential environmental impacts of the Proposed Action and the No-Action Alternative;
- Identifies unavoidable adverse environmental impacts of the Proposed Action;
- Describes the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Characterizes any irreversible and irretrievable commitments of resources that would be involved should DOE decide to implement its Proposed Action.

DOE must meet these requirements before it can make a final decision to proceed with any proposed Federal action that could cause adverse impacts to human health or the environment. This EA fulfills DOE's obligations under NEPA and provides DOE and other decision-makers with the information needed to make an informed decision about the construction and operation of the proposed approximately 30-megawatt wind energy project. The EA evaluates the potential individual and cumulative impacts of the proposed project. For purposes of comparison, this EA also evaluates the impacts that could occur if DOE did not provide funding or approve the interconnection request (the No-Action Alternative), under which DOE assumes that Phillips County would not proceed with the project. No other action alternatives are analyzed.

1.2 Background

The Community Renewable Energy Deployment (CRED) Program received funding through *the American Recovery and Reinvestment Act of 2009* (Pub. L. 111-5, 123 Stat. 115; Recovery Act). The Federal CRED Program represents a DOE priority to support the planning and installation of community-scale renewable energy projects by accelerating widespread commercialization of clean renewable energy technologies across the United States, diversifying the Nation's electricity supply options, while increasing national security and improving the environment.

Through competitive grants, the DOE CRED Program will help communities rapidly plan and deploy renewable energy systems which provide clean, reliable, and affordable energy supplies for their communities, while creating jobs and new economic development opportunities. The projects will demonstrate how multiple renewable energy technologies, including solar, wind, biomass, and geothermal systems, can be deployed at commercial scale to supply clean energy to communities. The CRED program empowers local communities to make strategic investments to meet the nation's long-term goals

for energy independence and leadership on climate change by supporting the planning and deployment of community renewable energy projects in communities nationwide.

DOE has awarded Phillips County, Colorado, (proponent) one of five competitive grants funded under the Federal CRED Program. DOE is now considering whether to authorize the County to use $2.55 million in Federal funding for partial funding of a wind energy project located in Phillips and Logan counties.

Phillips County has an agreement with National Wind, LLC, d/b/a Haxtun Wind LLC, for the design and permitting of the Haxtun Wind Project (proposed project).[1]

Phillips County and Haxtun Wind LLC are proposing to construct a wind energy project that would produce approximately 30 megawatts of electricity (proposed project) located in Phillips and Logan counties in Northeastern Colorado. The proposed project is located in Sections 29 and 32 T8N R47W and Sections 5, 6, 7, 8, 17 and 18 T7N R47W Phillips County and Sections 1 ,2, 3, 10, 11,12, 13 and 14 T7N R48W, Logan County, respectively (Figure 1-1). The proposed project would be located just to the south of the town of Haxtun, Colorado.

During the development of the proposed project, Haxtun Wind LLC submitted an interconnection request to the DOE Western Area Power Administration (Western) for the Project. The response to this request required substantial infrastructure upgrades. Subsequently, Haxtun Wind LLC submitted an application with Highline Electric Cooperative for a new system study based on an alternative, and more feasible, interconnection plan that would interconnect the proposed wind energy Project to Highline's transmission system at the Haxtun Substation located in the Town of Haxtun, Phillips County, Colorado.

The proposed project would affect the local economy by sharing revenues with local landowners and other project participants, by generating local jobs and substantial property taxes, and providing clean, renewable energy for the area communities.

In compliance with Council on Environmental Quality and DOE NEPA regulations, this EA examines the potential environmental impacts of DOE's Proposed Action (partially funding the Haxtun Wind Energy Project) and the No-Action Alternative, under which DOE assumes the proposed project would not proceed. When complete, this EA will provide DOE with the information needed to make an informed decision about whether using Federal funds for the proposed project might result in significant environmental impacts. Based on the Final EA, DOE will either issue a Finding of No Significant Impact, which may include mitigation measures, or determine that additional study is needed in the form of a more detailed environmental impact statement.

1.3 Purpose and Need for Proposed Action

1.3.1 DOE'S PURPOSE AND NEED

DOE's purpose and need is to ensure that Federal CRED funds are used for activities that meet congressional statutory aims to improve energy efficiency, reduce dependence on imported oil, decrease energy consumption, create and retain jobs, and promote renewable energy. Authorizing the expenditure

1. The majority of the funds required to construct the proposed project would come from private tax and equity investors identified with the assistance of the project developer, National Wind, LLC. Haxtun Wind LLC or a similarly named entity would then be organized under the laws of the State of Colorado as a Limited Liability Corporation to construct, own, and operate the Haxtun Wind Project.

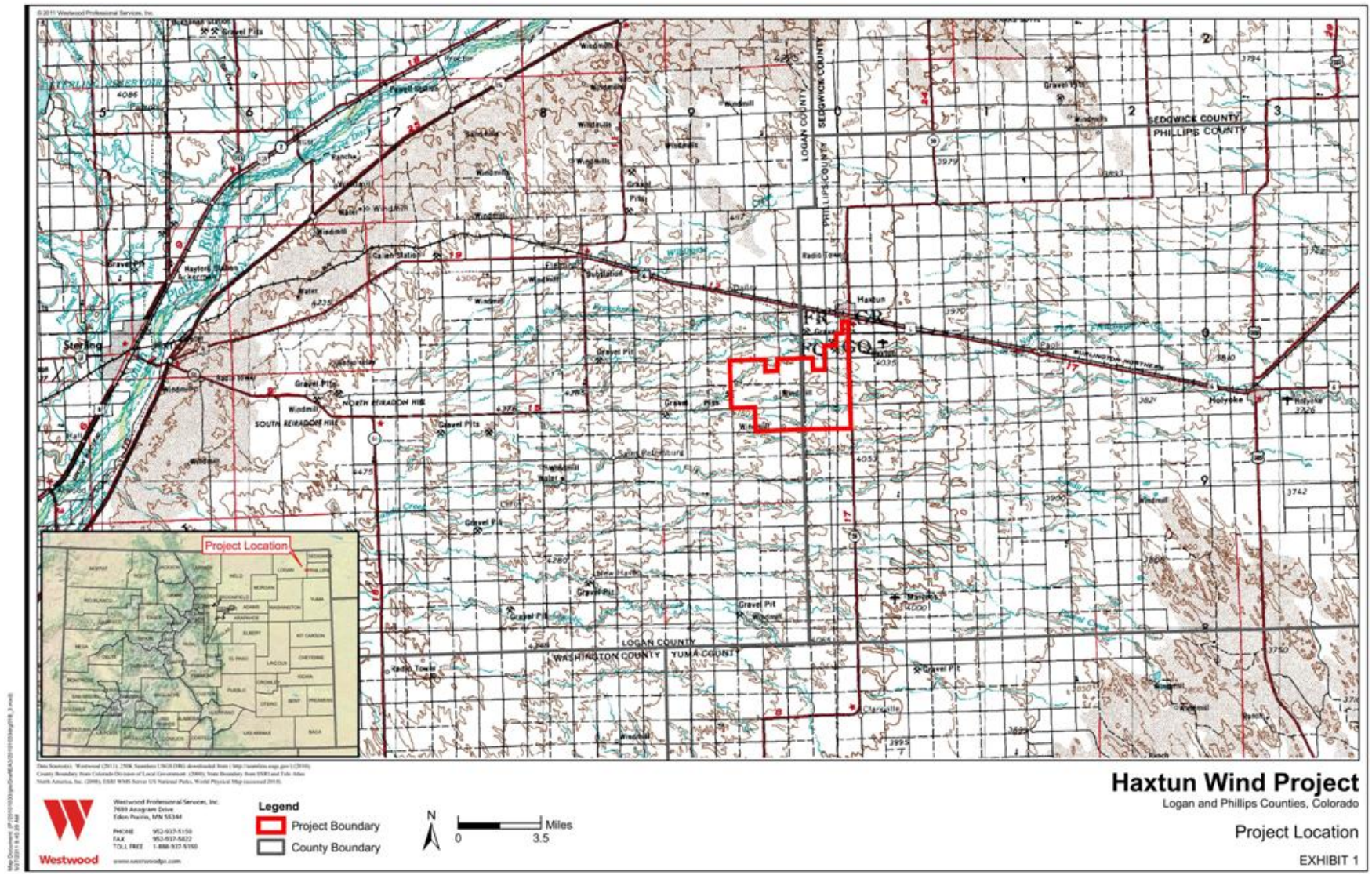

Figure 1-1. Location of the Proposed Haxtun Wind Energy Project

of Federal funding as part of the CRED Program would advance a number of the objectives to assist U.S. cities, counties, states, territories, and American Indian tribes to develop, promote, implement, and manage energy efficiency and conservation projects and programs designed to:

- Reduce fossil fuel emissions;
- Reduce the total energy use of the eligible entities;
- Improve energy efficiency in the transportation, building, and other appropriate sectors; and
- Create and retain jobs.

Congress enacted the Recovery Act to create jobs and restore economic growth through measures that, among other things, modernize the nation's infrastructure and improve energy efficiency. Provision of CRED funds for the proposed project would partially meet these goals.

1.3.2 PHILLIPS COUNTY'S PURPOSE AND NEED

Through the CRED Program, the State of Colorado can empower local communities to make strategic investments to meet the nation's long-term goals for increased energy efficiency and energy independence, leadership on climate change, and improved local air quality by supporting the planning and deployment of community renewable energy projects in communities nationwide. The Haxtun Wind Energy Project would help the State achieve the goals of this program.

1.4 Public Scoping Process

In preparation of this EA, DOE sent more than 1,000 notices of public scoping to stakeholders and interested parties including American Indian tribes, potentially affected landowners, and local, State, and Federal agencies, (see Appendix A). DOE also published a scoping letter on the DOE Golden Field Office Public Reading Room Website to solicit comments. The scoping letter described the proposed Haxtun Wind Energy Project and requested assistance in identifying potential issues to be evaluated in the EA.

To obtain comments from landowners and other potentially affected residents of Phillips and Logan counties, DOE held a public meeting at the Haxtun Community Center on May 27, 2010. That meeting was announced as the NECO Project on Wednesday, May 19, 2010 in the *Haxtun-Fleming Herald* newspaper. Representatives of the DOE Golden Field Office, Western, and Haxtun Wind LLC presented project details, received comments, and answered questions from the meeting attendees. Forty-one members of the public signed the meeting attendance roster (Appendix A).

DOE initiated early consultation with the U.S. Fish and Wildlife Service (USFWS), the Colorado Division of Wildlife (CDOW), and the Office of Archaeology and Historic Preservation, Colorado Historical Society (SHPO).

A chronology and documentation of the initial scoping process is in Appendix A. Documentation of agency comments and DOE's responses to those comments are provided in Appendix B.

A summary of scoping comments and sections in the EA where responses are located is in Table 1-1.

Table 1-1. Comments Received on the Scope of the EA

Comment	EA Section
Public Comments Delivered Orally – Public Scoping Meeting	
How are the lease arrangements and power purchase agreements structured for the Project? How long does it (the Project) go on?	2.2.1
How was the size of the Project determined? Who is the balancing authority?	2.2.1
How long do wind turbines last, and how do the proposed turbines compare to other wind turbines in eastern Colorado?	2.2.1
How often does an EA turn into an EIS?	1.2
What is the chance that the Project will be expanded into a larger facility?	2.2.1
Written Comments – Public Scoping Meeting	
What effect will the project have on jobs? Will there be any long-term jobs created?	2.2.5
How will transmission lines to the Haxtun Substation be sited? Will they be buried? Will they minimize impacts to developable land south of Haxtun?	2.2.1
Let's build the project.	NA
Informal Public Comments – Public Scoping Meeting	
How loud are the turbines? Will I be able to hear them at my house?	3.9
Will the transmission lines be buried? How deep?	2.2.2.4
Will there be ground vibrations when the turbines are operating?	3.9
Do wind turbines affect television, radio, and internet reception and what will be done if they affect my reception?	3.7
Agency and Native American Tribes Written and Verbal Comments[a]	
The Colorado Historical Society Office of Archaeology and Historic Preservation reviewed existing information and: • Determined that unidentified cultural resources may exist within the proposed impact area. • Recommended that a professional survey be conducted to identify any cultural resources in the Project area which are eligible to be listed in the National register of Historic Places.	3.3
The U.S. Fish and Wildlife Service suggested: • That the Project area be evaluated by a knowledgeable consultant for Endangered and Threatened species, • That the Project consider pre-construction and post construction wildlife monitoring. • If water resources from the Platte River were to be used a Section 7 consultation should be performed, • The Project consider incorporating guidelines presented in "Interim Guidance on Avoiding and Minimizing Impacts to Wildlife from Wind Turbines", • The Project address the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, • The Project adopt the Avian Power Line Interaction Committee's Suggested Practices for Avian Protection on Powerlines: The State of the Art 2006."	3.4 Appendix C
The Colorado Department of Wildlife was contacted and participated in a site review. Based on their comments during this review, a detailed Environmental Risk Assessment was performed and submitted on June 25, 2010. Comments and recommendations were received and resulted in additional acoustic monitoring, pre-construction avian surveys, and a commitment by Haxtun Wind to perform post construction avian and bat monitoring.	3.4 Appendix C
Consultation letters describing the Project and soliciting comments were sent to applicable representatives of the **Arapahoe, Ute, Southern Ute, and Cheyenne** Native American tribes on July 20, 2010. No comments from those tribes have been received.	NA

a. Letters providing information on the proposed project and soliciting comments were mailed to the USFWS, the Colorado State SHPO, and the Colorado Department of Wildlife in late April 2010.

1.5 Draft Environmental Assessment

DOE posted the Draft EA on the DOE Golden Field Office Reading Room Website (http://www.eere.energy.gov/golden/Reading_Room.aspx) and DOE NEPA Website (http:// http://energy.gov/nepa). DOE sent postcards to the individuals listed in Appendix A of this EA to notify them of the EA's availability on the web and to announce a 15-day public comment period on the Draft EA. DOE published a Notice of Availability in the *Haxtun-Fleming Herald*.

2. DOE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the DOE proposed action, the proposed Haxtun Wind Project that Phillips County is advancing (Section 2.2), and the No-Action Alternative (Section 2.3) under which DOE would not provide financial assistance.

2.1 DOE's Proposed Action

The DOE Proposed Action is to authorize Phillips County to expend Federal funds to partially fund the design, permit, and construction of a wind energy project, as described in the following section. DOE has authorized the County to use a percentage of its Federal funding for preliminary activities, which include preliminary design, environmental studies, preparation of the EA, and permitting. These activities are associated with the Proposed Action and do not significantly impact the environment nor represent an irreversible or irretrievable commitment by the DOE in advance of the conclusion of the EA for the proposed project.

2.2 Phillips County's Proposed Project

Phillips County would use Federal funding to facilitate and partially fund the design, permitting, and construction of the proposed project. Specifically, Phillips County would use DOE funding to initiate the planning and development of the Haxtun Wind Project, including:

- environmental review,
- project planning and design,
- easement acquisition,
- equipment purchase, and
- other project components as funding allows.

Also analyzed in this draft EA is the interconnection with Highline. To analyze environmental impacts of the interconnection, it is assumed for purposes of this EA that Highline would approve the interconnection request and construct, own, and operate identified additions to the Haxtun Substation that are required for the interconnection and completion of the proposed project.

2.2.1 OVERVIEW OF THE PROPOSED PROJECT

The proposed project was designed as an approximately 30-megawatt facility based on the available capacity of the both the 115 kV Sterling to Holyoke transmission line and the existing Haxtun substation. Based on existing conditions, the system would be able to accept an additional 30 megawatts of power without requiring an expensive network improvement. Interconnecting the proposed project to the Haxtun Substation should not require additional land area. Haxtun Wind LLC has filed a 28.8-megawatt interconnection request with Highline Electric Association with a point of interconnection at the Haxtun substation. Highline is completing system impact and facilities studies for the interconnection and will design, as needed, additional infrastructure for the interconnection.

The Haxtun Project is planned to have a 20-year power purchase agreement with a utility, with options to extend this agreement as necessary. The Project would operate on lands leased for 30-years, with subsequent options to extend the lease for two additional 10-year periods (total potential lease period of 50 years). Based on the life expectancy of the wind turbines, subsequent leases may require repowering with replacement turbines (Table 1-1).

The Project would impact 9,271 total acres (4,968 acres and 4,303 acres in Logan and Phillips Counties, respectively) and include 18 turbines (12 turbines and 6 turbines in Logan and Phillips counties, respectively).

The proposed Project would include 18 GE 1.6-100 MW wind turbines with a total project output nameplate capacity of 28.8 megawatts of renewable energy. Due to the wind regime at the site, the average megawatt output would be less. GE 1.6-100 turbines have a monopole design, a hub height of 80 meters (262 feet) and rotors with a 100-meter (328-foot) diameter operating at approximately 9-17 revolutions per minute. The maximum blade-extended height of each structure is approximately 130 meters (427 feet). GE wind turbines have a 20 to 25 year expected lifespan, and were designed to operate effectively in areas with slower average wind speeds.

The initial selection of turbine locations was based on turbine size and standard setbacks from roads, residences and structures to maintain public safety, and avoid adverse impacts to landowners and natural resources. Turbine locations were also chosen to have characteristics that facilitate constructability by avoiding steep slopes, unsuitable soils and substrates, and limited or difficult access. After initial project review, the plan was reduced from 20 turbines to 18 turbines. This change will result in an overall reduction of impacts. Turbine locations are approximate, and would be refined through the process of micro-siting, where each turbine location is selected based on geophysical assessments and detailed consideration of environmental constraints through noise and shadow flicker analysis and field studies. The environmental setting and potential impacts on the environment are discussed in Section 3, below.

The Project would include approximately 4.7 miles of permanent access road collocated with underground collecting electrical cable. An additional 1.2 miles and 5.2 miles of access road and underground collector cable, respectively, would be established in separate corridors.

Figure 2-1 illustrates the proposed distribution of wind turbines in the Project area. Five alternative wind turbine locations are proposed in the event that any of the initial turbine locations are found during Project implementation to be not viable.

Project post-construction Operations and Maintenance (O & M) facilities and Highline substation support facilities would be located outside the project boundary and include the existing Haxtun Substation just south of the town of Haxtun and O & M facilities to be located in the town of Haxtun. A system of underground electrical collector cables that would transmit electricity from each turbine to the transformer substation is planned as 34.5 kV, with a step-up to 115 kV at the transformer substation located within the project boundary prior to interconnecting at the Haxtun substation.

If it is necessary to have an O&M facility for this project, it is likely that an existing building within the town of Haxtun would be purchased and renovated or leased for Project use. The locations for the Haxtun Substation, the possible Project transformer substation, and the radial transmission line route within the Project boundary are provided in Figure 2-1. Haxtun Wind LLC is proposing connecting the Project to the existing 115 kV Sterling-Holyoke transmission line at the Haxtun Substation via a buried radial line. If a buried radial line is not feasible potential substation locations have been evaluated within the Project area to step up the Project's generation to be delivered to the Haxtun substation via and overhead 115kV radial transmission line.

Figure 2-1. Proposed Project Infrastructure and Residence Locations

2.2.2 CONSTRUCTION

The Project footprint (i.e., the area to be disturbed during construction and throughout the 30-year life-of-Project) would be limited to the areas immediately adjacent to turbines, access roads, and other facilities (**Table 2-1**). Approximately 139 acres would be disturbed to construct the project. After reclamation of disturbed sites not required for operation and maintenance of the Project, approximately 14 acres of disturbed land would remain for the 30-year life of the project.

Table 2-1. Estimated Surface Disturbance Acreage[a]

Disturbance Type	Initial Disturbance (acres)	Life-of-Project Disturbances (acres)
Turbine assembly areas/pads[b]	29.2	0.3
Turbine string corridors (collection line trenches and access roads adjacent)[c]	34.2	9.2
Other access roads (outside turbine corridors)[d]	5.6	2.2
Other collection line trenches (outside turbine corridors)[e]	12.6	0.0
Crane paths[f]	28.0	0.0
Overhead transmission line[g]	19.5	0.2
O&M Building Substation[h]	0	0
Collector Substation[i]	2.5	2.0
Switchyard[j]	0.0	0.0
Temporary construction yard (Including Laydown Yard)[k]	7.0	0.0
Total	**138.6**	**13.9**

a Disturbances are based on the preliminary layout with 18 turbine locations. The alternative turbine locations were not included in acreage estimates.
b Initial disturbance of 150-foot radius around on the turbine with a 15-foot radius around on the turbine for the life of project.
c Initial disturbance of 60-foot reduced to 16-foot for the life of the project. The 60-foot-wide disturbance corridor includes both access road and co-located collection line trenches.
d Initial disturbance of 40-foot reduced to 16' for the life of the project.
e Initial disturbance of 20-foot completely restored after construction.
f Initial disturbance of 40-foot completely restored after construction.
g Initial disturbance of 50-foot completely restored after construction with the exception of a 10-foot radius at each pole location.
h An existing 5-acre yard with building within the town of Haxtun would be utilized for the life of the project.
i A life of project footprint of roughly 210 feet by 410 feet was assumed with an additional 0.5 acre needed for construction.
j The project interconnects at an existing switchyard on the south side of Haxtun. No new disturbance would be needed.
k A temporary construction yard would be built and operated during construction. The yard would be removed and the area completely restored after construction.

Construction of the Project would involve the following actions typical of wind power installations in the semiarid west.

- Establishing site access;
- Grading the sites and constructing lay-down areas and the private road system;
- Removing vegetation from construction and lay down areas (for fire safety);
- Installing a concrete batch plant (if necessary);
- Excavating for tower foundations;
- Installing tower foundations;
- Erecting towers;
- Installing nacelles and rotors;
- Installing permanent meteorological towers (as necessary);

- Constructing electrical transformer substations;
- Constructing private radial transmission lines;
- Interconnecting towers, a control building, meteorological towers and substations with power-conducting cables and signal cables;
- Connecting with leased O&M or supervisory control and data acquisition (SCADA) building;
- Performing start-up testing and wind park commissioning, and
- Reclamation of temporarily disturbed land to be brought back to pre-construction conditions.

Additional activities may include constructing a temporary office and sanitary facilities for use during construction.

2.2.2.1 Site Access, Clearing and Grade Alterations

An estimated 95.9 miles of new access roads would be required for the Project (see Figure 2-1 and Table 2-1). Roads would be built and maintained to provide safe operating conditions at all times. The minimum full surfaced travel-way width would be approximately 16 feet; overall surface disturbance could be up to approximately 35 feet wide (see Figure 2-1 and Table 2-1). Disturbance width may increase in steeper areas due to cuts and fills necessary to construct and stabilize roads on slopes; however, most of the planned access roads would be on relatively flat terrace tops that reduce the need for extensive cut and fills. The combination of turning clearance requirements and maximum grade would guide road layout. Maximum grade becomes a critical road design parameter due to the anticipated weight of the turbine components and electrical transformers that would be brought to the site.

Approximately 7 acres of agricultural land would be temporarily disturbed to construct a laydown yard that would provide space for contractor work trailers; receiving, holding, and staging areas; equipment storage; and fabrication. The laydown area would be sited on relatively level, cultivated land to avoid impacts to areas in managed grassland.

Access roads would be constructed in compliance with all applicable local, State and Federal permits and requirements and in accordance with landowner easement agreements. Access roads would be constructed to withstand the expected weights of the trucks transporting turbine components and the construction and lifting equipment that would be used during construction. Roads would be located to minimize disturbance and maximize transportation efficiency and to avoid sensitive resources and steep topography. Access roads would be collocated with existing private roads to the extent practicable to avoid additional disturbance that would be associated with new road corridors.

During construction and operation of the proposed project, project-related traffic would be restricted to the roads developed for the Project (i.e., no off-road vehicle traffic permitted). Use of unimproved roads not specifically required for construction use would be limited to emergency situations only.

To maintain land productivity in agricultural areas, managed pastureland, and non-agricultural range land, topsoil consisting of the full depth of the A-horizon to a maximum depth of 12 inches would be stripped from areas planned for disturbance and stored within the easement. Topsoil removed during new road construction would be stockpiled within road easements. Topsoil from areas that would be converted to impervious surface such as concrete turbine foundations and access roads would be spread on other areas such as cut-and-fill slopes to facilitate restoration.

2.2.2.2 Foundation Excavations and Installations

Based on the native site soils and geology (see Section 3.3.1), the use of industry standard turbine foundation systems is anticipated. Such foundations are anticipated to be poured concrete, octagonal in

shape, approximately 50 feet in diameter and 8 feet thick. Foundations would weigh approximately 870 tons and the total weight of the foundation plus structure would be approximately 1,100 tons. These foundations would bear atop native soils or on the regional sandstone bedrock and be backfilled with soils excavated during construction.

A geotechnical exploration would be undertaken with a soil boring at each turbine location prior to final design of the foundation. Based on the variable nature and depths of the soils at the Project site, it is expected that an open excavation observation would be performed at each wind turbine location to verify conditions prior to forming for foundations. It is anticipated that an area of 1.6 acres would be disturbed at each turbine location for material and equipment lay-down and access. If necessary for support at individual locations, ground improvement options include over excavation and replacement with structural fill, dynamic compaction and use of stone columns, or driven pilings. In area with competent bedrock at depths of less than 9 feet, bedrock would be removed by ripping or controlled blasting, as necessary.

The excavation would be backfilled with the excavated materials once the concrete has cured (normally 28 days). While this would accommodate much of the volume of the material initially excavated, some excavated material would remain and would need to be redistributed on the site at cut and fill locations or to provide suitable grade for buildings and crane staging areas. Subsoil would not be spread over topsoil. Excess subsoil and rock removed by ripping or controlled blasting (if any) would be disposed of at a suitable approved location consistent with all applicable State and Federal regulations.

Throughout the period of foundation installation, precipitation that accumulates within the open excavations would need to be removed and disposed of according to the conditions of the proposed project storm water management plan (SWMP).

Two companies providing concrete foundation services in the town of Haxtun have the capacity to provide sufficient amounts of ready-mix concrete in a timely manner. One or both companies would be contracted to supply concrete for the Project.

Foundations for the Project substation and any other on-site material storage buildings, if necessary, as well as pads for each electrical transformer, would be constructed concurrent with tower foundation construction. On-site buildings would be small, pre-fabricated, and require only conventional spread footings designed to accommodate local codes and frost depth.

2.2.2.3 Tower Erection and Nacelle and Rotor Installation

Cranes are typically used for both tower erection and rotor installation. The cranes would operate entirely within the planned 1.6 acre area around each turbine location and would move between tower locations on the roads constructed for the Project. Gravel and rock likely would need to be placed on the areas around the planned tower locations to support the weight of the crane and to provide all-weather access in the areas where the crane would operate. If practicable, native sandstone removed during foundation, trenching, and cut and fill operations would be used to provide all-weather access. Turbine towers would be anchor-bolted to concrete foundations. Towers for the proposed project would arrive on site in segments (typically, segments would be no longer than 66 feet in length) and would be welded/bolted together as the tower is erected. The nacelles would contain a pre-assembled drive-train. The hub and blades would be installed on the nacelle.

2.2.2.4 Miscellaneous Ancillary Construction

Additional construction activities would include the installation of electric transformers and substations and power-conducting cables and signal wires. Power cables would be connected from each turbine to the collector substation. Approximately 4.7 miles of underground collection lines would be co-located with access roads. Another 5.2 miles of underground collection lines would be installed in areas that would not be collocated with access roads. Underground electrical and communications cables would be placed in approximately 2- to 4-foot- wide trenches along the length of each turbine string corridor. The proposed routes for connecting the turbines to the collector substation are indicated on Figure 2-1. Trenches for electrical distribution/collection and communications cables would be installed using conventional excavation and backfilling procedures or using a "plow" method to excavate a narrow trench and install the cable in one complete process. In some areas trenches would need to be excavated in sandstone bedrock as discussed above.

Trenches would be excavated to below frost line to a depth of approximately 4 feet, and electric distribution and communications cables would be placed in the trench using trucks. Cable installation depth may be adjusted to shallower depths depending on soil management practices in the agricultural areas or the nature and depth to bedrock in areas where bedrock is present. Installed cable depth would conform to all applicable Federal and Colorado codes. Trenches would be re-vegetated concurrently with re-vegetation of other disturbed areas.

Most of the Project's electrical and communications systems would be installed underground. However, approximately 3.2 miles of overhead private radial transmission lines would be installed from the Collector Substation within the project boundary to the Haxtun Substation located approximately 2.9 miles to the northeast of the proposed Project substation location (Figure 2-1). All overhead collection lines would be installed in conformance with the National Electric Safety Code, the American National Standards Institute, and Suggested Practices for Raptor Protection on Power Lines – the State of the Art in 2006 (Avian Power Line Interaction Committee 2006). Wooden poles with 45- to 55-foot installed height would be erected to the substation. Temporary disturbance would average 50 feet in width and all disturbance would be confined to the 130-foot- wide easement. To the extent practicable, overhead utility lines would follow existing property lines, roads, or utility easements to minimize impacts to property.

Conventional construction methods are expected to be sufficient for the transformer substation, (with professional staff as described in 2.2.2.5) and the pad-mount transformers at the base of each wind turbine. In general, at each location, the ground vegetation would be cleared, the land re-graded, and rock or gravel would be placed over the entire area to ensure drainage. The Project would require a switching facility at the existing Haxtun Substation. There is sufficient space at the existing Haxtun Substation to construct and operate a new switching facility, thus no additional impacts would be involved.

One or more grounding rods may be installed for electrical safety at the switchyard and substation. Alternatively, a metal grounding grid or metal net would be installed over the entire footprint of each of the facilities. These grounding features would also provide for lightning grounding. Each turbine tower would require similar lightning grounding. Grounding rods, grounding grids, or grounding wells would be installed for each tower. The type of lightning grounding needed for the proposed project would be decided by Highline during its facility study. This study would be a matter of public record. Concrete pads would be installed for the transformers at the base of each wind turbine generator. The transformers would be sealed. Transformer bushings, switches, capacitors, and other dielectric fluid-containing electrical devices would be mineral-oil-based dielectric oils with no polychlorinated biphenyls and would be managed in accordance with the Project Spill Prevention, Control, and countermeasures (SPCC) plan.

2.2.2.5 Final Testing

Initial post-construction performance testing would be conducted by qualified windpower technicians and would include checks of each wind turbine and the control system prior to final turbine commissioning. Electrical tests of the wind Project components (i.e., turbines, transformers and collection systems) and the substation would be performed by qualified electricians to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications. All installations and inspections would be in compliance with applicable codes and standards, including:

- National Electrical Safety Code;
- National Electrical Manufacturer's Association;
- American Society for Testing and Materials;
- Institute for Electrical and Electronic Engineers;
- National Electrical Testing Association;
- American National Standards Institute;
- State and Local Codes and Ordinances;
- Insulated Power Cables Engineers Association; and
- Occupational Safety and Health Administration (OSHA) Part 1910, Subpart S, 1910.308.

2.2.3 PUBLIC ACCESS AND SAFETY

A potential public safety issue is unauthorized or illegal access to the Project facilities and the potential for members of the pubic to attempt to climb towers, open electrical panels or encounter other hazards. Public access to private lands is currently restricted by landowners and would continue to be restricted in accordance with easement agreements. The substations and any other critical equipment would be fenced as required for public safety, but no other fencing is proposed within the Project area. Access points on the tower structure would remain locked when construction and maintenance personnel were not present.

All structures more than 200 feet tall must have aircraft warning lights in accordance with requirements specified by the Federal Aviation Administration (FAA) (AWEA 2004a). For wind power developments the FAA allows a strategic lighting plan that provides complete visibility to aviators but does not require lighting on every turbine. The lights would be installed on the nacelle prior to lifting the nacelle onto the turbine tower. In order to meet FAA requirements, Haxtun Wind LLC plans to light all perimeter wind turbine generators along with the highest turbine. Haxtun Wind LLC estimates that approximately 17 turbines would be lighted consistent with wind tower lighting recommendations provided in United States Department of Transportation (USDOT)-FAA guidelines. The final lighting arrangement would be approved by the FAA.

Dry vegetation and high winds may combine to cause a potential fire hazard around the Project. Fire preparedness and fire safety would be a component of required contractor training. All fires would be extinguished immediately by construction personnel if there is no danger to life or personal safety, and the appropriate landowner and the county sheriff's department would be notified immediately. Some fire-fighting equipment would be located on-site, in vehicles and in the O&M Building in Haxtun. If the fire cannot be extinguished by construction personnel, the landowner and sheriff would be so advised. Fire deterrents would include access roads, which may serve as fire breaks and regular clearing of vegetation from areas around transformers, towers and the substations as a component of project maintenance (for the life of the proposed project).

Safety signing would be posted around all towers, transformers and other high-voltage facilities, and along roads in conformance with applicable State and Federal regulations.

2.2.4 OPERATIONS AND MAINTENANCE

Haxtun Wind LLC or a designated contractor would operate and maintain the proposed project upon completion. All turbines, collection and communications lines, substations and transmission lines would be operated in a safe manner according to standard industry operation procedures. Routine maintenance of the turbines would be necessary to maximize performance and identify potential problems or maintenance issues. Each turbine would be continuously monitored from a remote location using a SCADA system to ensure operations were proceeding efficiently. Any problems would be reported immediately to Haxtun Wind LLC O&M personnel, who would perform both routine maintenance and most major repairs. Most servicing would be performed up-tower, without using a crane to remove the turbine from the tower. In addition, all roads, pads, and trenched areas would be regularly inspected and maintained to minimize erosion consistent with applicable SWMP and in accordance with the lease.

Access roads would be maintained in good condition (e.g., free of ruts, washouts, and holes) during the expected 30-year life of the project. Roads would be inspected during each site visit by O&M personnel and any problem areas noted for subsequent repaired as needed. Road maintenance requirements would be based on weather conditions and usage. Maintenance would be performed to ensure that roads are in a condition acceptable to the County (for county roads) and the landowners (for private roads). All fuels and/or hazardous materials would be properly stored during transportation and at the Project site consistent with required SPCC plans. All on-site personnel would be instructed in good housekeeping practices in order to keep the job site clean in a sanitary and safe condition.

2.2.5 WORKFORCE

Construction of the approximately 30-megawatt proposed project would create approximately 125 temporary construction jobs that would last approximately 4-6 months. Construction crews would typically work 10 to 12-hour work days, six days per week depending on the weather. The ongoing project team would require up to three fulltime personnel and consist of qualified contractors and subcontractors who employ trained and competent personnel. All contractors, subcontractors and their personnel would be required to comply with all State and Federal worker safety requirements, specifically all of the applicable OSHA requirements.

2.2.6 SAFETY TRAINING

Each contractor would be required to provide a site-specific health and safety plan as required by 29 CFR Part 1910 – Occupational Safety and Health Standards. In addition, due to the multiple employers that would have employees on site, safety would be coordinated on a Project-wide basis through activity-specific hazard assessments and Job Safety Assessments.

2.2.7 TRAFFIC

The majority of transportation operations would involve material and equipment transported to the site during the construction phase. In general, the heavy equipment and materials needed for site access, site preparation, and foundation construction would be typical of road construction projects: bulldozers, graders, excavators, front-end loaders, compactors and dump trucks. Typically, heavy equipment would be transported to the site by flatbed “low-boy” semi-trailers and do not pose unique transportation considerations. Most of the heavy equipment would remain on site through the duration of construction activities.

Typical construction materials hauled to the site would include gravel, rock, sand, and water, which are generally available locally. Ready-mix concrete would be transported to the site.

Construction of the Project components (infrastructure including towers) would occur simultaneously, using single vehicles for multiple tasks. During construction, the average number of daily vehicle trips to the site would vary, but would be on the order of 125 total trips, while the typical number of vehicles actually at the site would be around 50.

During normal operations and maintenance, traffic to and on the site would be limited and infrequent, and could include up to three to five four-wheel drive pickup trucks. During both construction and operations and maintenance, Haxtun Wind LLC and its contractors would use water, as necessary, to control dust from traffic on the Project site roads located on private property. Snow removal equipment (e.g., pickup trucks equipped with wing-style blades) would be utilized as needed during winter.

2.2.8 WATER USE

Water would be used in the construction of the turbine tower foundations and the substation foundations and for dust control during construction.

Haxtun Wind LLC estimates that a one-time use of less than 3.4 million gallons of water would be needed during the construction phase of the Project. This includes approximately 16,000 gallons of water that would be used to produce concrete for each turbine foundation, for a total of approximately 288,000 gallons for all 18 turbine foundations. Up to 1.3 million gallons of water would be used to compact soil under roads, crane pads, foundations, and substations. Up to1.8 million gallons of water would be used for dust suppression. However, if water availability is limited, dust would be controlled using other dust suppression agents (e.g. copolymers and hydrophilic salts). Dust suppression would be required on temporary and permanent gravel roads, and would be used sparingly. Water for concrete for foundations, soil compaction, and for dust control (if necessary) would come from off-site existing municipal or private sources, likely from existing wells within Haxtun, Colorado which is derived from groundwater. Most of this water use would occur during the approximate 6-month construction period. Minimal, if any, dust control is anticipated during the operations and maintenance phase of the Project.

Small amounts of water would be used to clean wind turbine rotor blades and eliminate dust and insect buildup, which otherwise deforms the shape of the airfoil and degrades performance. Haxtun Wind, LLC has estimated that up to 700 gallons of water per year would be used per turbine to clean the rotor blades. In addition, general water usage would be on the order of 150 gallons per day for the life of the project. Haxtun Wind LLC would negotiate use of existing landowner wells used for irrigation consistent with all applicable water appropriation permits administered by the Colorado Department of Natural Resources, Division of Water Resources (CDNR 2008).

2.2.9 HAZARDOUS MATERIALS

Hazardous materials are not anticipated to be used or stored on site with the exception of chemical constituents contained in fuels (gasoline and diesel fuel), coolants (ethylene glycol), and lubricants (oils and greases). Haxtun Wind LLC and its contractors would comply with all applicable hazard communication and hazardous materials laws and regulations regarding these chemicals and would implement a SPCC Plan. SPCC plans provide for the rapid response and clean-up of hazardous chemicals, including lubricating oils used in turbine nacelles.

In addition, Haxtun Wind LLC would comply with all applicable Federal and State regulations regarding notices to Federal and local emergency response authorities and development of applicable emergency

response plans, if required. To mitigate impacts from leaks of hazardous materials during on site storage, materials storage, and dispensing areas, any fuel, coolant, or lubricant storage would be equipped with secondary containment features in accordance with all applicable laws and regulations and appropriate engineering practices. Good housekeeping practices would be utilized during the duration of the Project. Vehicle refueling and minor maintenance would only be performed by trained and qualified personnel outside of any drainage areas, and would be consistent with the Project Construction Agreements (PCAs) discussed in Appendix D.

2.2.10 DECOMMISSIONING

Reclamation would be conducted on all temporarily disturbed areas to comply with easement agreements and the proposed project's SWMP. All temporarily disturbed areas would be permanently stabilized by measures set forth in the SWMP which may include re-seeding, permanent matting, or pavement. The ultimate goal is to return temporarily affected areas of the Project site to approximate pre-disturbance conditions.

Following construction, temporary work areas would be graded to match the pre-disturbance contours, and the areas would be seeded with appropriate native seed blends to match or enhance the vegetative cover present prior to construction. Prior to development of the SWMP, Haxtun Wind LLC would consult with the local Natural Resources Conservation Service (NRCS) office for recommendations on appropriate vegetation options and would obtain approval from the landowners to implement the recommended practices. Specific re-seeding requirements would be included in the SWMP. During and after construction, slopes would be stabilized as provided in the SWMP. Post-construction revegetation techniques would include ripping soils to reduce compaction; replacing topsoil to those areas where topsoil was stripped prior to construction; amending the soil as necessary; and reseeding disturbed areas. Disturbed areas would include but not be limited to portions of turbine pads not required for the expected life of the project, road cuts and fills, underground power line trenches and overhead power line routes. Over 80 percent of construction-related disturbances would be reclaimed upon construction completion (Table 2-1).

All agricultural land temporarily affected by construction would be restored and reclaimed to pre-construction conditions and productivity. Topsoil reserved from temporarily affected agricultural land would be replaced to the soil surface and graded to the original pre-construction contours. Any areas potentially affected by compaction would be remediated by deep ripping of the subsoil (14 to 18 inches deep) prior to topsoil restoration.

The Project would deactivate its storm water management permit only after assuring that all silt fencing and other temporary sediment control measures have been removed from the Project site and assuring that all areas permanently stabilized by revegetation have re-grown to 70 percent of pre-disturbance individual plant density levels.

At the end of the Project's estimated 30-year life (assuming that the project would not be re-powered by authorizing the installation of new or refurbished turbines), Haxtun Wind LLC would obtain any necessary authorization and permits from the appropriate regulatory agency or landowners to decommission the wind Project and would again apply for a SWMP to cover demolition and removal of Project-related improvements. Turbines, towers and transformers would be removed and recycled or disposed of at approved licensed facilities. Foundations would be broken up to a depth of four feet below grade and then abandoned in place unless intact foundations were allowed to remain in place by the landowner. All private Project roads would be removed or, upon landowner request, revert to landowner control. Underground power and communication lines would be abandoned in place; overhead power lines and poles would be removed. Reclamation procedures would be similar to reclamation measures

used to permanently stabilize temporarily disturbed soils and would be based on site-specific requirements and techniques commonly employed at the time.

2.2.11 PROJECT CONSTRUCTION AGREEMENTS: STANDARD CONSTRUCTION, OPERATION AND MAINTENANCE PRACTICES

Appendix D of this EA lists the project construction agreements (PCAs) and provides standard construction, operation, and maintenance practices that would be implemented, where and when applicable, to avoid and minimize impacts to the environment to the extent practicable.

2.3 No-Action Alternative

For purposes of comparison, this Draft EA evaluates the impacts that could occur if DOE does not provide funding (the No-Action Alternative), under which DOE assumes that the Project would not proceed. No other action alternatives are analyzed.

Under the No-Action Alternative, DOE would not provide Federal funding to Phillips County for the proposed project. As a result, installation of the project would be: (1) delayed while Phillips County looked for other funding sources, or (2) abandoned altogether if other funding sources could not be obtained. In addition, if the interconnection request to Highline is found to be economically unviable due to the extent and cost of network improvements determined by Highline to be triggered by the project, the project would not move forward. Furthermore, reductions in fossil fuel use and improvements in energy efficiency would not occur and DOE's ability to achieve its objectives under the CRED Program and the Recovery Act would be impaired. Finally, there would be no project related impacts.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section of the EA describes the affected environment in terms of environmental, social, cultural, and economic conditions in the project area as well as the potential impacts to these resources that could result from implementation of the proposed project and from the No-Action Alternative.

3.1 Environmental Consequences of the No Action Alternative

Under the No-Action Alternative, DOE would not authorize funding to Phillips County for the proposed project. As a result, installation of the project would be: (1) delayed while Phillips County looked for other funding sources, or (2) abandoned altogether if other funding sources could not be obtained. In addition, if the interconnection request to Highline is found to be economically unviable due to the extent and cost of network improvements determined by Highline to be triggered by the project, the project would not move forward. Furthermore, reductions in fossil fuel use and improvements in energy efficiency would not occur and DOE's ability to achieve its objectives under the CRED Program and the Recovery Act would be impaired. Any economic benefits from the installation of the wind turbines, whether to individual investors, landowners, local businesses, or local government entities would not occur.

If the project did proceed without DOE's financial assistance, the potential impacts would be essentially identical to those under DOE's Proposed Action (that is, providing assistance that allows the project to proceed). To allow a comparison between the potential impacts of a project as implemented and the impacts of not proceeding with a project, DOE assumes that, if it decided to withhold assistance from this project, the proposed project would not proceed.

3.2 Considerations Not Carried Forward for Further Analysis

Consistent with NEPA implementing regulations and guidance, DOE focuses the analysis in an EA on topics with the greatest potential for significant environmental impact. For the reasons discussed below, the proposed project is not expected to have any measurable effects on certain resources; therefore, these resources are not carried forward for further analysis.

3.2.1 AIR QUALITY

Air quality in the Project area is designated as "attainment" for all criteria pollutants including sulfur dioxides, nitrogen oxides, particulate matter and ozone (USEPA 2008). The State of Colorado only monitors for particulates and meteorology in the Eastern Plains Counties because those counties do not have the pollution sources that can generate health-impacting concentrations of the criteria pollutants. The only monitors currently in operation are in Lamar, Colorado. The other monitors were discontinued after a review of the data showed that levels of particulates were well below the standard and were declining (Colorado Department of Public Health and Environment, 2008). An operating wind energy project would not be considered a major source of air pollutants. The only impact to air quality would be temporary and would consist of minor amounts of vehicle exhaust and dust generated construction. These temporary releases would be minimized and controlled to the extent practicable through compliance with PCAs Air-1 through Air-3(Appendix D). During operation, the use of wind power instead of burning fossil fuels to generate electricity would have beneficial intermediate and long-term impacts on air quality because greenhouse gases and other pollutants emitted by conventional fossil fuel combustion at energy-producing facilities would not be produced. The proposed project would have minimal and temporary impacts to air quality.

3.2.2 PALEONTOLOGY

Paleontological resources (fossils) are the remains, imprints, or traces of once-living organisms that preserved in rocks and sediments and have been extinct for greater than 5000 years. No paleontological sites are listed for the area by the Colorado Museum of Natural History.

Two stratigraphic units exist on the Project site that may contain fossils and would be disturbed by excavations during construction; (1) Quaternary-age sediments consist of thin (0-4 feet thick) surface deposits of silty and fine-sandy, unconsolidated loess deposited less than 20,000 years ago, and (2) the Tertiary-age Ogalalla Formation that may consist of unconsolidated sands and gravels as well as competent rock layers (sandstone, siltstone, and conglomerate) deposited from 24 to 5 million years ago.

It is unlikely that substantive amounts of vertebrate fossils would be encountered in the thin loess veneer that mantles the underlying Tertiary sediments in the project area. However, the Ogallala formation has been known to contain fossils in discontinuous beds associated with distinct lithologies.

Excavation activities with the potential to affect paleontological resources include:

- Excavations for each of 18 turbine foundations (see Section 2.2.2.2) would affect approximately 1.6 acres (69,700 square feet) and would involve excavation of just over 19,000 cu. yd. of Quaternary and Tertiary Ogallala sediment.

- Excavations for 9.9 miles of buried electrical cables (Section 2.2.2.4) would cumulatively affect 3.6 acres and a volume of 23,000 cubic yards of primarily Quaternary sediment.

Excavation for access roads would be limited as the access roads would be on relatively level soils and would not require extensive areas of cut and fill. Because the Project excavation footprint is small (less than 150 acres during construction) and individual excavations would be limited in aerial extent, it is unlikely that an entire assemblage of fossils would be disturbed even assuming important fossils are encountered.

Because potentially fossiliferous areas of Ogallala Formation sediments would be excavated, avoidance and mitigation measures that involve contractor training in paleontological resource identification and supervision by a trained paleontologist would ensure recovery of any important finds. These measures (PCAs Paleo-1 through Paleo-5; Appendix D) have been designed to avoid and minimize to the extent practicable the potential for impact to paleontological resources at the Project site. DOE does not expect substantive impacts to paleontological resources as a result of the Project.

3.2.3 WATER RESOURCES: GROUNDWATER, STREAMS, WETLANDS, AND FLOODPLAINS

Water resources include wetlands, streams, floodplains, and groundwater. Water resources are indicated within the project area on Figure 3-1. Wetlands and streams were assessed in the field and are discussed in Appendix C.

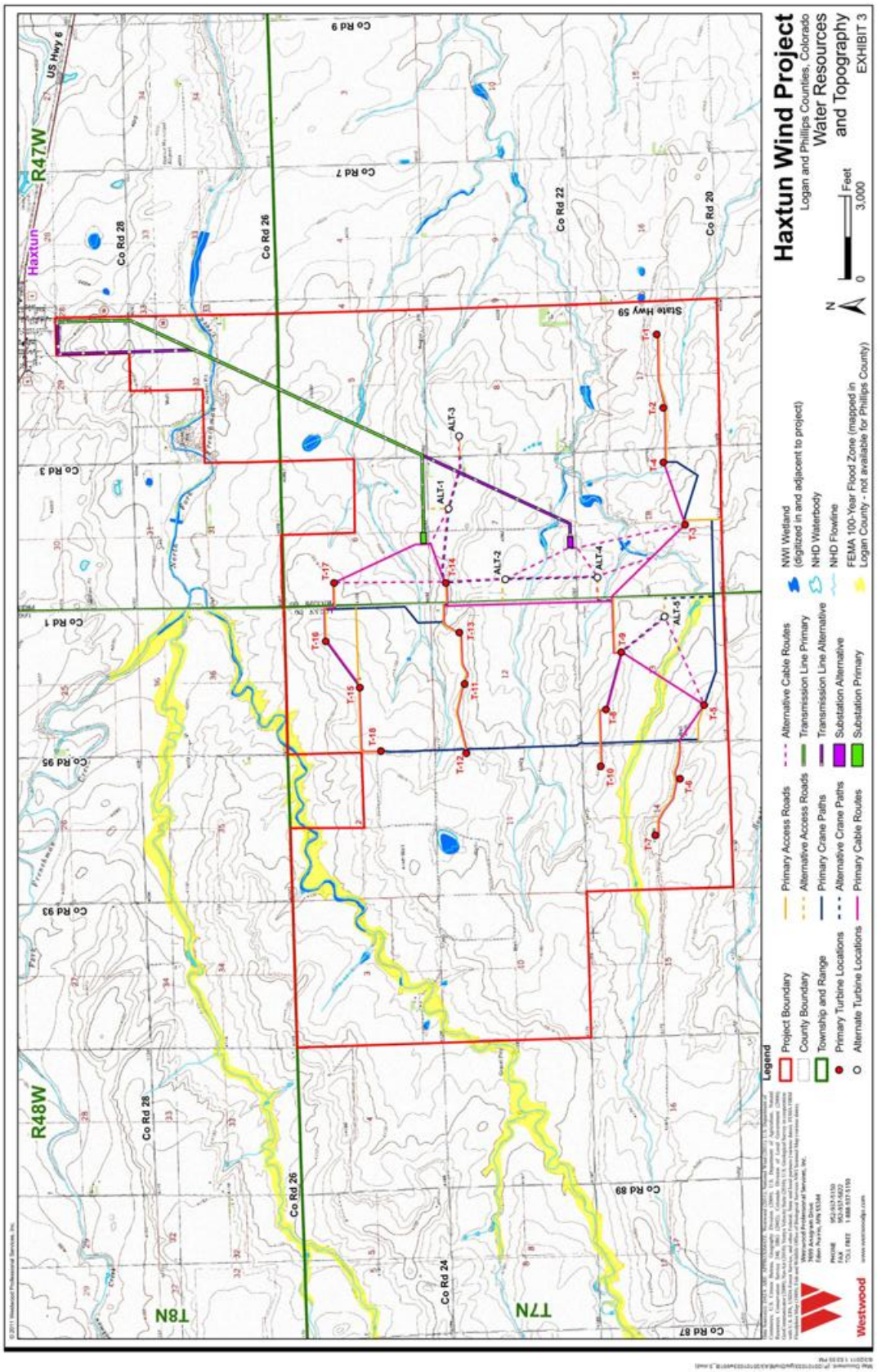

Figure 3-1. Water Resources and Topography

3.2.3.1 Surface Water Features

The Project design avoids impacts to surface water features to the maximum extent possible by placing virtually all infrastructure in relatively level upland areas where surface water features are lacking. No turbine locations (including alternatives) or permanent access roads would cross areas mapped as wetlands or streams. Some underground collector cable routes would cross intermittent drainages. For reference, intermittent drainage ways are identified as NHD (National Hydrography Dataset) flow lines on Figure 3-1. The construction crane paths shown on the preliminary project layout would cross intermittent streams in four locations, three of which are adjacent to existing roadway crossings. In the event that Project constraints during construction require temporary crossing of intermittent drainageways, it is possible that a culvert and small temporary fill could be required to accommodate crane movements. These crossings would represent short-term temporary impacts covered by Section 404 of the *Clean Water Act*, Nationwide Permit 14 established for linear transportation projects and administered by the US Army Corps of Engineers (USACE).

Temporary impacts to intermittent drainage ways associated with the bedding of underground cables or crane crossings would be restored to preconstruction contours and conditions. Existing drainage areas and patterns potentially affected by the development of the access road system would be delineated and preserved through the appropriate placement of culverts. In this manner, indirect impacts from drainage area changes would be avoided. Construction would comply with applicable PSAs (Appendix D), to avoid and minimize all impacts to surface water resources to the extent practicable.

The proposed project would have minimal potential for adverse impacts to wetlands and streams. No permanent filling impacts would result from the proposed layout (including alternatives). Existing drainage patterns would be preserved through appropriate access road design. The proposed project would have a temporary and negligible impact to surface water. Any areas disturbed would be restored to pre-construction conditions (PCAs WATER-1 through WATER-7, Appendix D).

3.2.3.2 Floodplains

A narrow Federal Emergency Management Association 100-year floodplain has been designated for the North Fork of Frenchman Creek on the Logan County portion of the Project area. No Project impacts are associated with the Logan County reach of Frenchman Creek. The nearest disturbance by planned roads and buried cable routing would be approximately 2,050 and 2,070 feet, respectively. The closest planned turbine is about 2,730 feet removed from Frenchman Creek in Logan County.

However, a downstream crossing of Frenchman Creek in Phillips County by the radial transmission line connecting the transformer substation to Western's Haxtun Substation is planned for the west side of State Highway 59. No construction or disturbance would be planned within the floodway of Frenchman Creek at this location, which would be spanned in its entirety consistent with project construction agreement GEN-10 (Appendix D). All temporary or permanent culverts and water conveyance features would be designed to prevent flooding, and no infrastructure would be constructed in the floodplains of existing drainages.

3.2.3.3 Groundwater

The proposed project would utilize the service of concrete suppliers in Haxtun and would rely on these suppliers for water required to mix concrete. Haxtun Wind LLC would similarly use water trucked into the construction site to provide drinking water for construction workers as well as compacting soil and for dust suppression as necessary. Activities during the life of the project would use existing wells and

would not require groundwater appropriation. No new wells requiring groundwater appropriation are planned for the life of the project.

3.2.4 LAND USE

Based on land cover, as shown in Figure 3-2, 76 percent of the 9,271-acre project area consists of cultivated cropland. The predominant cultivated crop is dry land winter wheat. Seven quarter sections are under irrigation with center pivots and most such areas are planted with corn.

Non-native grasslands cover approximately 22 percent of the project area. No native grasslands were observed within the project area. Most grasslands lie on steeper hillsides or ridge tops within crop fields. A small portion of the mapped grassland encompasses wildlife shrub plantings. The largest contiguous grassland area (currently used as pasture) covers about 944 acres. Most grasslands are grazed or hayed and all appear to be planted to introduced forage species such as smooth brome (*Bromus inermis*) and timothy (*Phleum pratense*). Many of the grasslands are heavily invaded by cheatgrass (*Bromus tectorum*).

As discussed in Section 2.2.2, turbines, access roads, and buried electrical collection cables would be sited primarily on agricultural land or managed hayland. Of the 146.6 acres of temporary disturbance, only about 9.9 acres of agricultural land would be converted to Project use over the life of the project. The 137 acres of land temporarily disturbed during construction would be restored to pre-construction contours, vegetation, and land uses using the applicable PCAs (see Appendix D). Based on this information, existing land uses in the Project area are not expected to have a substantive long-term impact, and no indirect impacts are expected to accrue to existing land use patterns.

3.2.5 LOCAL AND REGIONAL AVIATION

The closest turbine to the Haxtun Municipal Airport is approximately 3.3 miles to the southwest. The FAA has oversight of any object that could have an impact on the navigable airspace, communications/navigation technology of aviation (commercial or military), or U.S. Department of Defense operations. The FAA requires that a Notice of Proposed Construction (Form 7460-1) be filed for any object that would extend more than 200 feet above ground level. The estimated 400 foot height of the Project turbine towers triggers a FAA review that includes supplying the agency with the heights, locations, and elevations of each individual turbine in order to perform an aeronautical study applicable to each turbine.

- A determination of "No Effect" for the turbine in question authorizes the Project to proceed with construction under the criteria for location and height provided to the FAA.
- A determination of "No Hazard" is similar, but provides for a 30-day public noticing period after which construction can proceed if no adverse comments are received. Adverse comments may generate a more detailed analysis.
- In the event a determination of "Presumed Hazard" is provided, a detailed study is triggered that would explain the cause of the presumed hazard and evaluate impacts on aviation operations.
- The FAA also reviews tower safety lighting provided on behalf of Phillips County by Haxtun Wind LLC, and approves or modifies the lighting requirements to ensure that aviation would not be affected.

Twenty-three turbine locations (18 proposed and 5 alternative locations) are currently being evaluated by the FAA, but no determinations have been issued.

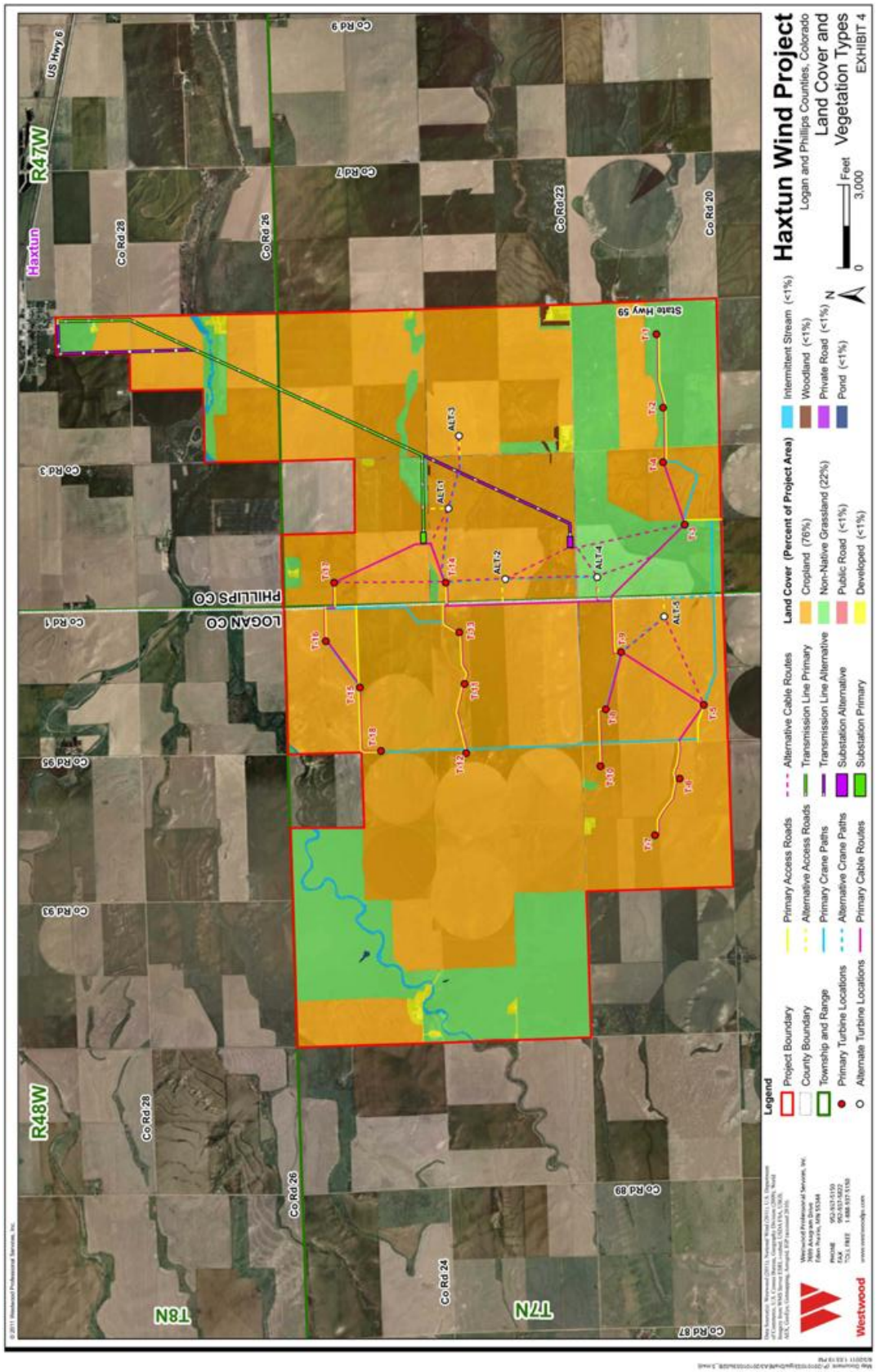

Figure 3-2. Land Cover and Vegetation Types in the Project Area

An earlier turbine configuration was also submitted for FAA review in 2010. Based on that review, four determinations of "No Effect" and 20 determinations of "No Hazard" were provided. None of these proposed or alternative turbine locations received a determination of "Presumed Hazard." The FAA analysis subsequently indicated that the analysis for the turbines that received a determination of "No Effect" was complete and authorized the construction of these turbines as of the date of determination (July 13, 2010). The 30-day comment period for the 20 turbines that received a determination of "No Hazard" produced no comments.

Specific turbines would be lighted according to FAA recommendations:

- Flashing red lights (L864) are recommended.
- Unlighted gaps or separations should be no more than 0.5 miles in length.
- Lights should be placed on each turbine at the end of a turbine string where a linear turbine configuration is used.
- Perimeter lighting of clustered turbines is acceptable if the gap between lit turbines is no longer than 0.5 miles.
- All isolated turbines that are distant from cluster groups or lines should be lit.

3.2.6 ENVIRONMENTAL JUSTICE

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," directs Federal agencies to address environmental and human health conditions in minority and low-income communities. The evaluation of impacts to environmental justice is dependent on demonstrating that high and adverse impacts from the proposed project are not disproportionately borne by any low-income or minority groups in the affected community. There will be no high and adverse impacts to any members of the community; therefore, there would be no adverse and disproportional impacts to minority or low-income populations.

The analyses in this EA do not indicate a potential for high and adverse impacts to the human population. The percentage distribution of low-income and minority populations in Sterling, Fleming, Haxtun, and Holyoke are similar and indicative of the distribution for Phillips and Logan counties. However, while the minority population percentage in these counties is lower than for Colorado and the United States as a whole, U.S. Census Bureau data indicate that incomes are considerably lower than the state and national household medians (see Section 3.3.4, below). Thus the temporary jobs and taxes brought into these relatively low-income communities would represent a small benefit to the area's economy. Therefore, the net impact of the proposed project would not result in disproportionately high and adverse impacts on minority and low-income populations.

3.2.7 INTENTIONAL DESTRUCTIVE ACTS

DOE considers intentional destructive acts (i.e., acts of sabotage or terrorism) in all its EAs and environmental impact statements (DOE 2006). Construction and operation of this wind energy project would not involve the transportation, storage, or use of radioactive, explosive, or toxic materials. The proposed project would not offer any particularly attractive targets of opportunity for terrorists or saboteurs to inflict adverse impacts to human life, heath, or safety. Impacts resulting from intentional destructive acts would be those resulting from the acts themselves, and would not be magnified by any aspect of the proposed project or alternatives.

It is not expected that there would be any intentional destructive acts that would impact electrical power service. However, should an act occur, which would lead to temporary proposed project shutdown, the shutdown would not substantively impact the local or regional electrical power grid. Any shut down due to an intentional act would mimic a temporary shutdown caused by mechanical failure.

3.3 Considerations Carried Forward for Further Analysis

3.3.1 GEOLOGY AND SOILS

3.3.1.1 Affected Environment

Physiography

The dominant physiographic feature in the project area is a nearly level southwest to northeast trending ridge that is flanked on the north and south by seasonal to ephemeral drainage ways incised approximately 100 feet into the surrounding plain (Figure 3-1). Drainage ways include an unnamed tributary of the North Fork of Frenchman Creek to the north of the ridge and seasonal to ephemeral tributaries of the South Fork of Frenchman Creek to the south of the ridge.

Total relief in the area is approximately 150 feet ranging from a low of 4,010 feet above mean sea level where the North Fork of Frenchman Creek crosses State Highway 59 to 4,170 feet above mean sea level at the western end of the ridge on which the turbines would be located. The ridge is a height of land that acts as a divide separating the minor watersheds of the south and north forks of Frenchman Creek. The ridge top is part of a relatively flat, eastward-tipping plain known locally as the "Kelly-LeRoy Table" that has been dissected by higher order ephemeral-to-seasonal unnamed drainage ways (Amen et al., 1977). Both forks of Frenchman Creek join to form Frenchman River which discharges to the North Republican River near the town of Culbertson, Nebraska approximately 130 miles to the southeast of the project site. Slopes are relatively steep from the edge of the ridge feature to the bottoms of the drainage ways. With the exception of closed basin, isolated wetlands (playas) are absent. Riparian wetlands, when present, are narrow and adjacent to the incised seasonal drainage ways.

Geology

Northeastern Colorado is underlain by a relatively thick sequence of alluvial Tertiary sediments. The youngest Tertiary sediments (deposited 2 to 6 million years ago) that are exposed at the land surface comprise the Ogallala formation which is extensive and thick in the proposed project area. These Tertiary sediments frequently form a large terrace or "tableland" composed of old sandy and gravelly alluvium that has been dissected as a result of gradual uplift during the late Tertiary and Quaternary. Frequently these tablelands have a "caprock" where the alluvial sediments have been cemented by calcium carbonate or amorphous silica. Also included in the Ogallala Formation are lacustrine marls, primary air-fall volcanic tuffs, and conglomerates. The Ogalalla Formation is widespread in the subhumid to arid areas of the Great Plains extending from Nebraska, Colorado, and Kansas south to Texas, and is an important aquifer supporting irrigated agriculture in many areas where it is found. A detailed review of the stratigraphy of the Ogallala Formation and associated fossil assemblages is in Ludvigson et al. (2002).

Rocks of Cretaceous age that underlie the Tertiary rocks are not exposed in the proposed project area, and are at depths that would not be reached by any excavations planned for the proposed project. Tertiary-age Ogalalla Formation and Quaternary-age loess sediments are the only geologic units that are expected to be potentially affected by shallow project excavations.

Soils

Information regarding soil types in the vicinity of the site was obtained from the NRCS Soil Survey Geographic Database (SSURGO2). The area (in acres) of digitized soil map unit polygons that lie within the project boundary in Logan and Phillips counties was determined via a spatial geographic information systems (GIS) query in ArcGIS (Figure 3-3). The characteristics and dominant properties (Table 3-1) were determined by query of the SSURGO2 Access Database and by examination of the Official Series Descriptions.

Soil distribution is consistent with site physiography and geology described above. The dominant soils are relatively fine-textured and formed in silty Quaternary loess over silty and loamy Tertiary age eolian sediments and calcium carbonate cemented sandstones that are present on ridge tops. Soils in strongly sloping positions associated with drainage ways and the flanks of the ridge tops formed in sandier material and may be shallow to bedrock. Soils in lowest positions adjacent to drainage ways formed in local alluvium of recent (Holocene) age. Topsoil depths range from thin (0 to 6 inches) to relatively deep (greater than 6 to 12 inches). Runoff class reflects slope, surface texture, and the presence of bedrock near the surface, with soils in higher runoff classes reflecting either finer textures, steep slopes, or the presence of bedrock near the surface.

Soils on the ridge tops are generally used for cropland. Rago, Kuma and Platner are considered Prime Farmland if irrigated. Several of these soils are irrigated within the project area; however, turbine placement in irrigated areas would be avoided.

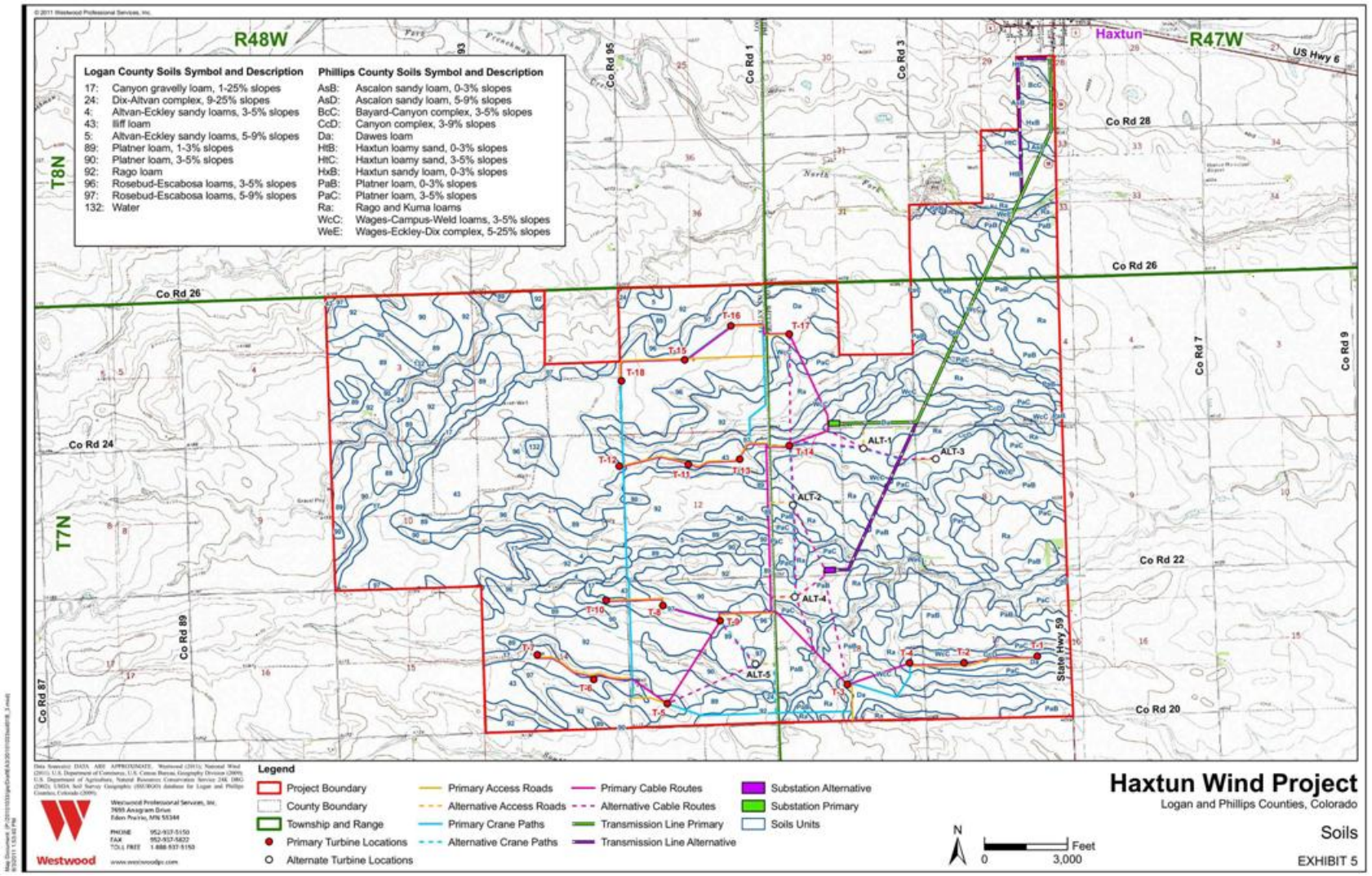

Figure 3-3. Soil Characteristics in the Project Area

Table 3-1. Selected Characteristics of Soils within the Project Area

Map Symbol[a]	Map Unit Name	Soil Name	Runoff Class[b]	Highly Water Erodible[c]	Highly Wind Erodible[d]	Topsoil thickness[e] (in)	Concrete Corrosion Hazard[f]	Bedrock Presence, Hardness, depth[g] (in)	Prime Farmland[h]	Landscape Position[9i]
Logan County, Colorado										
4	Altvan-Eckley sandy loams, 3 to 5%	Altvan	Low	Yes		>6-12	Low			ridges
		Eckley	Low			0-6	Low			knobs, ridges
5	Altvan-Eckley sandy loams, 5 to 9%	Altvan	Medium	Yes		>6-12	Low			ridges
		Eckley	Medium	Yes		0-6	Low			knobs, ridges
17	Canyon gravelly loam, 1 to 25%	Canyon	Medium	Yes		0-6	Low	Hard (11)		cuestas, knobs, ridges
24	Dix-Altvan complex, 9 to 25%	Altvan	Medium	Yes		0-6	Low			knobs, ridges, valley sides
		Dix	Medium	Yes		0-6	Low			knolls, ridges
43	Iliff loam	Iliff	Low			>6-12	Low	Hard (34)		cuestas
89	Platner loam, 1 to 3%	Platner	Low			>6-12	Low		If Irrigated	cuestas
90	Platner loam, 3 to 5%	Platner	Low			>6-12	Low		If Irrigated	hills, ridges
92	Rago loam	Rago	Low			>6-12	Low		If Irrigated	drainageways, flats, swales
96	Rosebud-Escabosa loams, 3 to 5%	Rosebud	Low			0-6	Low	Soft (33)		ridges, upland slopes
		Escabosa	Low			>6-12	Low	Hard (22)		flats, ridges
97	Rosebud-Escabosa loams, 5 to 9%	Rosebud	Medium	Yes		0-6	Low	Soft (33)		hillslopes, ridges
		Escabosa	Medium	Yes		>6-12	Low	Hard (31)		flats, ridges
132	Water	Water								
Phillips County Colorado										
AsB	Ascalon sandy loam, 0 to 3%	Ascalon	Low			>6-12	Low			ridges
AsD	Ascalon sandy loam, 5 to 9%	Ascalon	Medium	Yes		>6-12	Low			ridges
BcC	Bayard-Canyon complex, 3 to 5%	Bayard	Very low	Yes		0-6	Low			uplands
		Canyon	Medium			>6-12	Low	Soft (15)		uplands
CcD	Canyon complex, 3 to 9%	Canyon	High			>6-12	Low	Soft (15)		ridges
CdB	Chappell and Dix sandy loams, 0 to 3%	Chappell	Very low	Yes		0-6	Low			streams
		Dix	Very low			>6-12	Low			streams
Da	Dawes loam	Dawes	High			0-6	High			uplands
HtB	Haxtun loamy sand, 0 to 3%	Haxtun	Low		Yes	>6-12	Low			hills, uplands
HtC	Haxtun loamy sand, 3 to 5%	Haxtun	Low	Yes	Yes	>6-12	Low			ridges
HxB	Haxtun sandy loam, 0 to 3%	Haxtun	Low			>6-12	Low			ridges
PaB	Platner loam, 0 to 3%	Platner	High			0-6	Low		If Irrigated	intermittent streams
PaC	Platner loam, 3 to 5%	Platner	High			0-6	Low		If Irrigated	drainageways, hills, ridges

Table 3-1. Selected Characteristics of Soils within the Project Area (continued)

Map Symbol[a]	Map Unit Name	Soil Name	Runoff Class[b]	Highly Water Erodible[c]	Highly Wind Erodible[d]	Topsoil thickness[e] (in)	Concrete Corrosion Hazard[f]	Bedrock Presence, Hardness, depth[g] (in)	Prime Farmland[h]	Landscape Position[9i]
Ra	Rago and Kuma loams	Rago	High			>6-12	Low		If Irrigated	uplands
		Kuma	Low			>6-12	Moderate		If Irrigated	uplands
WcC	Wages-Campus-Weld loams, 3 to 5%	Wages	Low			0-6	Low			intermittent streams
		Campus	High	Yes		0-6	Low	Hard (30)		intermittent streams
		Weld	High	Yes		0-6	Low			ridges
WeE	Wages-Eckley-Dix complex, 5 to 25%	Dix	Low	Yes		>6-12	Low			channels, intermittent streams, stream terraces
		Wages	Medium	Yes		0-6	Low			channels, intermittent streams, stream terraces
		Eckley	Medium	Yes		0-6	Low			channels, intermittent streams, stream terraces

a Map symbol, as indicated in Figure 3-3, was taken from the SSURGO2 Database for Logan and Phillips counties, Colorado.
b Runoff class as determined directly from the SSURGO2 database.
c Highly water-erodible soils are those in land capability classes 4 through 8 and land capability subclass “e” indicating an erosion limitation or those soils with an average slope > 9%.
d Highly wind erodible soils are those soils in wind erodibility group 1 or 2.
e Topsoil thickness based on query of the SSURGO2 database for A-horizon thickness and/or soil organic matter > 2%.
f Concrete corrosion hazard taken directly from the SSURGO2 database.
g Bedrock presence indicated by restrictive layer. Hard (lithic) bedrock cannot be dug into with conventional construction equipment, but may require ripping or possibly blasting.
h Prime farmland taken directly from the SSURGO2 database.
i Landscape position taken directly from the SSURGO2 database.

3.3.1.2 Environmental Consequences of the Proposed Project

Mineral Resources

There are currently no active mineral extraction operations in the proposed project area and none are anticipated to occur in the future. Consequently, the proposed project would not impact mineral resources.

Geologic Hazards

Wind turbines, underground connecting cables, access roads, and the project substation would be restricted to the nearly level ridge top, and avoid the more steeply sloping areas leading to the drainage ways. The aboveground transmission line leading to the Haxtun substation would traverse the southern unnamed tributary to Frenchman Creek and the North Fork of Frenchman Creek itself. Turbine foundations and buried connecting electrical cables would require excavations of approximately 8 feet and 4 feet in depth, respectively. Side-hill cuts required for access roads may also result in excavation; however, the depth of such excavations is expected to be similarly shallow because access roads have been restricted to the relatively flat ridge tops and would not require deep cuts.

Since construction would be confined to the ridge tops, landslide hazards and other mass wasting hazards would be minimal. In the event that side-hill cuts would be necessary, all slopes would be stabilized using best engineering practices and PCAs EROS-1 through EROS-3 (Appendix D).

Soils

Approximately 139 acres of soils would be impacted during initial construction and approximately 14 acres would remain under roads, turbines, and facilities for the expected life of the project. A substantial acreage on the nearly level ridgetop is used for agricultural production (tame pasture and cropland) and disturbed by cultivation. Minor and temporary impacts would accrue to 108 acres that would be temporarily impacted during construction but would be restored to pre-construction conditions. Permanent impacts would involve 14 acres that would be permanently converted to access roads; and turbine and transformer substation foundations. Potential impacts include soil loss through erosion, compaction and loss of structure in soils that would be disturbed or driven on during construction, and soil mixing if construction occurs during wet periods when soils are subject to excessive rutting. Adverse impacts during construction would be avoided, minimized, and mitigated by compliance with applicable PCAs such as GEN-4 and GEN-11 (Appendix D).

Project impacts would be confined primarily to only the soils that occupy ridgetops where proposed project infrastructure is planned: the Iliff loams (Map Unit 43) in Logan County and Dawes, Wages-Campus-Weld, and Platner loams in Phillips County (Figure 3-3, Table 3-2). The aboveground 115 kV project transmission line would traverse more soil map units; however, disturbances to soils as a result of traffic or excavation would be temporary and minor in extent. Project infrastructure including underground connecting cables and turbine foundations would have to accommodate both hard and soft bedrock within the estimated excavation depths of the Iliff and Campus soils (Figure 3-3, Table 3-2).

All soil surfaces that would be disturbed or compacted in areas not needed for operation would be re-graded, loosened and re-vegetated in accordance with landowner wishes or easement agreements and consistent with PCAs GEN-4 through GEN-6 (Appendix D). Construction would be temporarily suspended after wet periods when excessive rutting is observed.

Because the overall post-construction footprint of the proposed project is small (14 acres) relative to the size of the proposed project area, long-term impacts to soils would be minor. DOE does not expect indirect impacts to soil and geological resources to occur.

3.3.2 CULTURAL RESOURCES

The Office of Archaeology and Historic Preservation (OAHP) was contacted by Haxtun Wind, LLC to perform an office inventory of cultural resources of the project area for the proposed project and provide comments regarding the potential for the project to adversely affect cultural resources. Their response indicated 28 sites and 16 surveys located in T7N R45-48W and T8N R45-48W.

The OAHP provided DOE with the survey report for the single survey that had been conducted within the current project area. The Colorado Department of Highways Archaeology Unit conducted a survey of the area 1.5 miles south of Haxtun to north of Haxtun (CDOH 1985). Both sides of State Highway 59 within Sections 28, 29, 32, and 33 of Township 8 north, Range 47 west were inspected. A single Isolated Find was identified during the survey. However, the site consisted of a single artifact found on the surface of a plowed field. As a result, the site was considered ineligible for listing on the National Register of Historic Places (NRHP) due to a lack of locational integrity and limited archaeological significance.

Portions of this previously executed survey intersected with the current project's defined Area of Potential Effect (APE). The APE is a geographic area which may be directly or indirectly altered as a result of a proposed undertaking. For the current project the APE included all areas within the proposed project boundary that would be potentially disturbed by turbine excavation, trenching for installation of buried collector cables, construction of access roads, construction of transformer substations, and construction of aboveground radial transmission lines (Figure 3-4). Since the 1985 survey included only a portion of the APE, the OAHP recommended that a Class III Cultural Resource Reconnaissance Survey be conducted and that the survey results be provided to the OAHP for review of adequacy and compliance with regulations.

Haxtun Wind LLC commissioned the recommended cultural resource survey, which began by investigating all previously listed sites within 1 mile of the proposed project boundary. Archaeological investigations were conducted within the APE. Based on results from previous cultural resource investigations, the proposed project area was considered to have low potential for prehistoric archaeological deposits due to a lack of permanent water resources within the proposed project area. However, the project area was considered to have moderate potential for historic archaeological deposits relating to historic Euro-American settlement of the region, although intact historical-age archaeological sites were considered to be unlikely due to decades of historical agricultural practices.

DOE also evaluated potential adverse visual impact the proposed project may have on immediately adjacent structures. The reconnaissance survey included an inventory of structures within one-mile of the proposed turbine locations (Figure 3-4). Also as part of the survey, a visual assessment was conducted of all structures that; a) were older than 50 years; b) retained architectural integrity; and c) potentially held historic significance.

3.3.2.1 Affected Environment

Archaeological Sites

No prehistoric archaeological sites were identified during the survey. Two historic archaeological sites and two historic isolated finds were identified during the survey. A historic archaeological site was defined as a location with intact features (e.g., structural or foundation remains, privy pits, etc.) regardless of number of artifacts, or fifty or more artifacts with diagnostic potential along with the possibility of intact subsurface deposits. An isolated find for historic archaeological materials for this project was a location with less than fifty artifacts of no or limited diagnostic capability. Further, these artifacts were not associated with features and had no possibility of intact subsurface deposits.

Isolated Finds

A sparse artifact scatter of approximately 10 items was identified on a level landscape near the eastern terminus of an east to west oriented access road located along the half section line leading to Turbine 15. The scatter includes window glass, milk glass, barbed wire, and a brick. No evidence of structural remains was identified and there is no integrity to the area due to historic farming practices.

Another artifact scatter was identified on a level terrace south of French Creek near the northeastern terminus of a proposed collection cable route. This isolated find had approximately 30 artifacts including amethyst glass, whiteware fragments, a stoneware fragment, and unidentified metal fragments. No evidence of structural remains was identified and there is no integrity to the site due to historic farming practices. It could not be ascertained if the artifacts were originally with this location, or had been brought in as part of a historic dump.

The above isolated finds have no integrity and no significance under the criteria for NRHP eligibility. DOE concludes that these identified isolated finds are not eligible for listing on the NRHP and should not be considered historic properties under the definition for such in 36 CFR 800.16. The OHAP found that the project would have no adverse effect on listed or eligible historic or cultural resources.

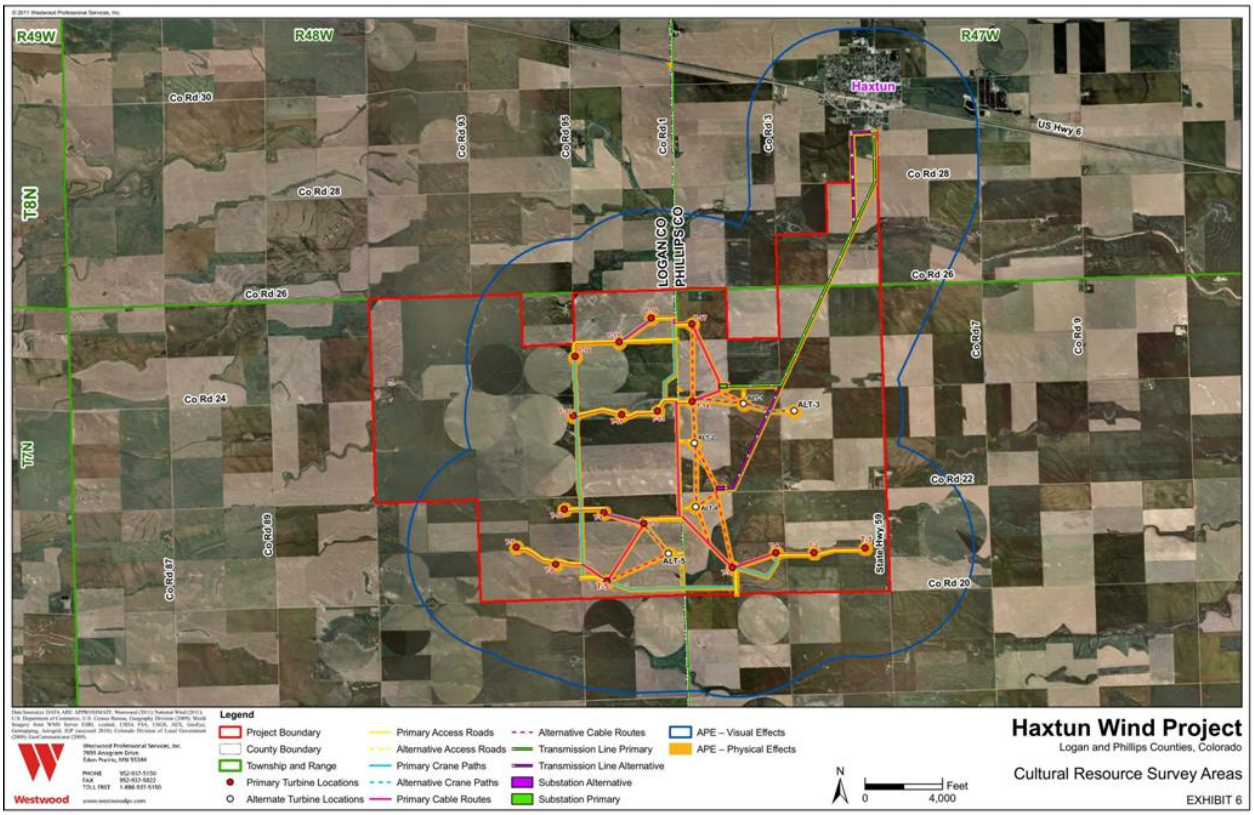

Figure 3-4. Cultural Resources Survey Areas

Historic Archaeological Sites

A historic archaeological site consisting of foundation remains was identified on the top of a small hill in Logan County. The site is located near an intersection point of several collection cable routes and access roads in the vicinity of Turbines T and A. Associated with this historic archaeological site were the concrete foundations of at least four structures. A cistern and two small depressions were also observed along with an existing windmill. It is evident that this location was a historic Euro-American homestead

with an approximate size of 4 acres. Archival research of the files maintained at the Logan County Recorder's Office in Sterling, Colorado and the General Land Office records maintained at the Bureau of Land Management office (available on-line at: http://www.glorecords.blm.gov/) identify the date of the structures most likely between 1921 and 1933 under the ownership of a Thomas M. Burnson who obtained the land under the Homestead Act of 1862. In 1933 the land was taken into public trust and then held by various land companies until 1999. This location has excellent integrity with a strong likelihood of intact subsurface deposits.

Since the immediate location of the site has not been subject to historic farming practices, the potential for intact, in situ archaeological deposits is high. Although the site maintains good integrity, further evaluation would be required in order to determine its significance.

A second historic archaeological site consisting of a scatter of historic debris and features was identified on the top of a hill in Phillips County. The site is located near the take-off point of a primary project access road and its intersection with a primary crane path. The access road begins at County Road 20 and terminates at Turbine T-3. The crane path begins at the aforementioned access road and terminates at Turbine T-5. Associated with this historic archaeological site is a scatter of historic debris consisting of amethyst glass, clear bottle glass, clear window glass, miscellaneous metal, white-bodied earthenware, stoneware, one brick fragment, one cement fragment, and a possible veterinary bottle with the Owens Illinois makers mark from plant 14 in Bridgeton, New Jersey. Plant 14 of the Owens Illinois Glass Company produced glass from 1930 to present (Lockhart 2006). Also located at the site is a possible feature consisting of a small pile of sandy soil with a single rebar rod and wooden post protruding from the center. This feature measures 6 feet by 6 feet and 2 feet high and is perhaps used to cover a well location.

A small strip of the site on the east side is now used as an agricultural field. The southern half of the site has been subject to the recent planting of three rows of conifers and a small grove of deciduous trees. The northern half of the site appears to have been disturbed and recently planted with grasses as evidenced by sparse grass and striations across the ground surface. There is no evidence of any structures or foundations within the site boundary. The site appears to have poor integrity and potential for intact subsurface deposits is low, but further evaluation is required to fully assess significance.

Assessment of Adverse Visual Impacts to Historic Structures

All structures within one-mile of proposed turbine locations were visually assessed due to the possibility of an adverse visual impact (Figure 3-4). A majority of structures included in the current inventory were less than 50 years old and not investigated further. Those few structures which were older than 50 years and maintained structural integrity were not remarkable examples of regional architectural styles. Rather, they were typical examples of local rural farming facilities that had undergone substantial modern renovations that had adversely affected the historic integrity of the structure which negated their potential to be considered historically significant within the eligibility criteria of the National Register of Historic Places (NRHP). As none of the structures met the criteria previously established for recordation during this selective survey, no structures were recorded.

3.3.2.2 Environmental Consequences of the Proposed Project

The historic isolated find sites do not exhibit sufficient features to qualify them as archaeological sites requiring further evaluation or preservation under State and Federal law. Both sites were identified during the survey of the defined APE. Both sites have the potential of being directly impacted by proposed construction activities related to the current project. However, both sites have no integrity and no significance under the criteria for NRHP eligibility. DOE concludes that these identified isolated finds

are not eligible for listing on the NRHP and should not be considered historic properties under the definition for such in 36 CFR 800.16.

The historic archaeological site in Logan County exhibits sufficient archaeological integrity and exhibits sufficient characteristics to potentially qualify for listing on the NRHP. Based on the discovery of the site, Haxtun Wind LLC has chosen to avoid the location by selecting an alternative location for the underground collector cable. With this alteration, no substantive impacts to potentially significant cultural resources would occur as a result of the project, and no adverse impacts to existing historic structures are expected. In order to ensure the integrity of any potential sites not observed during the detailed field review, Haxtun Wind LLC proposes to follow PCA Cult-4 (Appendix D).

The historic archaeological site in Phillips County has limited surface integrity, but there is a high potential for intact subsurface deposits and potentially could be eligible for listing on the NRHP. Based on the discovery of the site, Haxtun Wind LLC has chosen to avoid the location by selecting an alternative location for the access road. With this alteration, no substantive impacts to potentially significant cultural resources would occur as a result of the project, and no adverse impacts to existing historic structures are expected.

The field survey report was submitted to OAHP as requested. Comments are pending.

3.3.3 BIOLOGICAL RESOURCES

Biological resources include vegetation and animals consisting of mammals, birds, reptiles and amphibians, insects, mollusks and the habitats that support ecologically viable populations. Project impacts to vegetation and existing habitats that are expected to be negligible as discussed in Section 3.2.3 and 3.2.4, above. This section describes wildlife resources and special status and sensitive species.

3.3.3.1 Affected Environment

An environmental review from the Colorado Natural Heritage Program office (CNHP) at Colorado State University (Appendix C) focused on a 103-square-mile study area that encompassed the much smaller 14.5-square-mile proposed project area. This study indicated that the proposed project would be in one of the least ecologically diverse parts of Colorado. The environmental review coordinator remarked that the reviews typically result in identification of several rare species or community reports, but that this search yielded very little information as there were no tracked records in the search area provided to CNHP.

CNHP indicated that no known Potential Conservation Areas occur within the proposed project area and that no known “elements” are known to exist within 2 miles of the 103 square-mile study area. Potential Conservation Areas are areas of geographic focus for conservation of at-risk species. Elements are biodiversity units of conservation attention that may be rare species, ecological communities, animal assemblages, or complexes.

Vegetation types within the approximately 9,300-acre proposed project area were evaluated in the field on May 27, 2010 (Appendix C) and mapped on aerial photographs at a scale of 1 inch = 1,000 feet (Figure 3-2). No detailed vegetation species lists were prepared, but where grasslands were observed, they were characterized as either native plant communities or introduced, non-native species. DOE also obtained and reviewed land cover mapping for the project area as indicated in the U.S. Geological Survey National Land Cover Database.

Native wildlife typically require suitable natural habitat to fulfill food, cover, and water requirements. Long-term agricultural disturbance generally reduces plant diversity dramatically and converts suitable

habitat to lower quality habitat. Where food is available in agricultural land, animal populations that utilize the food source may be transients. However, most animals capable of moving to and residing in more diverse environments would do so.

There are no fisheries in the proposed project area due to lack of suitable streams or lakes/reservoirs to support fish populations.

Vegetation

Based on land cover, as shown in Figure 3-2, 76 percent of the 9,271-acre project area consists of cultivated cropland. The predominant cultivated crop is dry land winter wheat. Seven quarter sections are under irrigation with center pivots and most such areas are planted with corn.

Non-native grasslands cover approximately 22 percent of the project area. No native grasslands were observed within the project area. Most grasslands lie on steeper hillsides or ridge tops within crop fields. A small portion of the mapped grassland encompasses wildlife shrub plantings. The largest contiguous grassland area (currently used as pasture) covers about 944 acres. Most grasslands are grazed or hayed and all appear to be planted to introduced forage species such as smooth brome (*Bromus inermis*) and timothy (*Phleum pratense*). Many of the grasslands are heavily invaded by cheatgrass (*Bromus tectorum*).

Birds

A series of field reviews and migration surveys were performed at the site. Work plans developed in conjunction with the CDOW governed practices for point count studies during fall migration, winter conditions, spring migration, and spring breeding. These studies built on initial observations during an initial field review on May 26-27, 2010. A list has been compiled of all bird species observed incidental to the initial raptor nest search activities (Appendix C). These surveys provide an excellent overview of the bird species using the project area and surrounding area. Given that the habitats in the area are disturbed and primarily agricultural, birds that are present are adapted to disturbed environments. The avian community is dominated by passerines, most of which are common or abundant in an agricultural landscape during migration and breeding seasons. The most abundant species observed was the horned lark, a common species in Colorado. Waterfowl were notably scarce at Haxtun, presumably due to the lack of water features in the vicinity. One golden eagle was observed on one occasion during the spring migration study within the rotor swept height. There was no evidence of Federal- or State- listed species using the site, including Federal candidate or proposed species. The project area generally lacks habitats that typically support rare species (i.e., managed lands, large blocks of CRP or water features). It also lacks prominent migration stopover habitat for birds.

Native species that have a high fidelity to high quality natural environments [e.g., greater and lesser prairie chickens (*Tympanuchus cupido* and *Tympanuchus pallidicinctus*), mountain plover (*Charadrius montanus*), loggerhead shrike (*Lanius ludovicianus*), Cassins sparrow (*Aimophila cassinii*), burrowing owl (*Athene cunicularia*), and chestnut collared longspur (*Calcarius ornatus*)] were not observed, and are not expected to occur, as high-quality native environments typical of the Colorado High Plains are lacking in the proposed project area. A list of birds observed and a discussion of native bird species is in Appendix C.

CNHP indicated that the nearest tracked element is an occurrence record for a Greater Prairie-chicken approximately 8.5 miles from the southeast corner of the proposed project area. This distance is consistent with CDOW mapping of Greater Prairie-chicken habitat provided in Appendix C.

The mountain plover was proposed for listing under the Endangered Species Act in June 2010. To address this proposed listing, field survey work was amended to include the species. On May 12, 2011,

the U.S, Fish and Wildlife Service announced that the species was determined to not merit listing because threats to the species were not as significant as earlier believed (76 FR 27756). Based on this withdrawal of the proposed listing, field observations for the species were discontinued at the site.

Mammals (excluding bats)

Mammals that occur in the project area are generally common or abundant in northeastern Colorado and are also mostly well adapted to agricultural practices. These include both predator species and small prey species. Mammalian predator species that are likely to occur in the proposed project area include coyote (*Canis latrans*), red fox (*Vulpes vulpes*), swift fox (*Vulpes velox*), raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), American badger (*Taxidea taxus*), eastern spotted skunk (*Spilogale putorius*), and striped skunk (*Mephitis mephitis*).

A number of small mammals may occur in the proposed project area. Lagomorphs (rabbits and hares) that occur in the proposed project area include desert cottontail (*Sylvilagus audubonii*), eastern cottontail (*Sylvilagus floridanus*), and black-tailed jackrabbit (*Lepus californicus*). The white-tailed jackrabbit (*Lepus townsendii*) is less likely to occur due to its preference for less-disturbed native grasslands. Rodents that occur in the proposed project area likely include spotted ground squirrel (*Spermophilus spilosoma*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), black-tailed prairie dog (*Cynomys ludovicianus*), plains pocket gopher (*Geomys bursarius*), plains pocket mouse (*Perognathus flavescens*), silky pocket mouse (*Perognathus flavus*), hispid pocket mouse (*Chaetodipus hispidus*), Ord's kangaroo rat (*Dipodomys ordii*), western harvest mouse (*Reithrodontomys megalotis*), plains harvest mouse (*Reithrodontomys montanus*), deer mouse (*Peromyscus maniculatus*), northern grasshopper mouse (*Onychomys leucogaster*), bushy-tailed woodrat (*Neotoma cinerea*), prairie vole (*Microtus ochrogaster*), and house mouse (*Mus musculus*). Other mammals that could occur in the proposed project area include Virginia opossum (*Didelphus virginianus*), least shrew (*Cryptotis parva*), and eastern mole (*Scalopus aquaticus*). Mammals in the project area are expected to be largely absent in tilled agricultural lands or transient as they may use the area for food and seasonal cover when available. Smaller areas of native and non-native grassland in pasture land and along small drainages are likely used on a more permanent basis by small mammals such as rodents and smaller predator species.

No prairie dog colonies were observed in the project area during the May 26-27, 2010 field review. Prairie dogs appear to be absent within the proposed project area, most likely due to the predominance of annual agricultural crops and the small amount of the non-native grassland that remains. The *Conservation Plan for Grassland Species in Colorado* (CDOW 2003) suggests there is at least one prairie dog colony near the project location, but field observations did not corroborate this. The swift fox has been documented to occur throughout eastern Colorado (CDOW 2010), but there is relatively little grassland habitat suitable for swift fox in the project area.

Bats

Twenty-one species of bats are known to occur in Colorado according to CDOW (2010) and Bat Conservation International (Appendix C). Only five of the 21 species have a moderate potential to occur in the project area, and none of the 21 species have high potential to occur in the project area. The species with moderate potential to occur in the project area are relatively common and include the big brown bat (*eptesicus fuscus)*, silver-haired bat (*lasionycteris noctivagans)*, red bat (*lasiurus borealis)*, hoary bat (*lasiurus cinereus*), and the western small-footed myotis (*myotis ciliolabrum*). The big brown bat is often associated in with humans and development and has been documented in Logan County, but not in Phillips County. The silver-haired bat, red bat, and hoary bat are solitary tree-roosting species that account for a high proportion of the bat fatalities associated with wind projects. The silver-haired bat and red bat are often associated with woodland habitat such as riparian corridors, but the hoary bat has been known to use any habitat with trees. The western small-footed myotis is considered widespread and common.

A pre-construction acoustic monitoring program was undertaken in the fall of 2010 to evaluate the presence of bats in the project area. Bat echolocation calls were recorded from the evening of August 18th through September 30th each day beginning 30 minutes before sunset and ending 30 minutes after sunrise. As recommended by the CDOW, a single SDI Anabat unit was installed to record calls 44 meters (144 feet) above ground (see CDOW comment letter in Appendix B). Echolocation calls were successfully recorded throughout the monitoring period and analyzed for species and flight characteristics. A total of 17 bat passes were recorded in the six week period that were most likely composed of two to three unique bat species (silver-haired, hoary bats, and possibly big brown bats). This is considered a very low incidence of bat echolocation calls, which indicates very low bat activity in the area. It also appears likely that 3 of the 17 bat passes were 'repeat passes' made by the same individual bat just seconds after the first pass. These repeat passes would indicate even fewer bats. The overall low activity most likely is due to poor habitat and high winds.

Reptiles and Amphibians

A variety of reptiles and amphibians may occur in the proposed project area. Ornate box turtle (*Terrapene ornate*) and bull snake (*Pituophis catenifer*) were observed. Others that may occur include plains spadefoot (*Spea bombifrons*), Woodhouse's toad (*Bufo woodhousii*), Great Plains toad (*Bufo cognatus*), lesser earless lizard (*Holbrookia maculate*), prairie lizard (*Sceloporus undulates*), six-lined racerunner (*Aspidoscelis sexlineata*), many-lined skink (*Eumeces multivirgatus*), glossy snake (*Arizona elegans*), western hognose snake (*Heterodon nasicus*), bull snake (*Pituophis catenifer*), milk snake (*Lampropeltis triangulum*), and western rattlesnake (*Crotalus viridis*).

3.3.3.2 Environmental Consequences of the Proposed Project

Project impacts to vegetation and wildlife are expected to be small as little high quality habitat is present within the project area. These impacts would be subject to PCAs that are designed to avoid and minimize impacts (Appendix D). Examples include WATER-4 through WATER-7, GEN-1, 5, 6, and 10, EROS-2 and 3, VEG-1, 2, and 3, and WILDLIFE-1 and 2. Additional wind turbine siting recommendations are in Appendix C.

Vegetation

The project is not expected to adversely affect native plant communities of high ecological integrity or sensitivity because no such plant communities are known to exist within the project area. Fifteen of eighteen (83 percent) of the proposed turbines and four of the five alternative turbine locations (80 percent) have been preliminarily sited in cultivated fields to minimize the fragmentation of the remaining non-native grassland remnants. No threatened or endangered plant species are known to occur in the project area. All areas temporarily affected by construction would be restored according to the applicable PCAs VEG-1 through VEG-3 (Appendix D). Overhead electrical power transmission lines conveying power from the transformer substation in the project to the Haxtun Substation would cross the riparian area adjacent to Frenchman Creek. All impacts would be avoided by spanning the creek and associated riparian wetlands (PCS Water-4; Appendix D).

Terrestrial Animals: Mammals, Reptiles, Amphibians, Insects.

Infrastructure for the proposed project is generally confined to intensively managed agricultural land with limited habitat for native terrestrial animal species. The lack of water resources in these areas further limits the populations of terrestrial animals. Those species that occur within the primarily agricultural areas proposed for disturbance would be common and transient. These species would be more common in disturbed grassland habitats in riparian areas and steeply sloping ground. Terrestrial animals that may be in areas proposed for construction would be able to move to nearby undisturbed areas. Temporarily disturbed areas would be returned to pre-disturbance conditions, and only a small acreage of primarily agricultural land is proposed for permanent conversion to project use. It is unlikely that the project would

have a substantive adverse impact on terrestrial animals. Temporary impacts during construction would consist of noise and activity disturbance and would be minor.

Birds

The bird species observed within and around the proposed project area are all common and most are ubiquitous throughout the project area (Appendix C). All of the observed species are adapted to agricultural activities and associated fragmented habitats. Accordingly, the small amount of additional habitat fragmentation associated with the three turbines (Turbines 1, 2, and 4) and their respective access roads on non-native grassland is not expected to have any meaningful impact on these species.

No raptor nests were observed within the proposed project area during a May 26-27, 2010 field review. Additional observations made during avian survey work on the site in October-September 2010, February-March 2011, and April –June 2011 did not reveal any raptor nests within the project area (Appendix E). The nearest possible raptor nest, outside the area along the western project boundary, is 9,800 feet (1.85 mile) away from the nearest proposed turbine location (including alternatives). This exceeds the most restrictive CDOW guidance on raptor nest setbacks, which recommends a 2,640 foot (0.5 mile) setback from ferruginous hawk nests. It is possible that a small number of raptors could incur direct mortality from collisions with turbine blades while hunting or migrating through the area. However, the project area does not contain any topographic features or habitat types that would concentrate or funnel raptor movements during such activities. Any potential for direct raptor mortality is expected to be low.

Some birds would be struck and killed by the turbine blades during operation of the proposed project. However, of the millions to billions of birds killed annually by collisions with human made structures, wind turbines account for a minor percentage. In a review of studies on collision mortality by the National Wind Coordinating Committee (NWCC 2001), the major impact was by vehicles.

- Vehicles: 60 million – 80 million
- Buildings and windows: 98 – 980 Million
- Power lines: tens of thousands – 174 million
- Communication towers: 4 million – 50 million
- Wind generation facilities: 10,000 – 40,000

Wind turbines are estimated to result in 2.19 avian fatalities per turbine per year in the United States (NWCC 2001). The rate of bird fatality due to turbine collisions during this proposed project is expected to be within the range of bird fatalities reported in studies discussed in Appendix C and in NWCC (2001). Siting turbines in actively cropped areas may help reduce the potential for avian fatalities. Overall, bird fatality due to collisions with turbines from the proposed project would generally be expected to fall between 38 and 105 birds per year.

To refine the potential impacts of operating wind turbines on bird mortality resulting from wind turbine collisions, Haxtun Wind LLC agreed to conduct a series of pre-construction avian surveys of the project area during the fall migration, over-winter conditions, the spring migration, and spring breeding seasons (Appendix E). Survey methods were determined in collaboration with the CDOW. These surveys were conducted in September and October 2010, February and March 2011, April and May 2011, and June 2011. Point count surveys were conducted on 12 individual days along roadside transects. Methods and locations for the specific locations were selected to provide comprehensive coverage of the project area. Observations were recorded utilizing three altitude-of-flight criteria, below, within, or above the rotor swept height.

There were 33 species of birds observed in flight, and only four of these species had a measurable index of collision hazard (I > 0.001). These species include Horned Lark, Swainson's Hawk, Killdeer, and Mourning Dove. Overall, the risk for avian fatality at Haxtun is considered to be low, as only 10 percent of flights were within the rotor-swept height (RSH). Passerines typically account for most of the bird fatalities at wind energy facilities, but there is no clear correlation between high passerine use and fatality rates. Raptor fatality is likely to be low at the proposed site despite relatively high raptor use because the project will integrate mitigation measures into turbine design and siting.

Seasonal avian use at the project site was variable among seasons and bird groups. Additionally, migration patterns were not evident based on mean use. For example, spring and fall mean use numbers would be expected to be higher than wintering and breeding seasons because of migratory species moving through the area. This was not the case as wintering mean use for all birds was higher than fall mean use. Similar patterns were evident within the bird groups amongst seasons. This may be a function of the weekly survey timing in each season – perhaps major migration events occurred on days that did not coincide with the survey. Alternatively, it may indicate a lack of migration stopover habitat and/or routes through the area and that this portion of northeast Colorado may be more important to wintering species.

The risk of avian fatality can be reduced with project design strategies that minimize effects on avian habitats such as woodland, grassland, and pasture. The project turbine will be sited responsibly to minimize impacts on wildlife and habitats. Most proposed turbines (83 percent) are sited in cultivated fields to minimize the fragmentation of the remaining non-native grassland remnants. Although some habitat impacts are unavoidable, the proposed turbine locations minimize encroachment on potentially sensitive habitats, principally grassland areas. The risk to birds from the project is expected to be low.

Bats

The project area includes relatively little suitable roosting and foraging habitat for bats. Bat roosting habitat consists primarily of tree cavities, trees with loose bark, caves, mines, buildings, and rock crevices. The 9,721-acre project area includes no known caves, mines, or large rock outcrops. Woodlands cover less than 1 percent of the project area and the area includes only 11 building sites. Many bat species forage near water and the project area includes only two intermittent streams and two small ponds. The lack of standing water limits the availability of insects that depend on a water source. The lack of favorable habitats is expected to limit the potential abundance of resident bats in the project area.

However, some bat mortality may occur. Though suitable habitat is limited within the proposed project boundary, bat mortality could occur during the fall migration. Bats are relatively long lived and produce few young per breeding season, thus turbine-related mortality may potentially affect populations if the cumulative mortality rates affect the reproductive success.

Special Status and Sensitive Species

Endangered, threatened, and special concern species listed for the State of Colorado by the CDOW (2010) and for Logan and Phillips Counties by the USFWS (2010) include 19 birds, 13 mammals, 10 reptiles, seven amphibians, two mollusks, and one plant. A review of rare species distributions, habitat associations, and project area characteristics indicates that that none of these species have a high potential to occur in the project area (Appendix C). Based on a desktop review and observations made during a May 26-27, 2010 field review documented in Appendix C, four Colorado State-listed Special Concern species have a moderate potential to occur in the project area, including one bird (ferruginous hawk), two mammals (Northern pocket gopher and swift fox), and one reptile (common garter snake).

Federally Threatened and Endangered Species

Birds

The three bird species Federally listed as endangered or threatened and potentially occurring in Logan and Phillips Counties have very limited potential to occur in the project area. The piping plover (Federal-/State-listed threatened), whooping crane (Federal-/State-listed endangered), and least tern (Federal-/State-listed endangered), are listed by the USFWS as potentially occurring in Logan County, but not in Phillips County, as discussed below.

- The piping plover uses sandy lakeshores and riverbeds and may occur along the South Platte River, which is located 16 miles northwest of the project area. Because the project area contains parts of only two intermittent streams and no suitable piping plover habitat, this species is not expected to occur in the project area.

- The whooping crane and least tern are species associated with the South Platte River and require more wetland habitat than exists in the project area. Although the northeastern corner of Colorado is approximately 28 miles west of the 200-mile-wide whooping crane migration corridor, whooping cranes are occasionally observed in Colorado during migration. Of the 1,060 whooping crane observations recorded between 1943 and 1999 by Austin and Richert (2001), only five occurred in Colorado. None of these five were located in Logan or Phillips counties.

Mammals

There are no Federally protected endangered, threatened, or protected species in Logan and Phillips counties, Colorado.

Reptiles, Amphibians, and Mollusks

There are no Federally protected endangered, threatened, or protected species in Logan and Phillips counties, Colorado.

Fish

The only Federally listed fish that is known to occur in Logan and Phillips Counties is the pallid sturgeon that is listed by the USFWS because of its association with the South Platte River. The pallid sturgeon is a large bottom feeding fish associated with large, silty prairie rivers. There is no suitable habitat for the pallid sturgeon within the proposed project area, and the proposed project area is entirely outside of the drainage of the South Platte River.

Plants

The Western prairie fringed orchid (*Platanthera praeclara*) is a Federally listed threatened plant that could occur in Logan County. Preferred habitat for this species is unplowed, calcareous prairies and sedge meadows. Plants have also been observed in earlier successional communities such as borrow pits, old fields, and roadside ditches. The major historical cause of the species' decline has been the conversion of prairie and sedge meadow habitat to agricultural use.

State-Listed Threatened, Endangered, and Special Concern

The State of Colorado does not identify listed species by county, but provides a statewide list that was assessed in Appendix C. Endangered, threatened, and special concern species listed for the State of Colorado by the CDOW (2010) that are likely to occur in Phillips and Logan counties (exclusive of Federally listed species) include four birds, 3 mammals, 2 reptiles, and one amphibian (Appendix C).

Birds

The plains sharp-tailed grouse (*Tympanuchus phasianellus jamesii*), bald eagle (*Haliaeetus leucocephalus*), burrowing owl (*Athene cunicularia*) and ferruginous hawk (*Buteo regalis*) are State-listed endangered, threatened, threatened, special concern species, respectively. Nesting habitat for prairie sharp-tailed grouse is structurally diverse, with a mixture of grasses, shrubs, and forbs representing high-quality nesting habitat. For wintering habitat, prairie sharp-tailed grouse require deciduous trees and shrubs for feeding, roosting, and escape cover. Common tree and shrub species used by prairie sharp-tailed grouse include quaking aspen (*Populus tremuloides*), cherry (*Prunus* spp.), serviceberry (*Amelanchier* spp.), snowberry, sagebrush (*Artemesia* spp.), hawthorn (*Crataegus* spp.), willow (*Salix* spp.), and birch (*Betula* spp.). Like prairie-chickens, sharp-tailed grouse mate communally in leks. The nearest plains sharp-tailed grouse range and the nearest lek mapped by CNHP and CDOW are 3.4 and 8.5 miles from the Haxtun project site, respectively (Appendix C). The project area does not contain suitable habitat for this species.

Bald eagles utilize rivers and larger water bodies and for foraging and adjacent wooded areas for nesting and roosting. CNHP and CDOW mapping indicates that bald eagle and osprey habitat in all seasons is concentrated along the South Platte River about 15 miles northwest of the project site (Appendix C). The Haxtun Wind project site does not encompass any water bodies that would offer suitable habitat for these species.

Burrowing owls and ferruginous hawks are both associated with grasslands, but neither species was observed during the various field reviews (Appendix C). The ferruginous hawk also inhabits dry shrublands and the burrowing owl is often associated with prairie dog colonies, but may use other types of rodent burrows (e.g., ground squirrels). The only burrows with surface openings observed during the May 26-27, 2010 field review were badger burrows. Grasslands cover only about 22 percent of the project area and no prairie dogs colonies were observed during the field reviews (Appendix C).

Mammals

The black-tailed prairie dog and northern pocket gopher are known to occur in Logan County and are considered likely to occur in Phillips County, respectively (CDOW 2010). No prairie dog colonies were observed in the project area during the May 26-27, 2010 field review. Prairie dogs appear to be absent within the proposed project area, most likely due to the predominance of annual agricultural crops and the small amount of the non-native grassland that remains. Aerial photography for some parts of the proposed project area showed signatures of burrowing but upon inspection in the field these were found to be ant mounds (Appendix C). The *Conservation Plan for Grassland Species in Colorado* suggests there is at least one prairie dog colony near the project location, but field observations did not corroborate this. The swift fox has been documented to occur throughout eastern Colorado (CDOW 2010), but there is relatively little grassland habitat suitable for swift fox in the project area.

Reptiles and Amphibians

Other listed species with potential to occur in the proposed project area include two reptiles (the yellow mud turtle and the common garter snake, *Kinosternon flavescens* and *Thamnophis sirtalis*, respectively), and one amphibian (northern leopard frog, *Rana pipiens*). All of these species are associated with aquatic or semi-aquatic habitat that occur in parts of the Haxtun Wind project area that would be unaffected by construction or operations and maintenance activities.

Environmental Consequences of the Proposed Project

The project area contains little suitable habitat and is outside the occupied range of nearly all listed species. Most listed species depend upon wetlands and native grasslands, which are generally lacking in the proposed project area. Because of poor habitat availability, the proposed project area is unlikely to support endangered, threatened, or special concern species except on an incidental or limited occurrence

basis. Based on the information presented here, DOE concludes that the proposed project would have no effect on Federally protected, threatened, endangered, or proposed species or their critical habitat. The following discussion supports this conclusion.

Birds

It is extremely unlikely that any of Federally listed threatened or endangered bird species would utilize or travel through the proposed project area which is in the middle of an area of intensive agriculture. What little native short grass habitat is fragmented and is generally present only in steep areas and adjacent to drainage ways. The nearest potential extensive wetland habitat required by whooping cranes and piping plovers lies along the South Platte River and areas of sand hills approximately 20 miles northwest and 20 miles southeast of the proposed project area, respectively.

Ferruginous hawks may be present near the project area. Potential effects on raptors including ferruginous hawks are discussed in the previous paragraphs and in detail in Appendix C.

Other Animals

The project is not expected to adversely affect the few rare mammals with potential to occur in the project area (black-tailed prairie dog, northern pocket gopher, and swift fox) because:

- none of these species fly so there is no potential for direct mortality,
- none of these species have been documented to occur in the project area,
- potential habitat for these species in the project area is very limited, and
- turbines have been located in sites that provide little or no potentially suitable habitat for listed species.

Although the yellow mud turtle, the common garter snake, and the northern leopard frog could be associated with the two small stock ponds and intermittent streams within the project area, project construction and operation would have minimal to no effect on these habitats. The only anticipated impacts would be temporary and associated with two underground cable crossings of intermittent streams. The listed fish and plant species would only be associated with downstream reaches of the South Platte River, which is entirely outside the drainage area of the project. Therefore, listed reptiles, amphibians, fish, and plants are not expected to be adversely affected by the proposed project.

3.3.4 SOCIOECONOMICS

The proposed project area is located in a rural, agricultural area immediately south and west of Haxtun, in Logan and Phillips counties, Colorado.

3.3.4.1 Affected Environment

For the purposes of this EA, the APE for socioeconomic impacts includes the towns of Sterling, Fleming, Haxtun, and Holyoke and Logan and Phillips counties, Colorado. Fleming (Logan County) and Holyoke (Phillips County) are 11.4 and 17.5 miles northwest and southeast of Haxtun, respectively (Figure 1-1). The city of Sterling, Colorado (Logan County), is approximately 32 miles west of Haxtun along US Highway 6, has a population of 11,300 people and is a major service area for northeastern Colorado.

Holyoke and Sterling are the largest towns closest to the proposed project area. Sterling, Haxtun, Holyoke, and Fleming have slightly lower median household incomes than Logan and Phillips counties, and both counties have substantially lower incomes than Colorado as a whole (Table 3-2). The percent of the population that is living below the poverty line is similar among all four towns and both counties. Racial distributions in Haxtun, Holyoke, and Fleming are similar, reflecting a population that is

dominantly white. Holyoke and Sterling have a substantially larger Hispanic population than either Haxtun or Fleming.

Table 3-2. Selected Socioeconomic Data for Towns near the Project area, Associated Counties, and the State of Colorado

City/ County/ State	2000 Population	Racial Distribution				Median Age	Income			Avail. Hotel Rooms[a]
		White	His-panic	African Am.	Native Am.		Median Household Income	Per Capita Income	Percent below Poverty	
Haxtun	982	97.1	2.0	0.1	0.5	44	$30,265	$16,370	12.4	0
Fleming	426	96.7	2.3	2.3	0.2	39	$26,484	$12,113	12.4	0
Holyoke	2,261	89.6	20.4	0.0	0.3	38	$30,984	$15,697	14.6	53
Sterling	11,360	90.8	14.2	0.8	0.8	35	$27,337	$15,287	12.4	416
Logan County	20,504	91.7	11.9	2.0	0.6	36.5	$32,724	$16,721	12.2	-
Phillips County	4480	93.0	11.8	0.2	0.3	39.8	$32,177	$16,394	11.6	-
Colorado	4,301,261	82.8	17.1	3.8	1.0	34.3	$57,184	$24,049	9.3	-

Source: U.S. Census 2008.

a. Available hotel rooms determined by web query and contacting hotels by phone. Additional temporary housing is available in the towns of Yuma CO (3 motels, 41 miles from the project site); Julesburg, CO (3 motels, 41 miles from the proposed project site); Sindney NE (7 motels, 74 miles from the proposed project site), and Ogallala NE (8 motels, 60 miles from the proposed project site).

Phillips County (688 square miles, population density 6/square mile) has a lower population than Logan County. Over half the population of Phillips County resides in Holyoke, the county seat, and one-quarter of the population resides in Haxtun. Logan County (1,845 square miles, population density 11/square mile) is almost three times as large as Phillips County. Half the county population lives in the town of Sterling. Both counties are dominated by agriculture; however, Sterling is attracting several industries to Logan County.

The economy of Logan and Phillips counties is still largely reliant on agriculture. However, manufacturing, renewable energy, and business services have emerged as substantial forces in Logan and Phillips Counties. These sectors, combined with the City of Sterling's "retail hub" status, have diversified the economy and work force in Logan County especially. With its lower population and smaller cities that are more distant from interstate transportation, Phillips County is more agricultural.

3.3.4.2 Environmental Consequences of the Proposed Project

No substantive impacts to the socioeconomics of the area are expected. However, there would be a short-term economic benefit and a minor long-term economic benefit to the area. Approximately 125 construction jobs would be required during the approximately 4- to 6-month construction phase. O&M would require up to three full-time personnel for the expected life of the project. Most construction workers are expected to commute from Sterling, Fleming, Haxtun, or Holyoke Colorado and surrounding areas. Specialty construction workers, with specified wind power construction experience, would come from out-of-state, and the out-of-state work force is expected to be about 50 percent or about 60 workers, who would likely commute from Sterling during the construction period. Sterling has 567 vacant housing units and over 500 hotel rooms (Logan County Chamber of Commerce 2008b). There is adequate housing and associated infrastructure to support the 60 additional workers during the construction period.

The proposed project would generate sales and use taxes for goods and services purchased during construction and operation. It would also provide property taxes to the town of Haxtun and to Logan and Phillips Counties. All of these impacts would be beneficial to the affected towns/cities, to Logan and

Phillips Counties and to the State of Colorado. Logan and Phillips Counties and Sterling, Fleming, Haxtun, and Holyoke are relatively low-income communities (when compared to Colorado as a whole). The proposed project is expected to generate revenue needed by the county and the city, so no adverse effects to low-income communities would occur. Furthermore, the proposed project would generate revenue for the private landowners on whose land the proposed project is located, further benefiting the area's economy.

Because additional construction workers would be in the area and because there would be an increase in traffic, the proposed project could result in a small, temporary increase in the need for law enforcement. There would be no expected population increase resulting from the proposed project that would result in housing demands and public service demands that could not be met by existing resources in the area.

3.3.5 AESTHETICS AND VISUAL RESOURCES

Visual resources refer to all objects (man-made and natural, moving and stationary) and features (e.g., landforms and water bodies) that are visible on a landscape. These resources contribute to the scenic or visual quality of the landscape. A visual impact is the creation of an intrusion or perceptible contrast that affects the scenic quality of a landscape. A visual impact can be perceived by an individual or group as either positive or negative, depending on a variety of factors or conditions (e.g., personal experience, time of day, weather/seasonal conditions). Landscapes and their visual qualities exist in a dynamically changing physical, social and economic context, resulting in shifting and competing demands for land uses that may impact visual qualities.

3.3.5.1 Affected Environment

There is no State or national parks within 40 miles of the proposed project area. North Sterling State Park and the Pawnee National Grasslands are located 47 and 75 miles to the northwest of the proposed project area. The area reflects a rural setting with both occupied and abandoned farmsteads scattered along gravel roads. Land use within and adjacent to the proposed project area is a mixture of irrigated, tilled and Conservation Reserve Program (CRP) agricultural fields. Steeply sloping land and areas adjacent to intermittent to seasonal drainage ways are primarily in native grassland used for grazing or hay. The landscape is characteristically flat to gently rolling, with the green and brown colors of the agricultural fields interspersed with linear features such as roads and transmission lines.

The town of Haxtun is located immediately north of the Haxtun Substation. That substation would serve as the proposed project interconnection with Western's 115 kV Sterling to Holyoke powerline. Potentially sensitive receptors in the town of Haxtun include the Haxtun schools, a cemetery, the Haxtun town park, and a hospital. U.S. State Highway 6 is a regionally important highway that carries traffic between the rural towns of Holyoke to the east and Fleming and Sterling to the west. Colorado State Highway 59 serves as the eastern boundary of the proposed project site. Several county roads traverse the area generally on section lines. County roads in the proposed project area are not used often due to the sparse population within the area, but do serve to convey rural residents to Haxtun. This area of eastern Colorado is home to numerous wind turbines and the site of wind farms in the area is common. There are reportedly 339 wind turbines in Logan County. The visual elements of the proposed project area are common in northeastern Colorado.

Viewers in the general vicinity expect above-average scenery from a particular viewpoint. In the case of county roads, travelers are moving from place to place and expect to arrive expeditiously via a State or Interstate highway. Travelers typically choose U.S. Highway 6 and State Highway 59 to quickly move through the region. Conversely, any route that carries the official designation of a scenic highway tends

to attract motorists for the purpose of viewing scenery. U.S. Highway 6 and State Highway 59 are not designated as scenic highways.

The following discussion addresses the visual appearance of proposed project turbines, which would be the dominant visual feature of the project. The rotors would be 100 meters (328 feet) in diameter and would be attached to a nacelle placed on the top of an 80- meter (262-foot) tall tower for a total maximum height of approximately 130 meters (427 feet). The tower tapers from 15 feet in diameter at the base to 8.5 feet in diameter at its top. The rotor consists of three blades mounted to a hub at one end of the nacelle. The nacelle has approximate dimensions of 12 feet high by 12 feet wide by 28 feet long, and rotates to orient the blades into the direction of the wind. The turbines are typically painted white to blend in with the sky and clouds. The 18 turbines would be organized along three east-west trending strings that extend approximately 1.25 miles. A photo of a GE 1.6-100 wind turbine in an industrial wind facility setting is provided in Figure 3-5. Table 3-3 describes distances between the turbine and the various receptors.

Figure 3-5. Photo of GE 1.6 100 Wind Turbines in an Industrial Wind Facility Setting

Table 3-3. Maximum and Minimum Distances Between Turbines and Turbine Angular Size at Potentially Important Receptors

Receptor	Closest Turbine (feet)[a]	Angular size (degrees)[b]	Furthest turbine (feet)	Angular size (degrees)	Notes
U.S. Highway 6	13,100	1.87	27,000	0.91	The turbine strings would be oriented parallel to the road and would present a visual appearance of a long string of turbines with minimal overlap.
State Highway 59	1,200	20.37	19,200	1.27	The turbine strings would be oriented perpendicular to the highway and would present a visual appearance of a cluster of turbines with considerable overlap.
Haxtun School	16,900	1.45	31,600	0.77	The Haxtun High School, junior high school and Elementary School are one-story facilities located in the far north central portion of the city. Buildings and residences are present to the south that would obstruct the view of the turbines.
Haxtun Cemetery	14,300	1.71	28,900	0.85	The Haxtun Cemetery is located in the far northwestern portion of the city. Buildings and residences are present to the south that would obstruct the view of the turbines.
Haxtun Park	17,100	1.43	31,800	0.77	The Haxtun Community Park is located in the far northeast corner of the city. Buildings and residences are present to the south that would obstruct the view of the turbines.
Haxtun Hospital	15,400	1..59	30,100	0.81	The Haxtun Hospital district is a one-story 25-bed facility that is located in the center of the city. Buildings and residences are present to the south that would obstruct the view of the turbines.

a. The distance from the feature to the closes turbine was determine in a GIS.
b. The angular size was determined using a web served angular size calculator (http://www.1728.com/angsize.htm).

- The turbines would appear smaller and less obvious from US Highway 6. At the closest approach, the nearest turbine would be similar in size to a grain elevator seen from approximately one mile. The turbines would appear as a string extending for 1.5 miles.

- The turbines would appear very large to persons living in residences within the project boundary. Seen from 1,000 feet, the turbines would appear slightly larger than a 2-story house at 100 feet. At one mile, the turbines would appear slightly smaller than a water tower seen at 1,000 feet.

The proposed project wind turbines would be new and visible components of the rural landscape in and near the proposed project area. However, because of the placement of the towers south of Haxtun, the wind towers would be screened from view from important receptors in that town. Moreover, the turbines, while being highly visible components of the landscape, would be at a distance where they would not be overwhelming from State Highway 59 or US Highway 6. The turbines are symmetrical and would be neutral white to blend in with the sky. When seen from a distance, these features may be considered by many to be a visual amenity, while others would consider them an adverse addition to the landscape.

Visual impacts would also include short-term direct effects from ground disturbances and the visibility of construction crews, equipment, and vehicles working in the proposed project area and access roads. Short-term visual impacts during construction may be adverse, but would be minor because these visual impacts would last less than 6 months, and Haxtun Wind LLC would implement standard practices to reclaim disturbed landscapes to pre-disturbance conditions.

The substation, access roads, overhead power lines, vehicles, and dust plumes created during construction would also impact visual resources to lesser degrees. The transformer substation would be viewed most frequently by local landowners and travelers, and it would represent an industrial-type facility in a rural landscape. The proposed project area already contains several County roads and a number of private roads; construction of approximately 5.9 miles of access roads would constitute a minor increase in the number of roads in the proposed project area. During construction, vehicles and dust would be a fairly constant presence in the proposed project area. During the life of the project, vehicle traffic would be only slightly more than current traffic levels.

The visual impacts associated with this project would be moderate and consistent with the current viewshed in this part of Colorado.

3.3.6 ROADS, RECREATION, AND COMMUNICATION TOWER TRANSMISSION INTERFERENCE

3.3.6.1 Affected Environment

Several gravel surfaced county roads either bound or cross the proposed project area. In Phillips County, these include County Roads 28, 26, 24, 23, 20, 3, and 1. In Logan County they include County Roads 26, 22, 20, 95, 93, and 91. State Highway 59 forms the eastern project boundary (Figure 2-1).

Regional transportation is provided by US Highway 6 located one to three miles north of the proposed project area; State Highway 59 along the eastern project boundary and Interstate 76 located more than 10 miles north and west of the proposed project area. This network provides good, improved access to the proposed project area. The Burlington Northern-Santa Fe railroad, located along US Highway 6, provides rail service to the region. Denver International Airport is located approximately 115 miles from the proposed project area.

No State or National Parks, Wild and Scenic rivers or other areas of recreational, scenic or aesthetic importance are present within 40 miles of the proposed project area. A total of three state wildlife areas (SWAs) exist in Phillips County and nine are present in Logan County. The Holyoke and Frenchman's Creek SWAs are located 12 and 15 miles, respectively, to the southeast of the proposed project Area. The nearest is the Tamarack Ranch SWA, located more than 5 miles to the north of the proposed project area. Because the proposed project area is entirely located on private land, recreation including hunting is generally limited to the landowners themselves or granted to others by the landowners, except for use of the county roads to access off-site recreational areas (which are limited because most of the region is privately owned).

3.3.6.2 Environmental Consequences of the Proposed Project

Transportation

Traffic would increase on the roads leading to and within the proposed project area during the construction while equipment and materials are transported into the area. Oversized loads such as turbines and rotor blades may temporarily slow traffic on U.S. Highway 6, State Highway 59, and some county roads as they are moved into the proposed project area. This additional heavy traffic would also cause additional wear on existing roads. All such transportation would be conducted in accordance with Colorado Department of Transportation and county regulations. Based on compliance with such regulations and load management practices common to the industry (such as multiple-axel trailers), adverse impacts to roads would be negligible. Project-area roads are crowned, ditched and graveled and capable of supporting heavy loads. Minor rutting of gravel roads may occur. Such disturbances would be

a short-term during construction, and affected areas would be returned to pre-construction conditions after construction is completed.

The estimated maximum construction workforce is expected to generate approximately 25 additional vehicle trips per day for workers coming and going. The foundation for each turbine is expected to require an average of 40 truckloads (80 one-way trips) of concrete, and an additional 20 trucks (40 one-way trips) to access the site during turbine construction. Additional traffic from these vehicles would be short term, occurring during the pouring of the foundation and erection of the turbines. Using a combination of State highways and county and township roads within and adjacent to the proposed project area, the traffic impacts would be negligible. Because many of the area roadways have minimal average daily traffic currently, the additional vehicle trips represent a large percentage increase which would be noticeable to local residents, but would be less than the maximum seasonal traffic levels, such as levels that occur during the autumn harvest.

While it is possible that transportation of large pieces of equipment could impact traffic during the life of the project, most of this traffic would be pick-up trucks and medium-sized trucks similar to those presently used for agricultural activities. The increase in traffic would not cause a change in the transportation network in the proposed project area. Impacts to land use, transportation and recreation due to the proposed project would be short term and minor. Some land use impacts would be long term but minor. Transportation impacts would be short term and are expected to be minor. Applicable PCAs that would be implemented to avoid and minimize impacts to transportation are discussed in Section 2.2.7 and are covered under PCA Transportation 1 and Transportation 2 (Appendix D).

Recreation

The only common recreational activity within the proposed project area that may be affected by the project is hunting, as hunting is restricted in the immediate vicinity of wind turbines to reduce the potential for damage to blades and other facilities. Because the turbines would be located in cultivated fields, and in an area with ample expanses of huntable lands, the proposed project would have little or no detectable effect on hunting opportunities in the area.

Interference with Radio, Television, and Microwave Signals

The potential for degradation of commercial broadcast or private electronic broadcasts exists with installation of most commercial scale wind turbines. Degradation of amplitude modulated (AM) broadcast coverage can occur if a wind turbine is located within 2 miles of an AM directive antenna or within half-mile of a non-directive antenna. Frequency modulated (FM) stations can be affected by turbines within 0.5 miles of very low-power stations, 1.5 miles of low-power stations, and 2.5 miles of full-power stations (Comsearch 2007). There are no AM or FM transmitters located within these distances of the turbine locations.

Interference with radio, TV and microwave signals from underground and aboveground electrical transmission lines associated with the proposed project is expected to be limited, since interference generally occurs in older, overhead transmission lines with loose or dirty insulators and spark gaps. The underground collector lines for the proposed project would not impact radio and television signals.

Beginning in February 2009, all television signals were transmitted digitally. Based on this conversion, which eliminates potential wind turbine interference with television, the proposed project would not impact television signals.

Microwave signal transmissions are based on line-of-sight, and are more susceptible to interference from wind turbines. Specifically, a beam path obstruction from the turbine nacelle or the blades can disrupt signals, causing signal degradation. Three microwave transmission sites are located within 3 miles of the

project area. One on-site tower is present in the southeastern corner of the proposed project area. This tower is located approximately one-half mile west of State Highway 59 along County Road 22. An additional tower exists in Haxtun along US Highway 6. The third tower is 2.5 miles west of Haxtun along US Highway 6. Turbine placement has been designed to avoid line-of-sight corridors between these tower locations. Therefore, the proposed project would not impact microwave signals.

3.3.7 PUBLIC HEALTH AND SAFETY

The project site is private land, and as such, public access is restricted. Access to the area would continue to be restricted in accordance with easement agreements. Such restrictions would prohibit members of the general public from accessing the wind farm facilities. Protections against unauthorized entry would include fencing around substations and the use of locks and alarm systems where expensive or dangerous equipment is housed. Further, signs posting the presence of high voltage would likely discourage such entry. Existing public safety hazards include traffic on public and private roads, potential for fires, accidents related to agricultural and recreational activities, and electromagnetic fields.

3.3.7.1 Affected Environment

Potential traffic impacts from the project are discussed in Sections 2.2.7 and 3.3.6.2. Because the additional traffic volume would have little or no adverse impacts, there is little incremental risk to the public. Typical traffic in the area includes passenger cars, light trucks, farm equipment, and commercial vehicles such as semi-tractor-trailer trucks and various construction vehicles. Oversized loads traveling to the site would represent additional and atypical traffic for the area.

The potential for fire or explosion at the wind energy facility does exist. Potential sources include power transformers, the internal workings of the turbine nacelle, lightning strikes, and combustion of flammable liquids, such as lubricating oils. Fire protection in the area is provided by a volunteer fire department in Haxtun.

If someone were to intentionally break into a power transformer associated with the wind turbines, protective devices would prevent electrocution, and power transformers include safety devices to prevent short-circuits that would result in explosions and fires. Electrical protection for power transformers is accomplished with surge arresters, grounding, bonding, instrumentation, and switchgear. Fuses, switches, vacuum fault interrupters, circuit breakers, relays, meters, control power systems, and instrument transformers are all commonly used. Over-current protection would be provided on both the primary and the secondary side of each transformer.

Electrical equipment used in the proposed project area currently produces a variety of electromagnetic fields. The term electromagnetic fields (EMF) refer to electric and magnetic fields that are coupled together such as in high frequency radiating fields. For the lower frequencies associated with power lines, EMF is separated into electric and magnetic fields, which arise from the flow of electricity and the voltage of a line and are measured in kilovolts per meter (kV/m) and milliGauss (mG), respectively. The intensity of the electric field is proportional to the voltage of the line, and the intensity of the magnetic field is proportional to the current flow through the conductors. Transmission lines operate at a power frequency of 60 hertz (cycles per second, hz). Existing fields are present from natural sources, such the sun, and manmade sources, such as home electronics and cellular telephones.

3.3.7.2 Environmental Consequences of the Proposed Project

Traffic

The delivery of the erection cranes and wind turbine generators could affect traffic temporarily due to the size of the crane and turbine tower components and blades. However, the delivery of the oversized equipment and wind turbine components would be intermittent and cause only temporary traffic delays during ingress into the site to construct the turbines and egress from the site upon construction completion.

Roads in the proposed project area are not heavily used and the oversized loads of equipment to be transported on flatbed truck would be escorted for added public safety. These escorts would also ensure that railroad traffic is monitored while the loads cross rail lines. These safety protocols would alert drivers to the presence of oversized loads and help minimize the incremental risk to the public. Because of the sparse population density, the likelihood that emergency vehicle would utilize the roads at the same time as equipment transport is low. Thus, DOE concludes that there would be few or no traffic accidents or interference with emergency vehicles during construction and operation of the proposed project. Project minimization of traffic hazards is further discussed in Section 2.2.7 and Appendix D of this EA.

Fires

The potential for fire or explosion at the wind energy facility is minimal. A variety of power transformers would be employed at the turbine sites and the electrical substation, and all would incorporate fire protection elements into their design. These elements, such as barrier walls and metal housings, help to reduce the likelihood of property damage and the extent of transformer fires, should they occur. Wind turbine nacelles incorporate additional fire suppression equipment to control fires and limit danger to the general public. Lastly, all wind turbines, blades, and towers would be fully grounded for lightning strikes.

Electromagnetic Fields

One residence to the south of the existing Haxtun Substation and on the west side of State Highway 59 is 300 feet from the 115 kV 60 hz aboveground transmission lines that would take electricity from the project transformer substation to the Haxtun Substation.

Magnetic field strength is expressed in terms of teslas or gauss. Under Colorado rules, proposed magnetic field levels of 150 milliGauss (Mg) and below are deemed reasonable by rule and need not be mitigated to a lower level (CCR 723-3-3206). The proposed 115-kV transmission line, operated at maximum current and thermal capacity, would induce an estimated 60-hz magnetic field maximum of approximately 30 mG (0.03 gauss) diminishing to 0.4 and 0.2 mG at 200 and 300 feet distance, respectively (Table 3-4). These levels are well below the state thresholds.

Table 3-4. Typical 60-Hertz Electric and Magnetic Field Levels from 115 kV Overhead Power Lines

Field	Centerline	Approx. Edge of Right of Way	100 feet	200 feet	300 feet
Electric field (kV/m)	1.0	0.05	0.07	0.01	0.003
Magnetic field (mG)	30	6.5	1.7	0.4	0.2

Source: Western Power Administration, "Electric and Magnetic Fields Facts."

These magnetic field strengths compare with levels of magnetic field measured near common household appliances (Table 3-5) and are much less than the direct current magnetic field of the earth (0.6 gauss).

The respective values at the centerline of the proposed radial transmission line (see Table 3-5) would be at or well below this value, and would be even less at the edge of the right of way, confirming that EMF hazards would be low.

Table 3-5. Typical 60-Hertz Magnetic Field Levels from Common Home Appliances

Appliance	Magnetic field 6 inches from appliance (mG)	Magnetic field 2 feet away (mG)
Electric shaver	100	-
Vacuum cleaner	300	10
Electric oven	9	-
Dishwasher	20	40
Microwave oven	200	10
Hair dryer	300	-
Computer	14	2
Fluorescent light	40	2
Fax machine	6	-
Copy machine	90	7
Garbage disposal	80	2

Source: Western Power Administration, "Electric and Magnetic Fields Facts."

Health Risks of Long-Term EMF Exposure

Research has been conducted throughout the past three decades to determine whether exposure to power-frequency (60 hz) magnetic fields causes biological responses and health effects. Epidemiological and toxicological studies have shown no statistically significant association or weak associations between EMF exposure and health risks (NIEHS, 1999). Public health professionals have also investigated the possible impact of exposure to EMF upon human health for the past several decades. While the general consensus is that electric fields pose no risk to humans, the question of whether exposure to magnetic fields can cause biological responses or health effects continues to be debated.

In 1999, the National Institute of Environmental Health Sciences (NIEHS) issued its final report, *Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields* (NIEHS 1999), in response to the *Energy Policy Act of 1992*. The NIEHS concluded that the scientific evidence linking EMF exposures with health risks is weak and that this finding does not warrant aggressive regulatory concern. However, because of the weak scientific evidence that supports some association between EMF and health effects and the common exposure to electricity in the United States, passive regulatory action, such as providing public education on reducing exposures, is warranted.

In 2007, the World Health Organization (WHO) concluded a review of the health implications of electromagnetic fields (WHO 2007). In this report, the WHO stated:

> Uncertainties in the hazard assessment [of epidemiological studies] include the role that control selection bias and exposure misclassification might have on the observed relationship between magnetic fields and childhood leukemia. In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between extra low frequency (ELF) magnetic fields and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern [Environmental Health Criteria Volume No 238 on Extremely Low Frequency Fields at p. 12, WHO (2007)].

Also, regarding disease outcomes, aside from childhood leukemia, the WHO stated that:

> A number of other diseases have been investigated for possible association with ELF magnetic field exposure. These include cancers in children and adults, depression,

> suicide, reproductive dysfunction, developmental disorders, immunological modifications and neurological disease. The scientific evidence supporting a linkage between ELF magnetic fields and any of these diseases is much weaker than for childhood leukemia and in some cases (for example, for cardiovascular disease or breast cancer) the evidence is sufficient to give confidence that magnetic fields do not cause the disease (Id. at p.12.)

Furthermore, in their "Summary and Recommendations for Further Study" the WHO emphasized that:

> The limit values in [EMF] exposure guidelines should not be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection. (Id. at p. 12).

The WHO concluded that:

> Given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear (Id. at p. 13).

Industry standard designs have been established to minimize the risk to site workers and the general public. No atypical project design or equipment is proposed for this facility, and the transmission line has been routed to a location with the least impact on residential structures. In addition, the magnetic and electrical fields would be below current State guidance where such guidance exists. DOE concludes that, although there is some uncertainty about the health risks from long-term exposure to EMF fields, it is generally accepted that the risks are low, and thus the impacts from installing the above-ground power line within 300 feet of a residence would be minimal.

3.3.8 NOISE

Noise is any unwanted, undesirable sound. It has the potential to interfere with communication, damage hearing, and, in many cases, it is viewed as an annoyance. Noise can occur at different levels and frequencies, depending on the type of source and the distance away from the listener.

The standard unit of measure for sound pressure levels is the decibel. A decibel is a unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the measured pressure to the reference pressure, which is 20 micropascals. Typically, environmental and occupational sound pressure levels are measured in decibels on an A-weighted scale (dBA). The A-weighted scale deemphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear [i.e., using the A-weighting filter adjusts certain frequency ranges (those that humans detect poorly)] (Colby et al. 2009). Table 3-6 lists common outdoor and indoor sound sources and associated A-weighted noise levels.

Table 3-6. Sound Levels Produced by Common Noise Sources

Thresholds/Noise Sources	Sound Level (dBA)[a]	Subjective Evaluations[a]	Possible Effects on Humans[a]
Human Threshold of Pain Carrier jet takeoff at 50 feet	140	Deafening	Continuous exposure to levels above 70 dBA can cause hearing loss in majority of population
Siren at 100 feet Loud rock band	130		
Jet takeoff at 200 feet Auto horn at 3 feet	120		
Chain saw Noisy snowmobile	110		
Lawn mower at 3 feet Noisy motorcycle at 50 feet	100	Very Loud	
Heavy truck at 50 feet	90		
Pneumatic drill at 50 feet Busy urban street, daytime	80	Loud	
Normal automobile at 50 mph Vacuum cleaner at 3 feet	70		Speech Interference
Air conditioning unit at 20 feet Conversation at 3 feet	60	Moderate	
Quiet residential area Light auto traffic at 100 feet	50		Sleep Interference
Library Quiet home	40	Faint	
Soft whisper at 15 feet	30		
Slight rustling of leaves	20	Very Faint	
Broadcasting Studio	10		
Threshold of Human Hearing	0		

Source: EPA 1974

a. Note that both the subjective evaluations and the physiological responses are continuums without true threshold boundaries. Consequently, there are overlaps among categories of response that depend on the sensitivity of the noise receivers.

Background Information on Wind Turbines

An operating wind turbine generator can generate two types of sound: mechanical sound from components such as gearboxes, generators, yaw drives, and cooling fans, and aerodynamic sound from the flow of air over and past the rotor blades. Modern wind turbine design has greatly reduced mechanical sound and it generally can be ignored in comparison to the aerodynamic sound, which is often described as a "swishing" or "whooshing" sound (BLM 2005).

Wind turbines produce a broadband sound; that is, the sound occurs over a wide range of frequencies, including low frequencies. Low-frequency sounds are in the range of 20 to 100 hertz and infrasonic sound (or infrasound) is low-frequency sound of less than 20 hertz (generally outside of the range of human hearing). Compared to higher frequency sound, low-frequency sound propagates over longer distances, is transmitted through buildings more readily, and can excite structural vibrations (for example, rattling windows or doors).

Older designs of wind turbines, particularly those in which the blades were on the downwind side of the turbine tower, produced more low frequency sound as a result of the blades passing through more

turbulent air as a result of the tower blocking wind flow. Modern, upwind turbines produce a broadband sound emission that includes low-frequency sounds, but not at substantially high levels. A primary cause for low-frequency sounds in modern turbines is the blade passing through the change in airflow at the front of the tower, which can be aggravated by unusually turbulent wind conditions.

The University of Massachusetts at Amherst reported (Rogers 2006) on noise measurements made at four different wind turbines ranging in size from 450 kilowatts to 2 megawatts. The results indicated that at distances of no more than 387 feet from the turbines, all infrasound levels were below human perception levels. The report further states that there is "no reliable evidence that infrasound below the hearing threshold produces physiological or psychological effects." This lack of effects at levels below the hearing threshold was supported by a scientific advisory panel composed of medical doctors, audiologists, and acoustic professionals established by the American and Canadian Wind Energy Associations to review wind turbine sound and health effects (Colby et al. 2009). It was also supported by the findings from Canadian and Australian government reviews of available scientific literature (CMOH 2010; Australia NHMRC 2010).

3.3.8.1 Affected Environment

The proposed project area is rural farmland, grazing land and prairies, where agricultural activities, travel on state and county roads and the wind are the major contributors to ambient noise levels.

DOE considered noise from two perspectives: (1) construction noise associated with daytime activities during the 4-6 month construction period, and (2) noise associated with turbine operations during the anticipated 30-year life of the project. DOE made the following assumptions:

- Construction noise is associated with standard construction equipment that would include cranes, backhoes, tractor-trailers, bulldozers, excavators, trucks, etc.

- Construction noise would only occur between the hours of 7:00AM to 7:00PM, which would be the standard workday during the 4- to 6-month construction period.

- Construction equipment operating within the project area would be confined to the construction right-of-way granted for access roads, turbine locations, crane paths, buried collector cabling routes, transformer substation, aboveground radial electrical transmission lines, and existing county roads (see Figure 2-1).

- Noise associated with operating turbines would be associated with the gearing and other moving parts within the turbine nacelle (mechanical noise) and noise associated with the movement of the turbine rotor through the air.

- The noise analysis was conducted assuming the worst possible case scenario of a turbine in continuous operation for a 24-hour day, with operations occurring at the 44 mile per hour cutoff speed, but with noise conditions at the receptor representing calm conditions. Under slower wind conditions, the ambient levels at which the wind turbines would be audible at each receiver would be less than the assumed condition.

- For a typical rural environment, background noise is expected to be approximately 40 dBA during the day and 30 dBA at night (BLM 2005). Noise levels within the proposed project area are likely lowest during the morning and at night when wind speeds are lower, and highest in the afternoon when wind speeds are higher.

The Town of Haxtun and Logan and Phillips Counties do not have specific noise ordinances that regulate activities that could potentially cause adverse impacts to affected persons. Colorado has established a noise statute (C.R.S. 25-12-103) that provides maximum noise levels that would be permitted within 25 feet of a property line in areas zoned Residential, Commercial, Light Industrial, and Industrial (Table 3-7). No criteria are provided for areas zoned agricultural. For the purposes of analysis of noise associated with wind power facilities located in agricultural areas with residences, the residential zoning applies.

Table 3-7. Maximum Permitted Noise Values under the Colorado Noise Statute for Areas Zoned Residential, Commercial, Light Industrial, and Industrial

Zone	7a.m. to 7 p.m. (dBA)	7 p.m. to 7 a.m. (dBA)
Residential[a]	55	50
Commercial	60	55
Light Industrial	70	65
Industrial[b]	80	75

a. Residential noise criteria would be applicable to residences near wind turbines established in agricultural areas.
b. Industrial noise criteria are applicable for areas undergoing construction.
dBA = A-weighted decibel.

Thus the wind turbine noise cumulatively adds such a small amount to background ambient noise such that the increase in noise would not be discernible. By Colorado statute, the industrial values are used for temporary construction:

> "…[C]onstruction projects shall be subject to the maximum permissible noise levels specified for industrial Zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project (C.N.S. 25-12-103 (5)).

3.3.8.2 Environmental Consequences of the Proposed Project

Construction Noise

Construction related noise that is produced by machinery and vehicles would exceed ambient noise levels and would at times be heard for some distance within the proposed project area depending on atmospheric conditions. Noise levels would be typical of diesel-powered machinery and gasoline or diesel powered vehicles. Cement trucks, cranes and auguring equipment would produce noise during their operation, and increased noise would be noticeable to local residents and others in the vicinity of construction activities. These impacts would be moderate, likely disrupting residents and wildlife during construction hours only (7:00AM to 7:00PM). Overall noise levels would be similar in type and degree to noise currently produced by farm machinery, trucking, highway noise, and other construction projects. The effects of construction noise on residences in the project area would also be reduced by distance because most residences are quite distant from construction zones.

Construction noise would be reduced to the extent practicable by following PCA GEN-8 (Appendix D) and restricting equipment operation to the 7:00AM – 7:00PM workday.

Turbine Noise

The following analysis of noise documents that the proposed project would not have a substantive adverse effect on ambient noise levels at residences nearest proposed turbines. A detailed analysis of wind turbine noise and review of setback standards (Rogers 2006) indicated that objectionable noise levels were produced by industrial wind turbine facilities if appropriate setbacks were not used. Their recommendation was that if the setbacks were less than three times the tip height of a wind turbine, a

noise analysis should be performed to evaluate adverse effects. Using these guidelines, the minimum setback for this proposed project would be 1,278 feet (426-foot-tall turbines). All residences near the proposed project are well beyond this minimum setback distance.

However, in order to evaluate turbine noise, GIS combined with noise modeling methods (WindPRO Decibel module; EMD International, 2010) was used to determine the distance from all residences within a mile of the project Boundary (including only the most southern residences in the town of Haxtun) to a wind turbine (Figure 3-6) and the cumulative noise resulting from wind turbine operation experienced at a receptor residence. The results are provided in Table 3-8. Six and two residences are within 3,000 and 2,000 feet, respectively of an operating wind turbine. There are no residences within 1,000 feet of a proposed wind turbine. The closest wind turbine to a residence is 1,605 feet (Residence H/R8 and Turbine T-17) (Table 3-8).

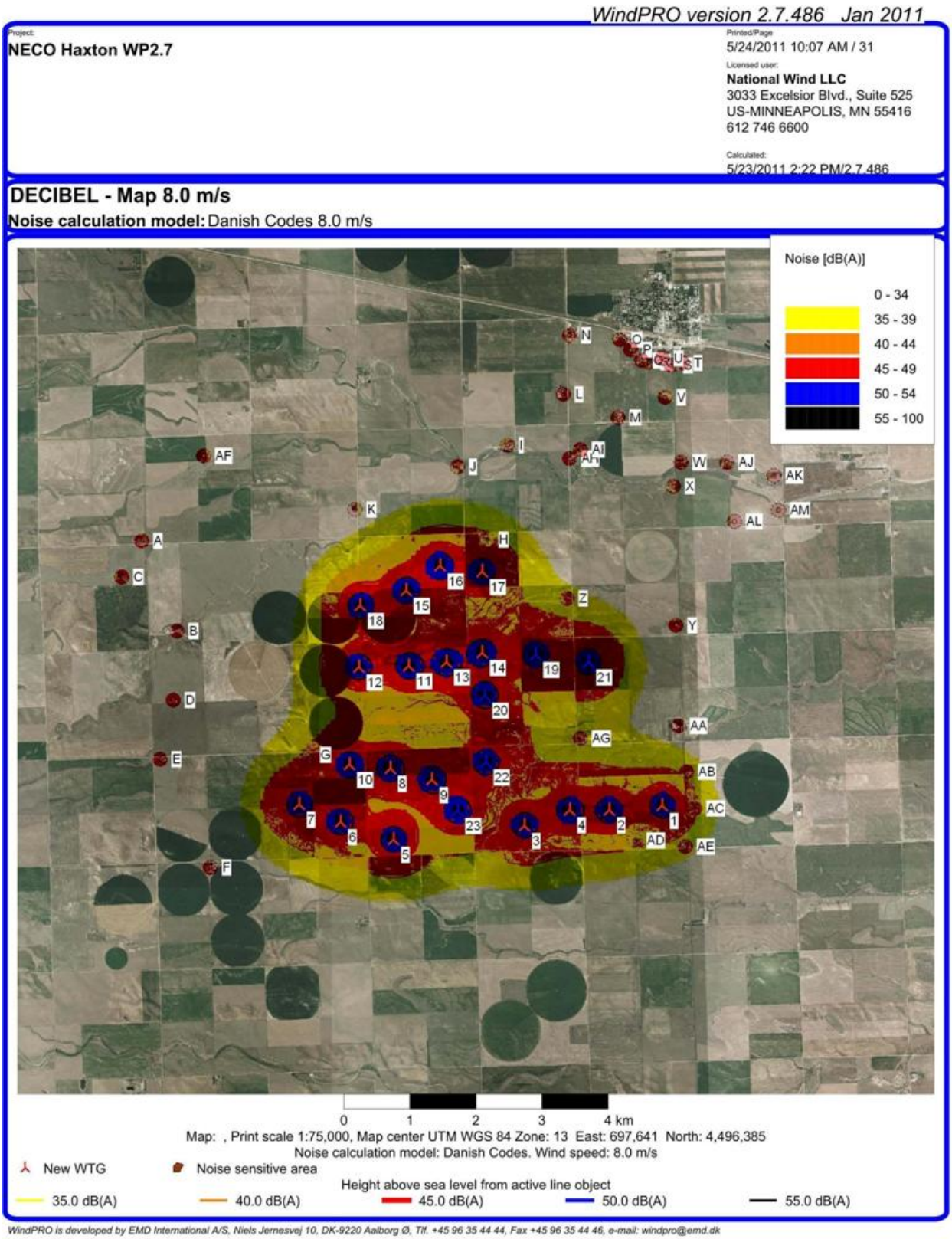

Figure 3-6. Decibel Map Showing Closest Receptors to the Project Site

The Decibel software is a computer model that can calculate sound levels after considering the noise reductions or enhancements caused by distance, topography, ground surfaces (including water), atmospheric absorption, and meteorological conditions.

Table 3-8. Noise Modeling Summary at Nearest Suspected Receivers

Residence[a]	Distances and Azimuths[b]			Predicted Wind Turbine Noise Levels, dBA[c]	Ambient Sound Level Threshold for Audibility, dBA Ldn[d]
	Turbine	Distance (feet)	Azimuth (degrees)		
G/R7	T-7	2,495	190.1	35.5	
	T-10	*2,080*	*103.4*	*37.5*	
	D Total[e]			*40.9*	
H/R8	*T-16*	*2,699*	*241.5*	*34.5*	
	T-17	*1,605*	*189.4*	*40.6*	
	D Total[e]			41.9	
AB/R28	T-1	2,037	216.7	37.9	
AC/R29	T-1	1,620	276.2	40.5	
AD/R30	*T-1*	*2,218*	*37.3*	*36.9*	
	T-2	*2,011*	*319.5*	*38.1*	
	H Total[e]			41.1	
AE/R31	T-1	2,367	331.2	36.2	

Source: National Wind Assessments LLC, 2010.

a. Receiver location based on suspected house locations digitized from 2009 high-resolution aerial photography. Letter refers to sites as listed in Noise Assessment Report. Letter-Number refers to turbine location on figures.
b. Distances and azimuths determine using GIS methods in Arcview 3.3. Distances are in feet separation between the residence in question and the turbine. Azimuths are in degrees clockwise from north. 0, 90, 180, 270 represent east, south, west, and north, respectively.
c. Assumes continuous operation at cut-off wind speed (9 m/s at hub height, worst-case scenario). Sound pressure in decibels (dBA).
d. Represents threshold ambient day-night level (Ldn) at which turbine noise would be likely audible. Levels in italics are those projects not likely to be audible at higher ambient levels.
e. The sound total combines the effects of multiple turbine sources.

The data in Table 3-8 represent predicted worst-case noise levels for all residences that are closer than 3000 feet to a wind turbine. Modeled noise levels at all other residence receptors are less than the lowest value (36.2 dBA) provided in Table 3-9.

All predicted noise values resulting from wind turbines operating under the worst case conditions (wind speed 8.0 m/s, continuous operation, receptors downwind of the turbine) are less than 50 dBA which is the maximum noise value permitted under the Colorado Noise Statute for residential areas during night-time periods (Table 3-7). All values are under 45 dBA which is the sound of a quiet home at night (Table 3-6), therefore, the predicted noise levels at the closest residential receptors are comparable to noise levels anticipated at a quiet home or rural nighttime ambient noise levels. DOE has concluded any impacts related to noise are minor.

Additional Noise Sources

Substations emit both transformer noise and switchgear noise. Transformers emit a low-frequency humming noise (caused by vibrations within the transformer). Substation noise levels at the nearest

residence would be below ambient levels as the nearest residence to the project transformer substation is over three quarters of a mile distant (Figure 2-1).

Based on the low levels of predicted noise values emitted from wind turbines at the closest residential receptors that would reflect ambient noise levels during nighttime in residential areas, DOE has determined that noise generated by the proposed project would not be adverse. Wind turbine and substation noise would be at or below ambient levels at the nearest residences. Due to the temporary and intermittent nature of noise effects and the presence of similar noise sources within the proposed project area, noise impacts to residents and wildlife would be minor.

3.3.9 SHADOW FLICKER

Shadow flicker describes the effect caused by the intermittent shadow cast by the rotating blades of a wind turbine. The phenomenon is mainly of concern where residences, public areas or roads are within the shadow of a turbine.

3.3.9.1 Affected Environment

Because of the strobe-like effect of shadow flicker, there have been investigations into whether it could produce epileptic seizures in susceptible photosensitive individuals. However, it has been determined that modern utility-scale wind turbines do not have the potential to cause these types of problems because of their relatively slow blade rotation. Studies indicated that flickers with a frequency greater than 3 hz could potentially induce photosensitive epileptic seizures. However, a wind turbine with a three blade rotor would need to rotate once per second (60 rotations per minute) for shadow flicker at a given point to reach a frequency of 3 hz. The turbines planned for the proposed project (GE 1.6-100 model) would rotate up to 17 times per minute, well below the rotation required to produce flicker at 3 hz.

Shadow flicker is often considered annoying by those exposed. Shadow flicker occurs only during the day and at times when the turbines are rotating. The effect is reduced or eliminated during cloudy days and with distance from the turbine, and varies with the angle of the rotating turbine blades relative to the sun. Intervening structures such as trees and buildings may reduce the intensity or eliminate the effect.

Distance from the rotating turbine blade is important as well. If the angular size of the rotating blade is larger than the angular size of the sun, the blade would completely block out the sun forming a distinct shadow with sharp boundaries. As the distance from the turbine increases to the point where the angular size of the rotor blade is substantially less than the angular size of the sun, the sun is not completely blocked, and the shadow is not as distinct, or dark. It is generally accepted that the shadow flicker effect is negligible beyond 10 rotor diameters (1000 meters or 3,280 feet for GE 1.6-100 model turbines) for this reason.

The magnitude and nature of shadow flicker associated with wind turbines can be understood by considering the geometry of the shadows produced and how these shadows are affected by seasonal changes in the angle of the sun.

- The area affected by shadow flicker would change as the sun's elevation changes throughout the day and its azimuth changes seasonally.
- Turbine shadows are longest at sunrise and sunset when the sun is lowest in the sky.
- The direction (azimuth) of the shadows also changes with the season. Seasonal and daily changes in sun angle can be estimated using sun charts that are calculated for specific latitudes.

- The worst-case scenario is to evaluate the azimuth of the potential shadow at sunrise and sunset at the summer and winter solstices. The result would be an envelope of the maximum spatial extent of potential shadow flicker associated with each turbine. For the area of Haxtun, the sun azimuths range from 60 to 120 degrees during sunrise and 240 to 300 degrees during sunset. The resulting shape of the envelope is like an hourglass or bowtie, with the turbine located at the southernmost portion of the narrowest part.

- The geometric relationship between the turbine rotor dimensions, hub height, and the changes in the suns azimuth and elevation with the seasons allows: (1) a quantitative assessment of the area potentially affected by shadow flicker and (2) a prediction of the maximum number of hours in a year that shadow flicker would be observed at a specific location.

3.3.9.2 Environmental Consequences of the Proposed Project

GIS was used to determine the distance of all residences within a mile of the project boundary (including the southernmost residences in the town of Haxtun) (Figure 3-7). The WindPRO "Shadow" program then was used to calculate the number of days and maximum number of hours per day and cumulatively per year that receptor residences would experience shadow flicker. The following conservative assumptions were used in the analysis:

- a maximum distance for influence of 3,280 feet (see Section 3.3.9.1 above),
- a minimum sun height over horizon for influence of 3 degrees,
- day steps and time steps for the calculation of one day and one minute, respectively,
- the sun is shining all day, from sunrise to sunset,
- the rotor plane is always perpendicular to the line between the sun and the receptor,
- the wind turbine generator is always operating.

Topography was used to remove wind turbines not visible from a given receptor.

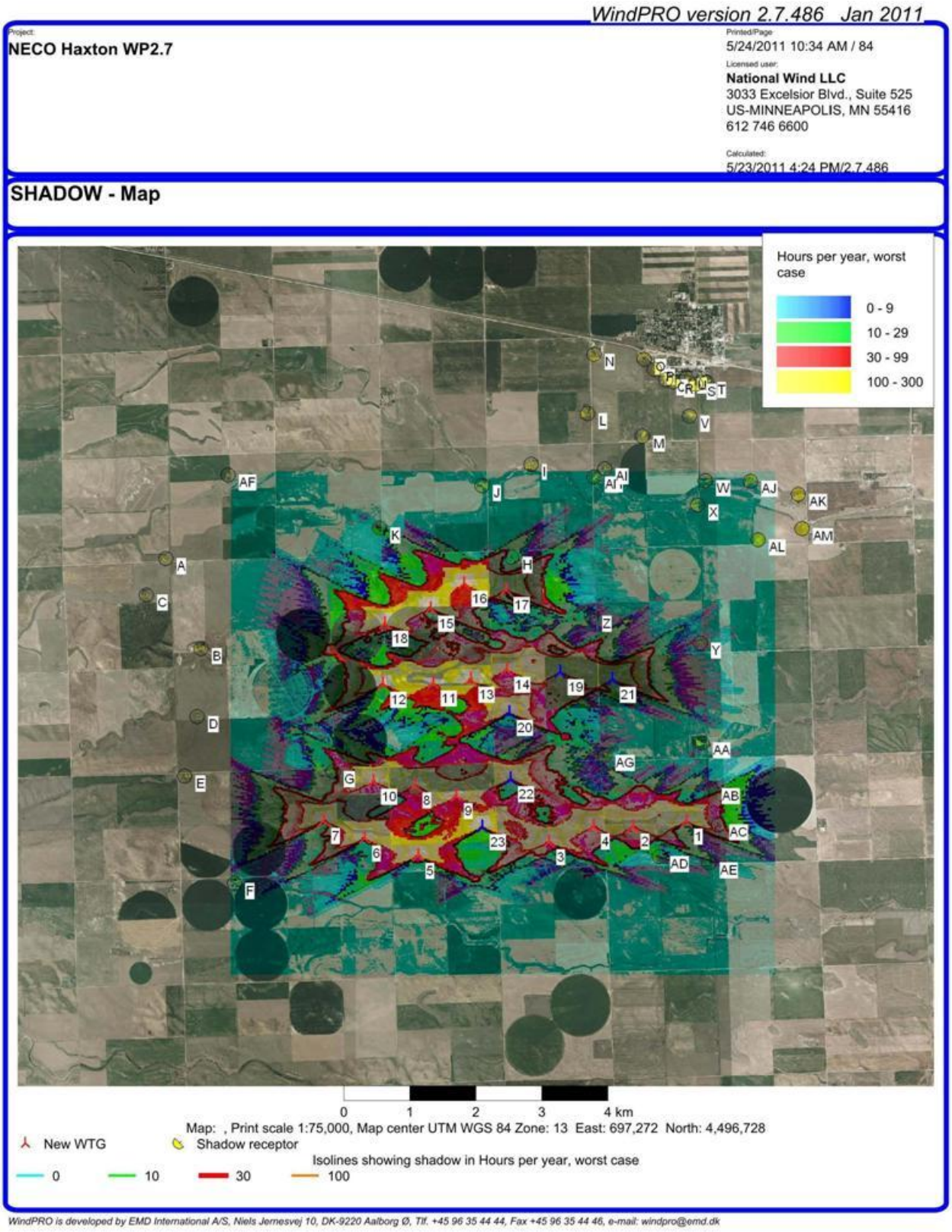

Figure 3-7. Shadow Flicker Map Showing Closest Receptors to the Project Site

Pertinent data and the results of the shadow flicker analysis for the potentially affected residences are in Table 3-9.

Table 3-9. Shadow Flicker Data[a] for Potentially Affected Residences

Receptor Residence Code[b]	Distance to Nearest Affecting Turbines (turbine code – feet)[c]	Calculated Shadow (hours per year[d])	Shadow (days per year[e])	Maximum Shadow (hours per day[f])
G/R7	8 – 4,124.42 9 – 6,263.14 10 – 2,079.65	25	48	0.46
H/R8	15 – 4,763.58 16 – 2,698.72	20	70	0.30
K/R11	15 – 4,794 16 – 5,176	8	46	0.13
Y/R25	21 – 4,720	3	22	0.13
Z/R26	14 – 4,981 16 – 6,489 17 – 4,501	10	74	0.15
AB/R28	2 – 4,295.59 4 – 6,127.97	6	41	0.17
AC/R29	1 – 1,620.08 2 – 4,261.94	47	92	0.47
AD/R30	3 – 5,576.66 4 – 3,614.60	18	78	0.21
AE/R31	1 – 2,367.24 2 – 4,213.12	12	71	0.16
AG/R33	20 – 5,229 22 – 4,830	9	71	0.13

a. Analysis performed using the "Shadow" module of WindPRO software.
b. Receptor Residence Code as indicated in Figures 2-1 and 3-6.
c. Nearest affecting turbines are those turbines with the potential to cast shadows on the receptor. More than one turbine have the potential to affect one residence in some cases.
d. Shadow hours per year are the number of hours that shadow flicker could occur on the receptor residence.
e. Shadow days per year are the number of days that have some period of shadow flicker at the receptor residence.
f. Maximum shadow hours per day is the maximum number of hours for the day with the most shadow flicker.

Under the worst-case scenario, the modeling results indicate that of the 39 receptor residences examined by the analysis, ten residences may experience shadow flicker for some part of the year. The remaining residences would be either too far from and/or are too far north and south to be within the shadow of a turbine.

The shadow flicker impacts reflected in the data provided in Table 3-9 would be substantially moderated when the effects of distance from the turbine, the effects of screening (where applicable), the presence of cloudy days, and periods when the wind turbine is not rotating, are accounted for.

Accounting for the Moderating Effects of Distance from the Receptor

The distance between a wind turbine and a receptor affects the intensity of the flickering. Shadow flicker intensity decreases with greater separation from the receptor to the turbine, up to a point where the change in light intensity is below what the human eye can distinguish. Shadows cast close to a turbine are more intense, distinct and "focused" because a greater proportion of the sun is intermittently blocked by the passing blades. As separation between the receptor and the turbine increases, the proportion of the sun that is blocked decreases and the shadows become less intense and less discernible. Shadow flicker intensity is also substantially reduced if the plane of the rotor is at an angle other than perpendicular to the

line of sight from the receptor to the sun, again because a smaller proportion of the sun is blocked by the passing blades. Ambient lighting conditions also affect the visibility of shadow flicker. Changing light intensity is more noticeable in a darkened room than outdoors where ambient light levels are higher.

The normal maximum distance used for modeling shadow flicker is approximately 10 times the rotor diameter (Burton et al., 2001; Office of the Deputy Prime Minister, 2004; Herbrandson and Messing, 2009; Irish Department of Environment, Heritage and Local Government, 2009), or 3,280 feet for GE 1.6-100 model turbine towers. At distances beyond 3,280 feet, the changing light intensity is low enough that a person does not perceive the turbine rotor as "chopping" through the sun, but rather as an object with the sun behind it. Shadow flicker would only be discernible at distances beyond 3,280 feet in rare circumstances such as in a darkened room with a single window facing the turbine.

Accounting for the Moderating Effects of Turbine Inactivity and Cloudy days

Haxtun Wind LLC has run a worst case simulation which does not account for the effects of weather (cloudy days) and expected turbine shut-down periods. The results indicate that the predicted shadow flicker on potentially affected residences would be reduced substantially from those presented for the respective residence receptors in Table 3-9.

3.4 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. An irreversible commitment of resources represents a loss of future options. It applies primarily to non-renewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity.

Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site). Irretrievable commitments represent the loss of production, harvest, or use of renewable resources. These opportunities are foregone for the period of the proposed action, during which other resource utilization cannot be realized. These commitments may be reversible, but the foregone utilization opportunities are irretrievable. The expenditure of Recovery Act funding from DOE would also be irreversible.

Table 3-10 lists the irreversible and irretrievable commitment of resources associated with the proposed project.

Table 3-10. Irreversible and Irretrievable Commitment of Resources

Resource	Commitment Description	Irreversible	Irretrievable
Land Use	Exclusion of future land uses in project area	Yes for expected life of project. Most impacts would be reversible after decommissioning unless the landowner requests that some access roads and turbine pads remain.	Project life
Visual Resources	Impacts to local scenic quality during construction and operations	No	Project life. Impacts to visual resources may be extended if the project was repowered and permitted.
Biological Resources	Habitat fragmentation, disturbance or loss of vegetation and impacts to habitats during construction and operations	No. Impacts would be confined to migratory birds and bats, and species adapted to agricultural land uses. Wildlife species can adjust to minor temporary loss of individuals without affecting overall populations.	No, depending on the habitat and species
Water Resources	Water consumptive use during construction	No	No
Wetlands	None expected, no wetlands on the proposed project site would be disturbed.	No	No
Geology and Geohazards	None expected.	No	No
Soils	Soil loss and erosion during construction and operations. BMPs and mitigation would reduce.	No. Impacts can be remediated by fertilization, topsoil stripping, and decompaction.	Soils under access roads and turbine pads would not be useable for the life of the project.
Paleontology	None Identified	No. If paleontological resources are encountered, the proposed project would conduct a recovery of the information.	No
Cultural Resources	Disturbance of eligible properties during construction and operations	None expected due to avoidance and mitigation.	No, if mitigated
Air Quality	None, if BMPs implemented during construction and operations	No	No
Construction Materials and Fuels	Use of materials and fuels during construction and operations	Most uses would be; recycling could mitigate some resources impacts	Yes, minor amounts of fuel and gravel resources.

3.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts associated with the project include:

- Long-term loss of approximately 9.9 acres of agricultural land that would be occupied by the wind turbine towers.
- A small increase in noise levels during construction; and
- Temporary traffic disruptions during construction.

The impacts from construction noise and traffic disruptions would be temporary. Loss of agricultural land would result in long-term impacts. Overall, impacts of the proposed project on the environment and human health would be minimal.

3.6 The Relationship Between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term use of the environment, as the term is used in this document, is that used during the life of the project, whereas long-term productivity refers to the period of time after the project has been decommissioned, the equipment removed, and the land reclaimed and stabilized. The short-term use of the site for the proposed project would not affect the long-term productivity of the area. If it is decided at some time in the future that the project has reached its useful life, components of the wind turbines could be decommissioned and the occupied sites would be available for other uses.

4. CUMULATIVE IMPACTS

Cumulative impacts are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor to collectively significant actions taking place over a period of time (40 CFR 1508.7).

For the purposes of assessing cumulative impacts, DOE considered the impact area for natural resources including surface and subsurface water, soils, geology, wildlife, and land use to be the area within 10 miles of the Haxtun Wind Project (Figure 4-1). This area is relatively homogeneous and consists primarily of land in agricultural use. The impact area for social resources, including roads, populations, and housing is Logan and Phillips counties.

4.1 Past Actions

The natural, human, and cultural environment within the Haxtun Wind Project area and in the general region has been altered by agricultural activities initiated during the late 1800's by the Homestead Act of 1862 resulted in the widespread conversion of short-grass prairie to farmland and rural residential development. Other developments that have affected the project area and the region include the establishment of infrastructure (roads, highways, railroads, pipelines, and transmission lines), extraction of natural gas, the creation of small towns that provide goods and services to the rural population; and water development (e.g., irrigation ditches, wind mills, and stock ponds). Over time the population has fluctuated as towns have grown and farms have been abandoned and consolidated. However, substantive alterations to the natural, human, and cultural environment have stabilized in the area.

No new towns have been incorporated in the last 50 years, and existing towns have not substantially increased in size. Population in Logan County increased by 3,205, and population in Phillips County increased by 283 during the 19-year period from 1990 to 2009, respectively. Most of the increase in population in Logan County is the result of a 2,350-person increase in the population of the town of Sterling. Agriculture has stabilized and the relative percentage of agricultural land and native prairie has changed little. The most important impact to natural resources in the area has involved CRP land. Both Logan and Phillips counties have large acreages enrolled in CRP that have essentially returned sensitive, erodible, plowed cropland to native pasture and prairie. It is likely that if existing CRP contracts expire and all of the land reverts to agricultural production the adverse effects to the natural environment would be substantial.

Given a stable rural environment, with the exception of the potential exploitation of gas and wind reserves discussed below, there are no large, planned projects that would have an adverse cumulative impact on cultural, societal, or natural resources in the area.

4.2 Reasonably Foreseeable Future Projects

Gas Reserves Exploitation and Storage

Gas exploration in northeast Colorado was initiated during the early 1900s when wells completed in the Late Cretaceous Niobrara Shale began producing economically viable amounts of natural gas. Extraction has continued, with the major gas reserves occurring in Logan County north of the South Platte River and in isolated pockets in Phillips County. While some existing gas wells are indicated in and near the project area, the absence of producing wells and sparse distribution of permitted wells suggests that (1) gas

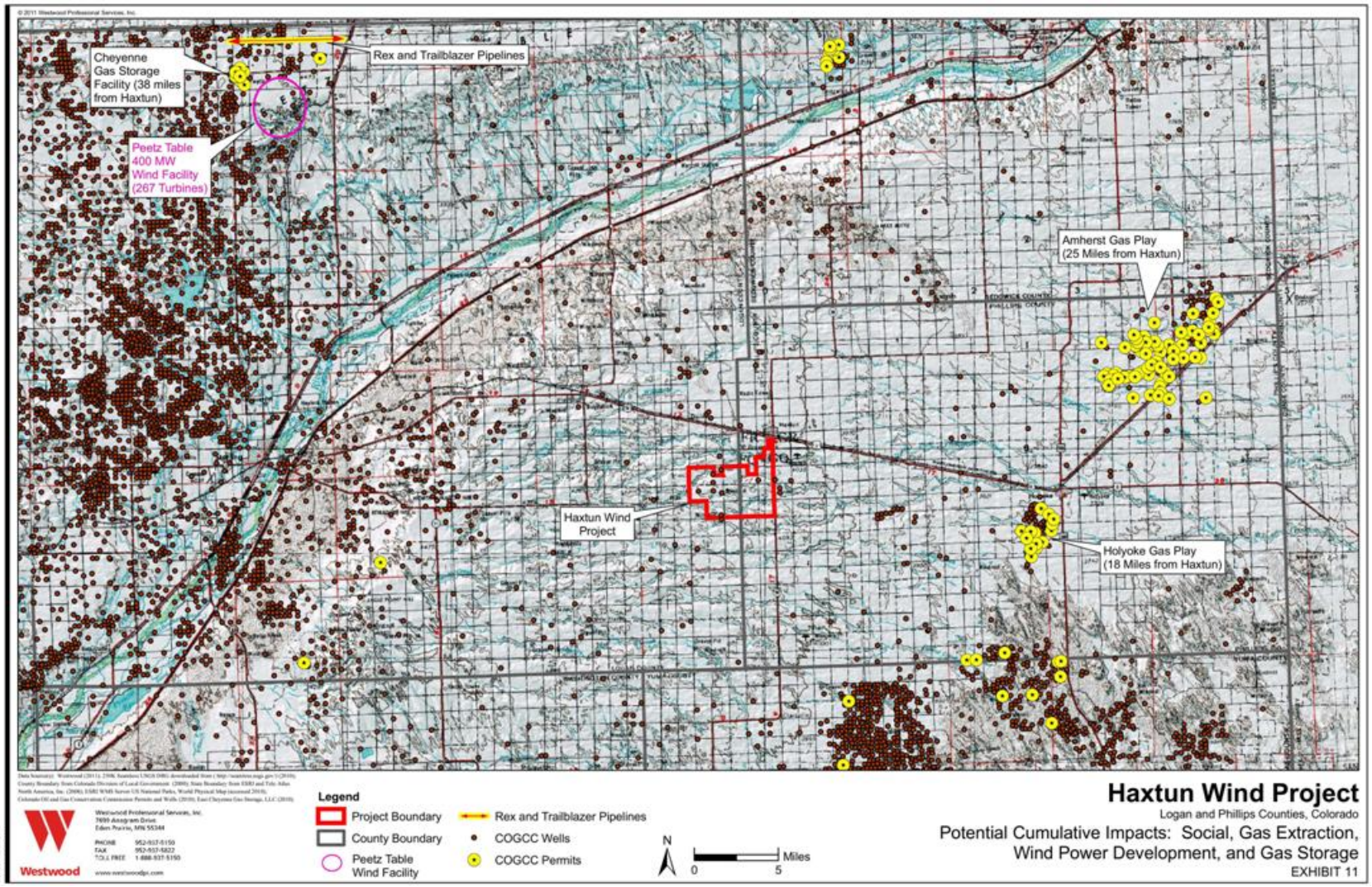

Figure 4-1. Potential Cumulative Impacts: Social, Gas Extraction, Wind Power Development, and Gas Storage

production in the area of the project has never been economically viable, and (2) future well development is unlikely.

However, the well fields north of the South Platte River in north-central Logan County and in Phillips County near the towns of Holyoke and Amherst are extensive with active producing wells. Much of the gas appears to have been extracted. New techniques have resulted in the economical extraction of gas that was previously unavailable, thus gas extraction and exploration is increasing and will likely increase for the foreseeable future.

The presence of depleted gas reservoirs and the close proximity of the Trailblazer and Rockies Express natural gas pipelines provide an excellent opportunity for a gas storage facility. Such a facility (East Cheyenne Gas Storage) has been proposed and is currently being construction on 2,400 acres in north central Logan County by Merchant Energy Partners, LLC. The facility is located 29 miles north of the town of Sterling in Logan County and is approximately 38 miles northwest of the Haxtun Wind Project. With respect to cumulative impacts, the facility has the following characteristics:

- Approximately 250 temporary construction personnel during the 3-year construction period,
- An estimated 15 to 25 permanent O&M staff.
- Six well pads for gas injection and withdrawal,
- Three additional well pads for water disposal and monitoring,
- A compressor station and gas processing facility on a 60-acre site,
- 5-6 miles of 8 to 24 inch gathering lines to connect each well pad to the compressor station and associated facilities.
- Approximately 4 miles of collocated 16 and 24 inch diameter pipeline interconnects to the Trailblazer and Rockies express natural gas pipelines
- A meter station,
- Associated temporary and permanent access roads.

In addition, new permits for potential gas wells have been granted to extract natural gas from two isolated sub-crops of Niobrara shale in Phillips County near the towns of Holyoke (14 new permits), and Amherst (64 new permits, located 18 miles southeast and 25 miles northeast of the Haxtun Wind Project area, respectively.

Logan and Phillips counties have an extensive history of natural gas exploration, with literally thousands of gas wells installed during the past 90 years. Many of the original reservoirs are depleted. However, new extraction techniques (hydrofracturing under high pressure) are permitting more gas to be economically extracted from areas that were previously thought to be depleted.

Planned Wind Power Facilities

One of the main developments in Logan County specifically and northeast Colorado generally is the development of utilities-scale wind facilities with the associated infrastructure of utility lines, roads, turbines, substations, and transmission lines; and the minor increase in population, housing, and services to maintain the facilities.

Currently there are no wind power facilities over 25 megawatts in Phillips County. Logan County currently has nearly 500 megawatts of existing wind power, representing over 330 wind turbines in three major projects, all located in the Peetz area of north central Logan County and approximately 30 to 40 miles from the Haxtun Wind Project:

- Peetz Table Wind Energy Center owned and operated by NextEra is a 400-megawatt wind power facility with 267 GE wind turbines (DOE 2005).
- The Ridgecrest-Peetz Project developed by EnXco and owned by Caithness is a 29.7-megawatt Wind facility with 32 wind turbines,
- Spring Canyon Project owned and operated by Inverenergy is a 60-megawatt development with 40 wind turbines.

Other wind power facilities operating in northeast Colorado (Weld, Morgan, Washington, Yuma, and Sedgewick counties) have been developed in Weld County:

- The 300.5-megawatt Cedar Creek Wind farm in Weld County uses 274 wind turbines,
- The 30-megawatt Ponnequin Wind facility in Weld County uses 44 wind turbines,

Wind power facilities that have been planned in northeastern Colorado and in development as of August 2010 include a 250-megawatt expansion of the Cedar Creek Wind farm (Cedar Creek II) just west of the existing Cedar Creek Wind farm in Weld County.

Wind projects in the foreseeable future are difficult to assess. The wind resource appears good, and it seems very likely that additional wind farms would be planned and developed in northeast Colorado, though no projects are currently planned within 10 miles of the Haxtun Wind Project.

4.3 Cumulative Impacts to Physical and Natural Resources

No substantive projects are currently planned for the area within 10 miles of the Haxtun Wind Project (the area of impact for physical and natural resources and infrastructure). Thus DOE does not expect cumulative impacts to the physical and natural resources analyzed in Section 3 of this EA.

4.4 Cumulative Impacts to the Human Environment

As discussed in the previous sections, Logan and Phillips counties have been primarily affected by (1) agricultural conversion of the pre-contact short grass prairie, (2) long-term exploitation of gas reserves in isolated locations distant from the Haxtun Wind Project, and (3) the recent development of wind power facilities (primarily associated with the Peetz area in Logan County).

Continuing development of oil and gas reserves associated with new hydrofracturing technologies that can economically recover additional gas from historically depleted gas reservoirs and the construction of the East Cheyenne Gas Storage Facility are too far removed from the Haxtun Wind Project area to have direct impacts to the physical and natural environment, and are unlikely to substantively affect infrastructure (roads and towns) in the immediate area of the Haxtun Wind Project. The same situation would hold if expansions to the Peetz Table Wind Center are considered.

However, should these projects proceed concurrently, there may be some stress on the existing availability of housing units (motels and hotels) necessary to temporarily house construction staff, and there would be an minor increase in the permanent population associated with the East Cheyenne Gas Facility in particular. In addition, the additional of several new producing gas wells, the construction of

the East Cheyenne Gas Storage Facility, combined with the construction of additional wind turbine facilities in addition to those associated with the Haxtun Wind Project could increase the cumulative visual impacts of these industrial facilities to the existing, primarily agricultural environment in northeast Colorado.

5. REFERENCES

Amen, A.E.; Anderson, D.L.; Huges, T.J.; and Weber, T.J. 1977. *Soil Survey of Logan County, Colorado. USDA SCS and Colorado Experiment Station*. U.S. Government Printing Office, Washington, D.C.

American Wind Energy Association. 2004a. Wind Energy Fact Sheet: Wind Turbine Lighting.

Austin, J.E. and Richert, A.L. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943-1999 [Online]. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND. (Version 01JUL2003), accessed May 20, 2010. http://www.npwrc.usgs.gov/resource/birds/wcdata/index.htm.

Australia NHMRC (Australia National Health and Medical Research Council) 2010. Wind Turbines and Health – A Rapid Review of the Evidence. July. Available online at: http://www.nhmrc.gov.au/publications/synopses/new0048.htm (accessed September 8, 2010).

BLM (Bureau of Land Management) 2005. *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States.* FES -5-11. June. U.S. Department of the Interior, Bureau of Land Management. Available online at http://windeis.anl.gov/documents/fpeis/index.cfm (accessed August 22, 2011).

BLM (Bureau of Land Management) 2010. General Land Office Records. Available online at: http://www.glorecords.blm.gov/.

Burton, T.D.; Sharpe,T.D.; Jenkins, N.; and Bossanyi, E. 2001. Wind Energy Handbook. John Wiley & Sons, LTD. New York.CDNR (Colorado Department of Natural Resources), Division of Water Resources. 2008. Guide to Colorado well permits, water rights, and water administration. Colorado Department of Natural Resources, Denver, CO.

CDOW (Colorado Division of Wildlife). 2003. Conservation Plan for Grassland Species in Colorado, accessed May 20, 2010. http://wildlife.state.co.us/NR/rdonlyres/F5F5631D-021A-4A80-8AB5-1AE158D5EFFB/0/wholeplan.pdf

CDOW (Colorado Division of Wildlife). 2010. Wildlife Species Threatened & Endangered List. Accessed via the internet at: http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/ThreatenedEndageredList/ListOfThreatenedAndEndangeredSpecies.htm

CDOH (Colorado Department of Highways) 1985. *Archaeological Clearance of Highway Project SR* 0059(15).

CMOH (Ontario Chief Medical Officer of Health) 2010. The Potential Health Impact of Wind Turbines. http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf (accessed September 19, 2010).

Colby, W.D.; Dobie, R.; Leventhall, G.; Lipscomb, D.M.; McCunney, R.J.; Seilo, M.T.; and Søndergaard, B. 2009. Wind Turbine Sound and Health Effects: An Expert Panel Review, prepared for American Wind Energy Association and Canadian Wind Energy Association. Available online at: http://www.awea.org/documents/AWEA_CanWEA_SoundWhitePaper_ExecSumm.pdf

Comsearch. 2007. Analysis of AM and FM Broadcast Station Operations in the Vicinity of the Prairie Wind Energy Project in North Dakota.

DOE (U.S. Department of Energy), Western Area Power Administration. 2005. Environmental Assessment, Spring Canyon Wind Project, Logan County Colorado, formerly known as The Peetz Table Wind Project. DOE/EA-1521.

DOE (U.S. Department of Energy) 2006. Memorandum. Office of NEPA Policy and Compliance. Need to Consider Intentional Destruction Acts in NEPA Documents. December 1, 2006.

Eurelectric 2003. EMF Exposure Standards Applicable in Europe and Elsewhere.

Herbrandson, C. and Messing, R.B. 2009. Public health impacts of wind turbines. Minnesota Department of Health, Environmental Health Division White Paper.

Irish Department of Environment, Heritage and Local Government, 2006. Wind Energy Development Guidelines.

Logan County Chamber of Commerce. 2008b. Tourism Information: Lodging Information for Sterling and Logan County. Available online at: http://www.logancountychamber.com/tourismlodging.html

Ludvigson, G.A.; Sawin, R.S.; Franseen, E.K.; Watney, W.L.; West, R.R.; and. Smith, J.J. 2002. A review of the stratigraphy of the Ogallala Formation and Revision of Neogene (Tertiary") Nomenclature in Kansas. Current Research in Earth Sciences, Bulletin 256(2).

NIEHS (National Institute of Environmental Health Sciences) 1999. NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. NIH Publication No. 99-4493.

National Wind Assessments LLC, 2011, NECO Haxton (sic) WP2.7 noise assessment report generated by WindPRO version 2.7.486 and calculated May 23, 2011.

NWCC (National Wind Coordinating Committee). 2001. Avian collisions with wind turbines: a summary of existing studies and comparisons to other sources of avian mortality in the United States. National Wind Coordinating Committee (NWCC) Resource Document prepared by Western EcoSystems Technology, Inc.

Office of the Deputy Prime Minister. 2004. Planning for renewable energy a companion guide to PPS22. Published for the Office of the Deputy Prime Minister, Queen's Printer and Controller of Her Majesty's Stationary Office.

Rogers, A.L., Ph.D. 2006. Wind Turbine Noise, Infrasound and Noise Perception. Renewable Energy Research Laboratory, University of Massachusetts at Amherst. January 18. Available online at: http://www.windpoweringamerica.gov/ne_issues_sound.asp (accessed August 24, 2010).

U.S. Census Bureau. 2008. Census information for Logan and Phillips Counties and the towns of Haxtun, Sterling, Holyoke, and Fleming, Colorado. Available online at: http://quickfacts.census.gov/qfd/states/08/08075.html (accessed 2010).

U.S. Department of the Interior, Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rule To List the Mountain Plover as Threatened; Proposed Rule. Federal Register, Volume 76, Number 92. (76 FR 27756)

USEPA (U.S. Environmental Protection Agency) 2008. Air Quality Nonattainment Areas Map – Criteria Air Pollutants. Available online at: http://www.epa.gov/air/data/nonat.html?st~CO~Colorado

World Health Organization 2007. "Extremely low frequency fields." *Environmental Health Criteria*, Vol. 238. Geneva.