Tribal Renewable Energy - Final Report

Project Title: Northern Cheyenne Wind Energy Development Project

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Recipient Organization: Northern Cheyenne Tribe

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I. INTRODUCTION

Purpose

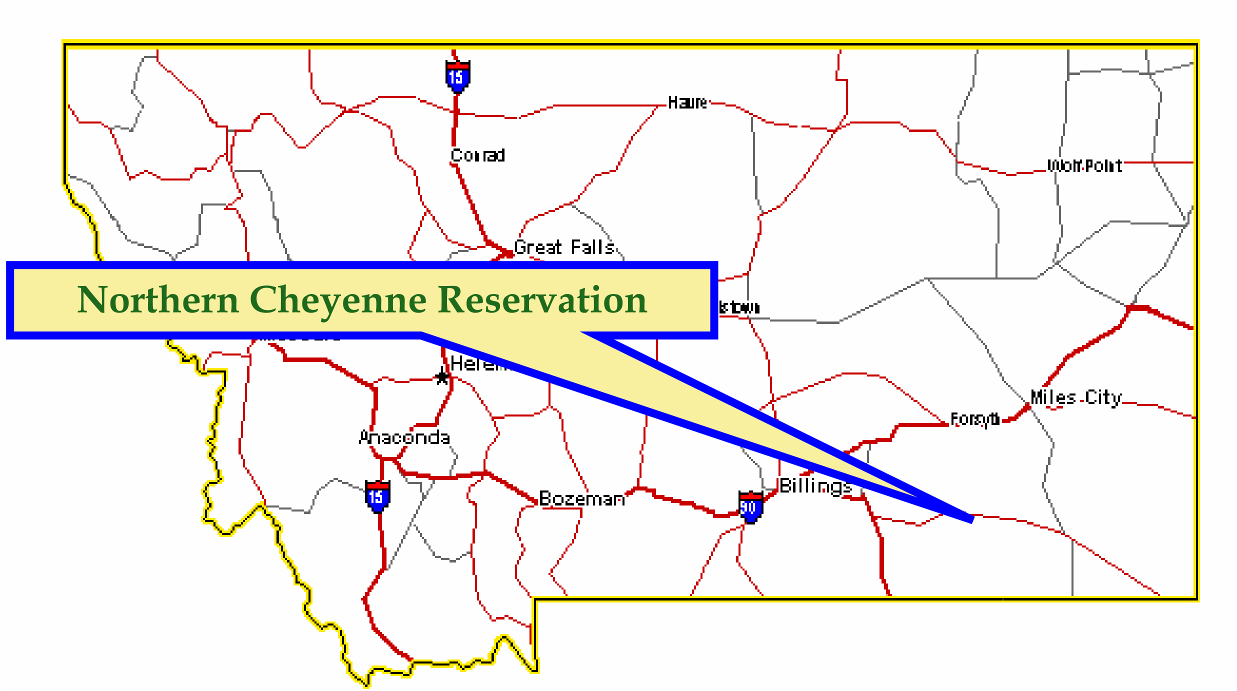
The Northern Cheyenne Tribe (NCT), located on the Northern Cheyenne Reservation within the state of Montana was a recipient of a Department of Energy Renewable Energy Development Grant, GO12100, under the "Renewable Energy Development on Tribal Lands FY2004" program. The NCT selected Distributed Generation Systems, Inc. (DISGEN) of Lakewood, Colorado to manage the project at the direction of the Tribe. The specific development objectives focused on the completion of all the actions required to qualify a specific project for financing and construction of the 30 MW wind facility. In order to qualify for commercial financing, the project required specific and detailed information on the following activities:

- A detailed Avian Assessment suitable for obtaining permits from the federal agencies such as the Bureau of Indian Affairs (BIA)
- A detailed cultural assessment suitable for obtaining permits from the BIA and to the satisfaction of the Tribal Historical Preservation Office (THPO);
- The preparation and filing of a National Environmental Policy Act (NEPA) Environmental Assessment Report and obtaining permits;
- An Interconnection Feasibility Study and an Interconnection Systems Impact Study with Tongue River Electric Cooperative (TRECO).
- An interconnection Agreement with TRECO
- A wind turbine selection analyses based on wind resource
- A geotechnical analyses and foundation design suitable for construction estimates
- Photo-simulations suitable for community information meetings
- Six community information meeting
- Identifying and meeting with prospective power purchasers
- Assessment of financing alternatives
- Obtain, on a best-efforts basis a power purchase agreement
- Obtain financing commitments from at least one source.

This report will detail the outcome of each above activities.

Project Description

The property selected for development is on Tribal Trust Lands near the community of Lame Deer on the Northern Cheyenne Indian Reservation within the Big Horn and Rosebud Counties of Montana. The project is planned for twenty (20) wind turbines, each 1.5 Mw in size. The area selected has an elevation of approximately 4400 feet. It is currently utilized for grazing and some forestry, which is limited due to fire damage. The project site is adjacent to a 69kV transmission line owned by Tongue River Electric Cooperative (TRECO). The site has excellent access from US Highway 212 and is about ten miles east of Lame Deer on the northern side of the highway.



The NCT, in conjunction with DISGEN, selected a tribally-owned parcel of trust land for the feasibility study of a commercial wind facility. The property consists of approximately 1900 acres. A fifty meter (50m) anemometer was installed in October 2002 as part of the Wind Energy Feasibility Grant awarded to the Northern Cheyenne Tribe. A twenty meter (20m) anemometer, provided by the National Renewable Energy Laboratory (NREL), was installed in the project area in February 2003. Corollary climatological data, including detailed wind data, has been collected since 1992 from four locations within, or bordering, the project area. This information has been collected as part of the environmental monitoring of the 2250 megawatt Colstrip coal fired power plant approximately twenty six miles (26 mi.) north of Lame Deer. DISGEN's meteorologist, Ed McCarthy, analyzed this data and compared it to the data obtained from the meteorological towers and estimates a capacity factor for the project of approximately 34%, depending upon the wind turbine selected and its power curve. The resulting capacity factor indicates that a commercial wind energy project is feasible in this location.

II. RESULTS OF ACTIVITIES

A. Detailed Avian Assessment

The US Fish & Wildlife Service (USF&WS) is the consulting agency for any NEPA permits involving fauna. The avian issue has long been a sensitive and emotional issue for the USF&WS and others; although the latest studies indicate very limited impact on birds from wind turbines as compared to other human endeavors. The NCT and DISGEN have conducted preliminary discussions with the USF&WS and have agreed on an avian study protocol; the costs of which are reflected in the grant application budget. The studies are detailed and took a continuous effort for more than one year to accumulate sufficient information for the USF&WS to render recommendations. DISGEN is confident, based on the Phase I Avian Assessment that no fatal flaws will be identified in subsequent detailed studies. However, information may be discovered that may require mitigation measures in the construction and operations and maintenance of the wind project, should it be completed. DISGEN utilized the services of Western EcoSystems, Technology (WEST) for this study. Two reports of can be found in **Appendix A** Ecological and Study and the Potential Impact Index for the project Area.

B. Cultural Assessment

Cultural issues on both Tribal and Non-Tribal lands are very significant and must be studied to the satisfaction of both the Bureau of Indian Affairs (BIA) and the Tribal Cultural authorities. The NCT has a Tribal Historical Preservation Office (THPO) which has been involved in the preliminary cultural analysis of both the meteorological tower installations under the Feasibility Study and the assessment of the proposed project area. DISGEN utilized the services of a archaeologist who compiled a report that can be found in **Appendix B** with the results of the Class I file and research, Class III inventory, and oral interviews with Northern Cheyenne tribal elders.

C. NEPA Report

In order for the BIA to issue a permit, all the studies required under NEPA, as they apply to the project area, must be completed with the appropriate documentation. The NEPA Report is required. Subsequent to the completion of the studies and the submittal of the NEPA Report, the NCT and DISGEN are confident, based on studies conducted to date, that the BIA will determine a "Finding of No Significant Impact (FONSI)" within an Environmental Assessment (EA). The EA is the least difficult process within the NEPA requirements and DISGEN is confident that the EA will be sufficient The NEPA Report, in no small measure will be a determining factor in the issuance of the FONSI. DISGEN staff will prepare the report in consultation with experts in this field. DISGEN has prepared a draft of the EA that will be submitted to the BIA that can be found in **Appendix C**.

D. Interconnection Feasibility Study and Systems Impact Study

The Tongue River Electric Cooperative (TRECO) is the utility serving the NCT Reservation. In order to interconnect a generating station to the electric system, the utility will require an Interconnection Feasibility Study and a subsequent Systems Impact Study. The feasibility study examines the local system to determine if the proposed project can be physically interconnected technically and that the local infrastructure can absorb the energy and capacity being proposed. The Systems Impact Study assesses the wider transmission system and defines any equipment upgrades required as a result of the project. DISGEN utilized the services of Electrical Consultants, Inc to complete this study which can be found in **Appendix D**.

E. An Interconnection Agreement

An interconnection Agreement with TRECO: In order to obtain financing, whether it is institutional investor financing or through the RUS, both the owner and lender need assurances that when the energy is produced, there is a transmission pathway to deliver the energy to the purchaser. This pathway is contractual and is provided for in the Interconnection Agreement between the project owner and the interconnecting utility. This agreement is sometimes referred to as an Interconnection and Wheeling Agreement. In order to limit the cost to move (wheel) energy from the project to the purchaser, it is advantageous for the purchaser to be the interconnecting utility or at least connected to the interconnecting utility. In this case, there are several such entities interconnected to TRECO at the Colstrip power plant. Central Montana and TRECO facilitated an interconnection study which indicated that 30MW could be successfully interconnected to the TRECO 69kV line which is directly interconnected to the Colstrip Coal Fired Power Plant. The studies did not include a Facilities Upgrade Study which will determine if other components on the TRECO system need to be replaced or upgraded to complete the interconnection. Funding for the Facilities Upgrade Study is available once a power purchase agreement is negotiated which is provided by the BIA.

F. Wind Turbine Selection

A wind turbine selection analyses based on wind resource: In selecting a wind turbine, there are two important variables, (i) how much energy will the turbine produce from the available wind resource and (ii) what is the installed capital and operating costs of that wind turbine? Each wind turbine model has a unique power curve that defines the turbine electrical energy output for each increment in increased wind speed. This results in a designed projected output for the project. DISGEN's contract meteorologist, Ed McCarthy, will compare the designed projected outputs for a range of commercially available wind turbines and will recommend one or two turbines for consideration. DISGEN in 2004 selected the 1.5 MW GE wind turbine for its initial proposal to the Northwestern Energy. The wind study is ongoing since the last wind resource report in 2003. The last wind resource report can be found in **Appendix E**.

G. Geotechnical Analysis

DISGEN contracted with local geotechnical consultant to complete a geotechnical analysis and foundation design suitable for construction estimates and can be found in the **Appendix F**. The foundation cost is a significant variable in the total cost of a project. The foundation must be designed to the very specific load bearing capabilities of the soils in which the foundation for the turbine and tower will be installed. The geotechnical report will be provided to the foundation design firms which will custom-design the foundation for the site. This design will then be cost estimated by a construction company and the value included by DISGEN in the final project pro-forma.

H. Photo-Simulations

DISGEN has provided photo-simulations for the project and can be found in **Appendix G**. Digital photographs are taken of the project area from specific sensitive locations. The wind turbines are then superimposed onto the photographs in the precise locations specified in the site plan. The turbines are sized to correspond to distance. This technique is quite precise and very effective at demonstrating to interested parties what the project will look like after construction.

I. Community Information Meetings

The NCT Economic Development group conducted several community information meetings regarding the wind project. An example of the presentation can be found in **Appendix G**. Maintaining a quality communications program with the communities, political districts and tribal membership is essential for public support for the project.

J. Power Purchasers

DISGEN identified and offered proposals to prospective power purchasers such as PacifiCorp, Pennsylvania Power and Light, Puget Sound Power and Light, Avista, Portland General and Northwestern Energy (formerly Montana Power and Light) are all participants in the Colstrip power plant near Lame Deer. An example of the bid documents can be found in **Appendix H**.

K. Financing Alternatives

Assessment of financing alternatives: There are two principle methods of obtaining project financing on tribal lands, (i) institutional investor financing and (ii) Rural Utilities Services (RUS) financing. The institutional financing has a shorter cycle time and can fully utilize the Federal Production Tax Credit. RUS financing is restricted to "Act Beneficiaries" which include tribes, but restricts purchasers to entities that serve communities with less than 2500 in population. A 30 Mw wind project will likely require institutional financing unless Central Montana becomes the purchaser. Both of these models will be assessed and presented to the NCT for consideration. An example of an institutional project pro-forma is included in **Appendix H.**

L. Power Purchase Agreement

Obtain, on a best-efforts basis a power purchase agreement (PPA): DISGEN has extensive experience in drafting these documents and also has several templates for various forms of these agreements. Once a power purchaser expresses a willingness to negotiate a PPA, the parties will enter into a Letter of Intent that binds the parties to the negotiation and defines the key business points. Cooperative parties can complete a PPA in less than one month. The difficult task is locating the willing purchaser. The PPA is the financeable asset in wind projects. Without the PPA, neither of the financing options referenced above can be completed. This is by far the most difficult aspect of the development process and cannot be guaranteed. The market conditions at the time the project is ready to proceed will govern the ability to obtain the PPA.

M. Financial Commitments

Obtain financing commitments from at least one source: At the direction of the NCT, DISGEN will obtain financial commitments from either the institutional investors or the RUS. DISGEN has ongoing relationships with certain institutional investors that have expressed a willingness to finance theses projects. Both the institutional investors and the RUS will likely require a limited waiver of sovereign immunity in order to provide the funds. The waiver will focus on specific aspects of Federal Court jurisdiction and the ability to repossess the equipment in the event the project does not perform satisfactorily

III. SUMMARY

The wind resource at the NCT is marginal, but under the proper financing structure could be competitive in Montana. The candidate power purchaser is Central Montana G&T Cooperative, the entity that provides the energy to Tongue River Electric Cooperative (TRECO) the energy provider to the NCT and the owner of the 69kV line crossing the project area. DISGEN met on several occasions with both Central Montana and TRECO to discuss purchasing the electricity and the Renewable Energy Certificates (RECs). TRECO has a sole source contract with Central Montana, so the purchase of the energy and the RECs would be between the project and Central Montana. Central Montana suggested a price for both the energy and RECs at approximately $32.00 per MWh. Given the increases in turbine pricing over the past several years, this price is not achievable given investors rate of return requirements. The PPA is the single greatest barrier to the completion of the project.

Central Montana and TRECO facilitated an interconnection study which indicated that 30MW could be successfully interconnected to the TRECO 69kV line which is directly interconnected to the Colstrip Coal Fired Power Plant. The studies did not include a Facilities Upgrade Study which will determine if other components on the TRECO system need to be replaced or upgraded to complete the interconnection. BIA agreed to supply $50,000 to complete this study if the PPA issue can be resolved.

Environmental studies were coordinated with United States Fish and Wildlife Service (USFWS) and were performed under the direction of Western EcoSystems Technologies (West) in Cheyenne Wyoming and DISGEN. A Phase One Environmental Assessment was completed by West and no fatal flaws were identified. Subsequently, flora and fauna studies were completed with no significant impacts identified. Further, DISGEN worked with the NCT Environmental Office to conduct ethnographic studies, interviewing tribal elders in the native tongue to assess any potential spiritual issues. Some potential spiritual sites were identified but were outside the planned areas for disturbance of the wind facility. As the project is located on Tribal Trust Land, the BIA has strongly suggested that BIA will be the authorizing agency for the National Environmental Policy Act (NEPA) review. It is believed that West can update and edit with the assistance of DISGEN, the Environmental Assessment Document (EA) for review and approval by BIA. Completing the EA and obtaining the review and approval of BIA is an open issue.

Open Issues

1. **<u>Power Purchase Agreement:</u>** In the past eighteen months, the State of Montana has imposed on Northwest Energy a requirement to purchase renewable energy from 10MW or smaller facilities. This requirement seems to be applicable to the NCT wind project as Northwestern has a delivery point at Colstrip approximately 26 miles distant. The TRECO 69kV line is directly interconnected to Colstrip, so the economic question is what would TRECO charge for the use of its line? The previous management of TRECO indicted they would simply recover their costs which were quite small; between one and two dollars per MWh.

2. **Finance Structure:** The NCT has always had the desire to "own" the wind facility. There are two issues with that desire, (i) the NCT has no available funds to invest and (ii) the project must use any and all tax credits in order to achieve competitive economics. Without the use of the tax credits, there is almost zero probability that the project can achieve the required economics. As the NCT is a tax-exempt entity, should the NCT own the project, the amount of tax credits would be reduced proportionately to the NCT capital investment.

   DISGEN believes that to maximize the value to the NCT, a traditional project finance structure is warranted. Under that structure, the NCT would enter into an easement or lease agreement with a qualified developer. That easement would allow the developer to (i) study the wind resource, (ii) have access to and from the site, (iii) construct a wind facility on the site subject to a site plan and (iv) transmit the resulting energy and RECs from the site. In return, the NCT would be paid an above-market annual royalty based on gross revenue of the project. The developer would maximize the value to the NCT under this agreement and commit to tribal employment preference. DISGEN is currently working with the Rosebud Sioux Tribe under a similar arrangement. The BIA has not approved an easement for wind energy development on Tribal Trust Land and the process seems quite long. BIA is currently reviewing such an agreement for a larger project on the Rosebud Sioux Tribe and little progress has been made.

3. **Interconnection Agreement:** The interconnection agreement is typically a straightforward document that allows the interconnecting utility to control the project to prevent unacceptable voltage and frequency problems on the grid. The utility must be allowed to separate the project from the system very quickly in the event of a system emergency condition. A key concern of the utility is that the starting and stopping of the wind turbines not adversely impact the other customers on the system. This will be very unlikely in the case of the NCT project because the line in question is typically not energized. Once a PPA been signed and the turbine manufacturer selected, the interconnection agreement can proceed promptly. It makes little economic sense in this particular instance to proceed with the agreement because the line is currently not loaded.

4. **Environmental Assessment:** The BIA has informed both DISGEN and the NCT that it will be the permitting authority in consultation with the USFWS. All of the necessary field studies have been completed and once the turbine selection and final site plan are complete, then the EA document can be forwarded to the BIA for approval. DISGEN is confident that a Finding of No Significant Impact (FONSI) will be made by the BIA. The BIA has not approved a commercial wind facility on Tribal lands and so BIA is learning how wind turbines work and the pros and cons of project development and operations.

5. **Government Loans or Loan Guarantees:** It seems clear that based on the information we have provided to several federal agencies including DOE, BIA, DOA and RUS, that government loans or loan guarantees to wind projects under a limited recourse structure is something the agencies have not done. While the agencies are very supportive of development on Tribal Lands, the current policies and procedures make the process of qualifying these projects very difficult at best and the timing is likely to take a year or more, if ever. Consequently, DISGEN is moving to arrange commercial financing for the tribal projects where tribes have decided to enter into the easement agreements generally described above.

Conclusion

DISGEN continues to believe that development of renewable energy facilities on Tribal Lands is an effective form of economic development for the benefit of the tribes. However, the difficulties in the areas of environmental permitting and the apparent legislative handcuffs worn by government agencies in the process of development on federal lands seems to be too cost-prohibitive and time consuming to be economically competitive. Certainly, developing these lands is feasible, but the costs are significantly higher doing so than on fee lands.

APPENDIX A

Avian Studies

Ecological Baseline
Potential Impact Index

Northern Cheyenne Tribe
North Cheyenne Reservation

Ecological Baseline Study for the Northern Cheyenne Wind Project

October 2003

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INTRODUCTION AND BACKGROUND

Distributed Generation Systems, Inc (DISGEN) is planning a small wind generation facility for the Northern Cheyenne Nation in Rosebud County, Montana (Figure 1). The proposed development will consist of approximately 30 MW and 20 turbines. Most wind facilities currently being constructed throughout the U.S. are much larger, ranging from 75 – 100 MW and 50 – 67 turbines in size.

DISGEN has asked Western Ecosystems Technology, Inc. (WEST) to develop a standardized protocol for a baseline study of wildlife use of the project area for the purpose of predicting the impacts of the project on wildlife. The following protocol contains an outline of the proposed ecological baseline study. This protocol for the ecological baseline study is similar to protocols used at the Vansycle, Klondike, Stateline, Maiden, Condon and Nine Canyon wind projects in Oregon and Washington, the Buffalo Ridge Windplant in southwest Minnesota, and the SeaWest Windplant in Wyoming. The outline has been developed based on our experience related to wildlife wind turbine interactions at projects throughout the U.S., an initial reconnaissance survey and USFWS potential impact score of the study area, a meeting with Rob Hazelwood, Montana U.S. Fish and Wildlife Service (USFWS), and Rick Stefanic, Bureau of Indian Affairs (BIA). The following protocol has also been prepared considering the relatively small size of the proposed wind plant and the ranking of the site within the medium impact rank category.

Overview of the Baseline Studies

The principal objectives of the baseline study for this proposed wind project are to: (1) describe the temporal and spatial use of wildlife in the proposed project site; (2) describe the occurrence of any federal and state threatened, endangered, proposed, candidate, or sensitive-status plants and animals and their potential habitat that may be affected by the project, (3) estimate any potential impacts to habitat and wildlife that could result from the construction and operation of the proposed wind energy development project, and (4) identify potential project modifications and/or mitigation measures that could potentially reduce negative impacts.

These objectives can be addressed by a combination of data collected at the proposed project site and from baseline and post-construction monitoring data collected at other wind development sites. The baseline study report may also provide information that can be used to design a post construction (operational) monitoring study as appropriate.

In addition to site-specific data, the baseline study will use existing information and results of studies conducted at other wind plants. Data collected at existing wind plants have greatly enhanced our ability to estimate potential bird and bat mortality at proposed wind plants. For several wind power projects, standardized baseline data on avian use and raptor nesting have been collected in association with standardized post-construction (operational) monitoring, allowing comparisons of avian use to mortality. Additional information about species that are known or likely to occur in the vicinity of the proposed wind project have been gathered from appropriate agency databases and from reports developed for other regional projects and will be used within the final impact analyses.

The site-specific baseline study will consist of the following components: 1) Vegetation Mapping, 2) Avian Use Surveys, 3) Winter/Early Spring Driving/Walking Surveys for Sensitive Wildlife, 4) Raptor Nest Surveys, and 5) General Wildlife Observations. Carcass searches will begin after construction is completed. Details of carcass survey methods, such as search intensity and duration will be determined after review of the results of baseline studies and will be coordinated with USFWS and BIA officials.

1. Vegetation Survey and General Project Mapping

Key information about vegetation and physical characteristics and observations within the general project area will be maintained in a comprehensive project mapping system. Any prairie dog towns present within the project area will also be mapped.

2. Avian Use Surveys

The objective of avian use surveys is to provide information that can be used to predict potential impacts, and identify methods of avoiding and/or mitigating impacts by estimating temporal and spatial use of the general project area by birds. The avian use surveys consist of counts of birds observed within circular plots around observation points. Avian use surveys will focus on documenting use of the project area by migrating and breeding raptors, and by breeding songbirds.

3. Winter/Early Spring Driving/Walking Surveys for Sensitive Wildlife

Because existing information indicates that wintering bald and golden eagles are a potential concern, focused winter/early spring surveys will be conducted to document the presence and quantify the distribution of wintering bald and golden eagles. Surveyors will drive or walk a pre-determined survey route at bi - weekly intervals.

4. Raptor Nest Surveys

The objective of raptor nest surveys is to provide information that can be used to predict potential impacts to nesting raptors and to identify methods of avoiding and/or mitigating impacts. Ground based surveys will be used to locate raptor nest locations within ½ mile of project facilities and should identify raptor nests susceptible to disturbance from construction and identify breeding raptors with the highest risk of impacts from operation of the windplant (i.e., collision risk).

5. General Wildlife Observations

The objective of general wildlife or in-transit observations is to document wildlife habitat and occurrences on site. All wildlife species of interest or species not previously documented on site through other surveys that are sighted while field observers are traveling between plots or in the general project area will be recorded and mapped.

STUDY AREA

The potential project area is located within T 2 S, R 43 E, Sec 17, 18, 20, 29-30. Most of the project area is characterized by relatively tall ridges dominated by open Ponderosa pine. Within the project area large areas of forest were recently burned and salvage logged, resulting in large openings within a forest matrix. Other habitat types present near the project area include riparian areas, open sagebrush and grassland and cliffs. The Tongue River and associated mature cottonwood riparian areas are found east of the project area by approximately 7 miles. Open sagebrush and grassland habitats are also present east of the project area. See the attached phase one screening report for detailed maps of the project area.

BASELINE STUDIES

Key questions that will be addressed through the baseline study and by review of relevant data and literature include:

1. What wildlife species occur in the general project area?
2. Are any federal or state listed threatened, endangered, proposed, candidate or sensitive animal and/or plant species or their habitat known to occur in the general project area?
3. How do indices of avian use of the general project area compare with other wind energy development sites that have been studied in western North America?
4. What are the potential direct and indirect impacts of the project on wildlife and plants (e.g., habitat loss, disturbance/displacement, potential mortality) based on use, abundance, physical geography, vegetation types, etc., of the proposed site compared to other existing and proposed wind project sites?

To answer these and other key questions, baseline studies will incorporate results from studies of existing, new, and proposed wind energy development projects in the west (subject to data availability) and across the U.S., in conjunction with baseline data collected at the proposed wind project.

Information Review

Existing information on species and habitats of greatest interest, which are known or likely to occur in the vicinity of the project impact area, will be reviewed, mapped, and incorporated into field surveys. This section provides sources of existing information that will be reviewed before field surveys are conducted, and parameters that will be included on project maps. Much of the existing information available for the project area has been collected for the phase one screening report (see attached).

Review of Baseline Data at Other Wind Plant Facilities

A large amount of data and literature are becoming available regarding the expected impacts of wind energy developments on wildlife and particularly birds (Erickson et al. 2001) and bats (Johnson 2003). For many wind energy development project studies, standardized post-construction (operational) monitoring data have typically been collected along with standardized data on avian use, raptor nesting, and habitat information. The ability to estimate potential bird mortality at wind plants is greatly enhanced by reviewing data collected over the past 6 years at these other wind plants.

Information from other wind projects can be used to 1) better quantify the expected impacts on the species/groups of concern, 2) assist in planning the sampling effort for baseline studies on the site of interest, and 3) potentially modify the sampling effort proposed for new data collection if the review of existing information along with the baseline data supports the modifications.

Mapping

Mapping will cover the general project area. Key information about biological characteristics and observations will be maintained in a comprehensive project mapping system for use in wind project siting, impacts evaluation, mitigation, and monitoring.

Base Map

The maps used will include USGS 7.5-minute topographic maps and available aerial photography and digital orthophotography. The preferred layers include the following:

- Topography and important habitat features
- Water resources and other drainages
- Roads
- Legal boundaries (e.g., township, range, section)
- Dwellings
- General Vegetation types
- Seasonal and historical ranges for species of interest
- Survey points
- Study area boundaries
- Transect and observation locations
- T&E species locations and areas surveyed
- Nest and/or roost sites for raptors (e.g., trees, cliffs, old windmills)
- Project facilities
- Caves, mines, and other bat habitats
- Prairie dog towns

All parameters except potential nest sites are available from existing sources or reconnaissance visits. Potential raptor nest sites and suitable habitat will be identified from MFWP, USFWS or other data, aerial photography, and field reconnaissance.

Field Maps

USGS quadrangle maps and/or digital orthophotographs will be used as field maps during the study. The quadrangle maps or orthophotos will be used to produce the base maps on which observation locations and flight paths will be recorded for the avian use surveys. The quadrangle maps will also be used as the base maps for recording locations of potential habitat for status species, status species observations, and in-transit observations of other species of local interest.

Field Methods

The proposed methodology has been designed to provide baseline information necessary to assess potential impacts to wildlife and plant species as a result of the construction and operation of a wind energy development project. The elements of the proposed study are described below.

General Vegetation Survey

The vegetation types in the general project area will be inventoried from aerial photographs, digital orthophotos, or through field surveys and mapped on the base map. Habitat classifications will be assigned using a habitat classification system or other appropriate standard methods. Habitat mapping will be completed prior to November 2004.

The vegetation and non-vegetation land-cover expected to be present are anticipated to be as follows:

- Agricultural dry (AD, irrigated or non-irrigated cropland, winter wheat, plowed, or stubble)
- Coniferous forest (CF, includes ponderosa pine and other coniferous forest types)
- Upland trees (UT, planted groves or individual trees, live or dead)
- Riparian trees (RT, groves or individual trees along drainages)
- Riparian non-forested (RI, non-forested vegetation along drainages)
- Shrub-steppe (ST, dominated by native shrubs such as sagebrush, rabbitbrush, bitterbrush)
- Grassland (GR, native grassland with few or no shrubs)
- Conservation reserve lands (CRP, former croplands planted as grasslands)
- Developed (DE, residential, farm, industrial/commercial, urban)
- Surface water (WA, rivers, streams, stock watering ponds)
- Wetlands (WE, including emergent, scrub-shrub, and forested wetlands)
- Rocky outcrops (RO, cliffs or outcrops)
- Praire Dog Towns (PD, Includes active and inactive prairie dog burrows)

A vegetation/land-cover map of the general project area will be prepared. The area of each vegetation type within the proposed altered areas will be calculated.

Each vegetation type identified in the field will be described in terms of dominant and co-dominant plant species composition and abundance using visual estimates. Percent shrub cover will be estimated for the shrub-steppe class. Locations of small features or habitats too small to map on the base maps (e.g., rocky outcrops, springs), but which may be locally important to wildlife and status species, will be recorded.

Surveys for wetlands will also be conducted within the proposed project area. The National Wetland Inventory map (subject to availability) for the project impact area will be used as an initial wetland base map, field-verified in areas that could be affected by project components, and updated as needed. The presence of county noxious weeds within the general project area will be assessed.

Winter and Early Spring Driving/Walking Surveys

A combination of driving and walking surveys will be conducted during the winter and early spring to document the presence and quantify the distribution of wintering bald and golden eagles and other species of concern. Surveyors will drive a pre-determined survey route at bi - weekly intervals from November 1, 2003 – March 31, 2004. Survey routes will be established along existing roads within and near the project area (Figure 1).

Along the public roads, depending on the traffic and safe pull-off availability, the surveyor will look for eagles and other sensitive species within the viewshed from the road. When the surveyor is stopped, areas of large cottonwoods and conifer trees will be scanned with binoculars to locate perched eagles. A spotting scope will be used if closer views are required to confirm identifications or if a potential roost tree grove has been identified in the distance. In between stops, the observer will drive at a steady speed of approximately 25 mph (40 kph), where appropriate. Surveys will be conducted in the morning and evening hours, alternated each survey. If bald eagles or other status species are sighted, they will be given an observation number and mapped on USGS 7.5' quadrangle maps. Habitat, activity, and time of day will also be recorded for each observation. Flight paths of bald and golden eagles will be mapped for as long as the bird is visible. Documented perch and evening winter roost site locations will be recorded. Sites with a high potential for evening roosts (based on site characteristics), but not documented as being used during the field survey, will also be recorded on maps. All other special status wildlife and species of local interest observed will be recorded, including big game, waterfowl, and other raptors. The direction of the route followed (forward or reverse), total time spent and distance driven/traveled will be recorded for each survey route. If bald eagle winter roosts are located, the survey will be scheduled to either begin before dawn or end at dusk, and include up to 30 minutes of observation of birds leaving or entering a roost site.

Avian Use Surveys

The objective of the avian use surveys is to estimate the temporal and spatial use of the general project area by birds, especially migrating raptors. Avian use survey data will consist of counts of birds observed within circular plots around observation points following methods established by Reynolds et al. (1980). Observations made while in-transit between points and during other surveys will also be reported. Weekly surveys will be conducted from April 1, 2004 – October 3, 2004 in order to document diurnal avian use during the spring migration, breeding and fall migration seasons.

A total of 5 stations will be established within and adjacent to the area proposed for development so that the data collected on avian use is well representative of the entire project area (Figure 1). A sampling approach will be used to ensure that the most likely locations of turbine strings are well represented, with many of the proposed turbine strings located within observation viewsheds. Some constraints on locations of observations will include access, visibility limitations imposed by the terrain, and the conceptual nature of the layout of turbine strings and access roads. More survey stations may be added if needed.

All birds seen during each survey will be recorded. Estimated distance to each bird observed will be recorded to the nearest meter. The survey radius of the circular plots will be up to 2,625 ft (800 m) depending on the limitations of the terrain. Plots will be surveyed for 30 minutes each. An equal effort will be used for all plots. Flight or movement paths of all species of interest will be mapped on USGS base maps and given corresponding observation numbers. The map will indicate whether the animal is within or outside the survey radius based on reference points at known distances from the plot center. Topographic maps will be used to aid in recording locations of observations as accurately as possible.

The behavior of each raptor/large bird observed and the habitat in which or over which the bird occurred are recorded. Behavior categories recognized include perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT, noted in comments). Vegetation types of observations will also be recorded. The initial flight patterns and vegetation types (first observation) are uniquely identified on the data sheet and subsequent patterns and habitats (if any) are also recorded. The flight direction of observed birds is also recorded on the data sheet map. Approximate flight height at first observation is recorded to the nearest meter; the approximate lowest and highest flight heights observed are also recorded. Any comments or unusual observations are noted in the comments section. Locations of raptors, other large birds, and any species of concern seen will be recorded on the field maps, by observation number. The field maps will be prepared as portions of the USGS quadrangle or orthophotos, which include the survey plot.

Landmarks will be located to aid in identifying the 800 m boundary of each observation plot. Observations of birds beyond the specified radius will be recorded, but will be analyzed separately from data within the plot/transect. Weather information, including temperature, wind speed, wind direction and cloud cover, will be recorded for each survey point. The date, start, and end time of observation period, plot number, species or best possible identification, number of individuals, sex and age class, distance from plot center when first observed, closest distance, height above ground, activity, and habitat(s) will be recorded.

Plot surveys will be scheduled to cover all daylight hours. During a set of surveys, each plot will be visited once. Observation days will be divided into two periods, morning (6:00 a.m. to noon) and afternoon (noon to 6:00 p.m.). A pre-established schedule will be developed prior to the field surveys to ensure that each station is surveyed approximately the same number of times each period of the day during the period of study and to efficiently utilize personnel time by minimizing travel time between plots. The survey schedule will require flexibility in response to adverse weather conditions, which may cause delays and rescheduling of surveys.

Raptor Nest Survey

The objective of the raptor nest surveys is to gather information on nesting species detectable from the ground within ½ mile of all project facilities. This area should include the nests most susceptible to impacts by construction and operation of the wind plant. Locations of inactive nests will also be recorded as they may be occupied during future years. All nests, whether active or inactive, will be given a unique identification number and the location recorded using a GPS unit. Broadcast surveys for forest dwelling species (northern goshawk, Cooper's hawk) will be used as needed. Surveys for nesting accipiters will follow established methods (Kennedy and Stahlecker 1993, Joy et al. 1994). Surveys will be conducted during the late spring of 2004.

General Wildlife Observations

All wildlife, especially large birds (raptors, shorebirds, waterfowl, waterbirds, upland gamebirds, big game, and/or unusual species (such as state listed or sensitive-status species, mammals, reptiles, amphibians) sighted while field observers are traveling between plots or on site will be recorded on in-transit or general wildlife observation data sheets. The data recorded are similar to those recorded during the plot studies. The observation number, date, time, species, number of individuals, sex/age class, height above ground, and habitat will be recorded. Observations of TES species will be recorded in additional detail, mapped on a USGS quadrangle map by the unique observation number, and summarized. A final list of all species to be recorded and mapped will be developed in consultation with the USFWS wildlife biologists. Common raptors and other large birds such as red-tailed hawk, Northern harrier, American kestrel, common raven, great-blue heron may be recorded, but flight paths may not need to be plotted on maps. If required, observations of big game will be recorded during all field surveys, with standardized data collected during the winter/early spring driving/walking surveys and the avian point count surveys.

STATISTICAL ANALYSIS OF BASELINE DATA

Data Compilation and Storage

A database will be established to store, retrieve, and organize field observations. Data from field forms will be keyed into electronic data files using a pre-defined format that should make subsequent data analysis straightforward. All field data forms, field notebooks, and electronic data files will be retained for ready reference.

Quality Assurance/Quality Control (QA/QC)

QA/QC measures will be implemented at all stages of the study, including field data collection, data entry, data analysis, and report preparation. At the end of each survey day, each observer will be responsible for inspecting his or her data forms for completeness, accuracy, and legibility. Periodically, the study team leader will review data forms to insure completeness and legibility; any problems detected will be corrected. Any changes made to the data forms will be initialed and dated by the person making the change.

Data will be entered into a relational database (e.g., ACCESS) and checked thoroughly for data entry errors. Any errors will be corrected by referencing the raw data forms and/or consulting with the observer(s) who collected the data. Any irregular codes detected, or any data suspected as questionable, will be discussed with the observer and study team leader. Any changes made to the raw data will be documented for future reference.

Statistical Analysis and Products

Statistics and data to be generated for the project may include the following:

- Survey areas for each survey component.
- Vegetation/habitat mapping and statistics.
- Raptor nests by species and locations (map).
- Species lists by study period, and study unit (if applicable).
- Tabulation of nest timing, occupation, and success by raptors (table).
- Summaries of flight paths and heights, by species and season (if different) (maps and tables).
- Species and proportion of flights passing within the zone (including the rotor swept area) potentially occupied by wind turbines (table).
- Behavior patterns by species, group, vegetation type, and/or land form (tables).
- Relative use by species, season, and observation point (tables and maps).
- Locations of TES species and other species of concern (map).
- Counts of big game in the study area.
- Detailed comparisons of avian use, raptor nest densities, and habitat composition between the project and other new or proposed windplants.
- Detailed comparisons of avian use, and habitat composition between the project and other new or proposed windplants including Foote Creek Rim, Vansycle, Stateline, Condon, Nine Canyon, Columbia Hills, Maiden, Klondike, Buffalo Ridge and other project baseline studies dependant on availability.

The number of raptors and other species seen during each point count survey will be standardized to a unit area and unit time searched. For example, if 4 raptors are seen during the 20 minutes at a point with a viewing area of 2.01 km^2, these data may be standardized to $4/2.01 = 1.99$ raptors/km^2 in a 20-minute survey.

Point count data will be plotted to illustrate differences in raptor and other bird use between: (1) seasons, (2) times of day, and (3) stations. Mean values and 90% confidence intervals will be reported.

Maps of large bird flight paths will be developed, showing point count and in-transit survey observations. Further information will be gained to guide placement of the wind turbines from analysis of the vegetation type and topographic data derived from the map database (e.g., habitat types, distance to canyons, distance to water, etc.). Vegetation types or other topographic variables that appear to attract birds, or that birds avoid, will be identified based on a comparison of available habitat used by birds and knowledge of individual species biology.

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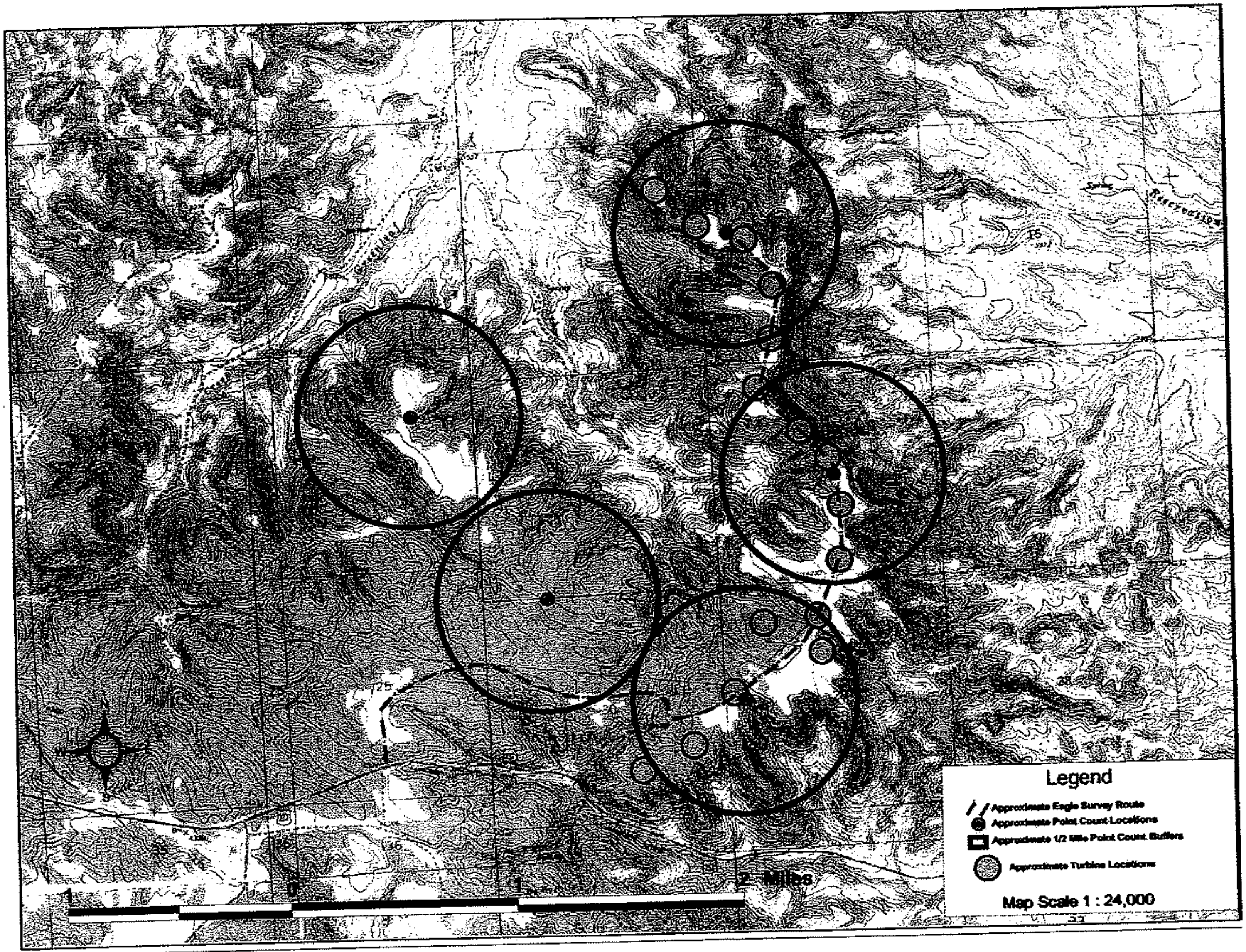


Figure 1. Locations of proposed turbines, point count stations and the eagle survey route.

APPENDIX A – DRAFT FIELD DATA FORMS

Page ____ of ______.

Eagle and Incidental Observation Data Sheet: *Northern Cheyenne Wind Site*

DATE: _________ OBSERVER ______ START TIME _______ END TIME _______

WEATHER: VISIBILITY(CIRCLE ONE) good fair poor CLOUD COVER(%) ______ TEMP(^{o}C) ______

WIND DIRECTION (CIRCLE ONE) N NE E SE S SW W NW n/a WIND SPEED(KPH) Low: High:

PRECIPITATION(CIRCLE ONE) none light rain rain light snow snow sleet hail other

Eagle Survey or ***Incidental*** **(CIRCLE ONE)** Direction of Route **(CIRCLE ONE)** North – South or South - North

Obs. No.	Time	UTM EASTING[b] / UTM NORTHING	Species	Sex	Age	# Inds.	Distance (m) from observer: 1st	Distance (m) from observer: closest	Activity	Flight Characteristics: Flight Height (m): 1st	Flight Characteristics: Flight Height (m): low	Flight Characteristics: Flight Height (m): high	Flight Characteristics: Dir.	Habitat	A[a]
1									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
2									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
3									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
4									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
5									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
6									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
7									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
8									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
9									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
10									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
11									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
12									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
13									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
14									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
15									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
16									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
17									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
18									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
19									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	
20									PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT	

a Check if Observation was Auditory only

b Record UTM or map the location of each observation

Comments:

Codes
PE = Perched, SO = Soaring, FL = Flapping, FH = Flushed, CS = Courtship, HO = Hovering, OT = Other, GS = Grassland, CF = Coniferous, SV = Salvage Logged, CR = Cottonwood Riparian, AG = Agriculture, DS = Deciduous Shrub, SB = Sagebrush, RK = Rock, RI = Willow Riparian, OT = Other

STATION *A*

AVIAN OBSERVATION DATA SHEET: *Fixed Point Surveys – Northern Cheyenne Wind Site*

PAGE ______ OF ______

DATE: ____________ OBSERVER ______ START TIME ______ END TIME ______

WEATHER: VISIBILITY(CIRCLE ONE) good fair poor CLOUD COVER(%) ______ TEMP(°C) ______

'ND DIRECTION (CIRCLE ONE) N NE E SE S SW W NW n/a SPEED(KPH) Low: ______ High: ______

.ECIPITATION(CIRCLE ONE) none light rain rain light snow snow sleet hail other

Obs. No.	Species	Sex	Age	# Inds.	Distance (m) from observer: 1st	Distance (m) from observer: closest	Activity	Flight Characteristics: Flight Height (m): 1st	Flight Height (m): low	Flight Height (m): high	Flight Characteristics: Dir.	Habitat	Instantaneous Count (Height/Distance): 1	2	3	4	A[a]	10 min incr.
1							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
2							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
3							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
4							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
5							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
6							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
7							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
8							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
9							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						
10							PE SO FL FH CS HO OT					GS CF SV CR AG DS SB RK RI OT						

[a] check if Auditory only

Comments ______________________________

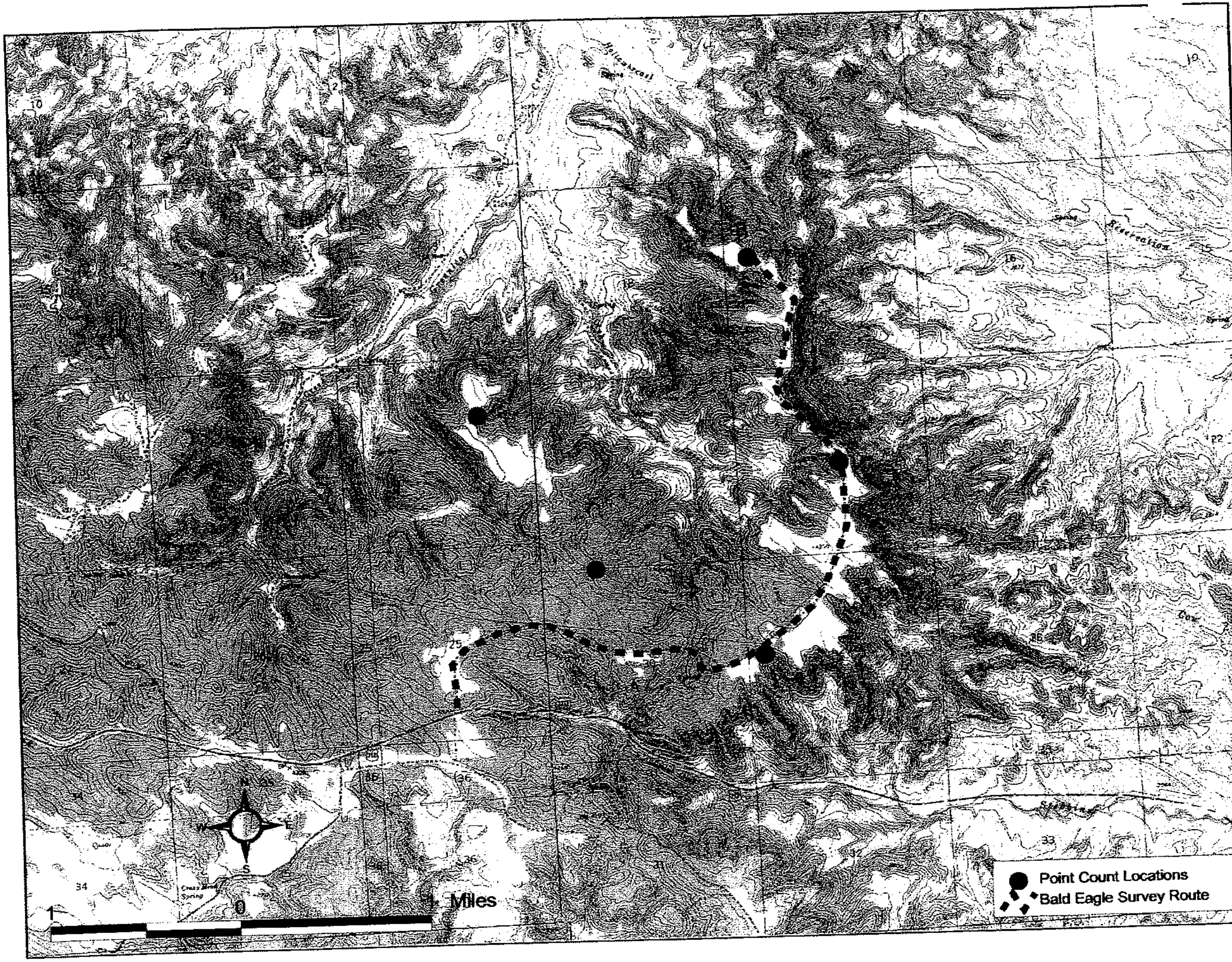
General Wildlife Observations

Obs #	Spp	# observed

Codes

PE = Perched, SO = Soaring, FL = Flapping, FH = Flushed, CS = Courtship, HO = Hovering, OT = Other, GS = Grassland, CF = Coniferous, SV = Salvage Logged, CR = Cottonwood Riparian, AG = Agriculture, DS = Deciduous Shrub, SB = Sagebrush, RK = Rock, RI = Willow Riparian, OT = Other

WEST, Inc.



Point Count Locations
Bald Eagle Survey Route
1
0
1 Miles
N
S
W
E

Appendix B – Phase One Screening Report

Phase One Screening Report:

Northern Cheyenne Nation

Lame Deer Site

Rosebud County, Montana

April 23, 2003

Prepared for:

Disgen

Prepared by:

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Cheyenne, Wyoming 82001

INTRODUCTION:

Wind energy is one of the fastest growing sources of "green" energy in the U.S. However, wind plants can have negative effects on wildlife. Although studies have shown both the direct and indirect effects on wildlife by most wind plants to be minimal, state wildlife agencies, the U.S. Fish and Wildlife Service and environmental organizations have concern over the potential effects of wind plants on wildlife. State wildlife agencies and environmental organizations are concerned with issues such as critical wildlife habitat, avian fatalities and the disturbance or loss of unique plants and habitats. The U.S. Fish and Wildlife Service is charged with enforcing the Endangered Species Act, The Eagle Protection Act, and the Migratory Bird Treaty Act, and is concerned about impacts to migratory birds and listed species (candidate, proposed, threatened, or endangered). Currently, several wind power companies are conducting studies required by the described agencies.

When exploring potential wind plant sites, knowledge of potential wildlife issues would help the wind industry identify and avoid possible conflicts with wildlife and state and federal natural resource agencies. WEST, Inc was asked by Disgen to evaluate potential impacts to wildlife at a prospective wind plant site. The area is located northeast of Lame Deer within Rosebud County, Montana on the Northern Cheyenne Reservation (Figure 1). This report focuses on the following wildlife issues:

- Raptor Issues
    1. Identifying areas of potentially high nesting density
    2. Identifying areas of potentially high prey density
    3. Examine topography to determine the potential for high use and nest locations
    4. Determine the species likely to occur in the area
    5. Determine the potential for migratory pathways
- Candidate, Proposed, Threatened, Endangered or State Protected Species
    1. Identify the potential occurrence of federally listed or state protected species through existing literature and database searches
    2. Evaluate the suitability of habitat at wind plant sites for protected species
- State Wildlife Issues (using existing state wildlife agency information)
    1. Determine if site is considered a critical winter or parturition area or other highly valuable habitat
    2. Determine if area is considered a migratory route for game species
    3. Examine habitat during site visits to determine the potential for use by game or state protected species
- Unique habitat
    1. Evaluate the uniqueness of the site relative to the surrounding area. For example: wildlife might be fatally attracted to a desirable habitat (a rocky bluff) surrounded by undesirable areas (short-grass prairie)
    2. Determine the potential for sensitive or protected plants to occur on site through a habitat evaluation and a search of existing information

- Bats
  1. Determine the potential for bat deaths at the wind plant site. Proximity to potential feeding sites and hibernacula will be evaluated
  2. Determine species likely to occur in the area

- Avian Migratory Pathways

METHODS:

Biological resources within the project and evaluation areas were evaluated through a search of existing data and a site visit. The project and evaluation areas were visited on February 19, 2003 to evaluate habitat, potential for avian migratory pathways, and look for raptor nests, prey populations and other biological resources.

Several sources were used to identify biological resources within the project area, including a site visit, information obtained from the Billings office of the USFWS, requesting data from the Montana Natural Heritage Program, interviews with local experts and other sources of information (see Literature Cited). After biological resources within the project area were identified, we analyzed the potential for conflicts with the potential wind plant based upon baseline and mortality studies conducted at other wind plants throughout the U.S.

Study Area. The potential project area is located within T 2 S, R 43 E, Sec 17-20, 29-30 and T 2 S, R 42 E, Sec 24. We also evaluated a much larger area in the event the project was expanded, hereafter referred to as the evaluation area. The area evaluated for potential wildlife impacts includes land owned by the Northern Cheyenne east of Montana 39 and north of US 212 (Figure 2). Most of the evaluation area is characterized by relatively tall ridges dominated by open Ponderosa pine. Within the project area large areas of forest were recently burned and salvage logged, resulting in large openings within a forest matrix. Other habitat types are present within the evaluation area, including riparian areas, open sagebrush and grassland and cliffs. The Tounge River and associated mature cottonwood riparian areas are found on the eastern edge of the evaluation area. Open sagebrush and grassland habitats are also present in the eastern portion of the evaluation area.

RESULTS:

Raptor Issues

Nesting density and species breeding in area. Nesting habitat for raptors is present throughout the evaluation area, including open ponderosa pine forest, riparian areas and cliffs. Within two miles of the project area, most potential nesting habitat is limited to one area with some rock outcrops and cliffs (Figure 2), open ponderosa pine habitat and riparian areas along Greenleaf Creek and Stebins Creek (Figure 3). Potential nesting densities are difficult to assess and may depend largely on potential prey densities. Nesting densities of some species are likely to be higher on or near cliffs or riparian areas. Due to the presence of a variety of habitats, several species have the potential to nest within the evaluation area (Table 1).

Table 1. Raptor species potentially breeding within the evaluation area. Species distribution information is based on the Montana Bird Distribution Database (2003) and information obtained from the USFWS.

SPECIES	**HABITAT**
American kestrel (*Falco sparverius*)	Open habitats; Will nest in cliffs or snags
Prairie Falcon (*Falco mexicanus*)	Open habitats; Mostly nest in cliffs or rock outcrops and not likely to nest within the project area.
Merlin (*Falco columbarius*)	Open pine forest and open habitats; Nest within trees and old raptor or magpie nests
Bald Eagle (*Haliaeetus leucocephalus*)	Nesting and wintering habitat likely limited to Tounge River riparian area. No nesting habitat is present within the project area due to lack of large bodies of water
Golden Eagle (*Aquila chrysaetos*)	May nest in open forest, open habitats or cliffs
Osprey (*Pandion haliaetus*)	May nest along Tounge River riparian area
Red-tailed Hawk (*Buteo jamaicensis*)	Open forest or open habitats
Ferruginous Hawk (*Buteo regalis*)	Open habitats, not likely to nest within the project area.
Northern Harrier (*Circus cyaneus*)	Open habitats, not likely to nest within the project area.
Swainson's hawk (*Buteo swainsoni*	Open habitats, not likely to nest within the project area.
Cooper 's hawk (*Accipiter cooperii*)	Forested areas or riparian areas
Northern Goshawk (*Accipiter gentiles*)	Forested areas
Flammulated Owl (*Otus flammeolus*)	Forested areas
Great-horned Owl (*Bubo virginianus*)	Will nest in most habitats
Northern Saw-whet owl (*Aegolius funereus*)	Forested areas or riparian habitats
Short-eared owl (*Asio flammeus*)	Open habitats, not likely to nest within the project area
Burrowing Owl (*Athene cunicularia*)	Open areas, likely limited to prairie dog towns. Not likely to nest within the project area
Eastern Screech Owl (*Otus asio*)	Cottonwood riparian areas
Long-eared Owl (*Asio otus*)	Open habitats, not likely to nest within forest or project area

Potential for prey densities. Due to snow cover throughout most of the project area, it was difficult to evaluate the potential for prey densities. The potential exists for colonial species of rodents, such as ground squirrels, to occur within burned and other open habitats in the project area. One large black-tailed prairie dog town is present within the southeast portion of the evaluation area, approximately 3 – 4 miles from the project area. (Figure 2). Species such as golden eagle, red-tailed hawk, ferruginous hawk and burrowing owl may spend large amounts of time hunting within the prairie dog town. Burned areas within the project area may also provide habitat for relatively high densities of woodpeckers, such as the northern flicker and hairy woodpecker. Species such as Cooper's hawks and northern goshawks may be attracted to areas with relatively high densities of woodpeckers.

Does the topography of the site increase the potential for raptor use? At other wind plants located on prominent ridges with defined edges, raptors fly along the rim edges, using wind updrafts to maintain altitude while hunting, migrating or soaring. Turbines are often placed on prominent ridges, in order to use higher wind speeds and updrafts that raptors also use. The project area contains some prominent ridges, and the potential for raptors to use updrafts while hunting, soaring, or migrating through the area is high (Figure 4).

Federal and State Protected Species

According to the U.S. Fish and Wildlife Service (2003), four species listed under the Endangered Species Act are present within Rosebud County: bald eagle, black-footed ferret, and interior least tern. The black-tailed prairie dog is currently considered a candidate for listing under the endangered species act.

Bald Eagle. Bald eagles are documented as breeding along the Tounge River within the latilong of the evaluation area. Bald eagles may use the Tounge River and the associated riparian area adjacent to the evaluation area for nesting and winter habitat. The proposed project area is located approximately eight miles east of the Tounge River. It is highly unlikely that bald eagle nesting or winter roost habitat is present within the project area. However, bald eagles may also occasionally fly through the project area while hunting or migrating. The Bald eagle is currently listed as threatened under the Endangered Species Act.

Black-footed ferret. The black-footed ferret (*Mustela nigripes*) is listed as endangered under the Endangered Species Act. Black-footed ferrets rely on active prairie dog towns for food and shelter. One large black-tailed prairie dog town was observed within the southeast portion of the evaluation area. Since 1987, no populations of black-footed ferrets have been discovered in the wild, and it is highly unlikely that black-footed ferrets exist within the project area. Never the less, the potential exists for black-footed ferrets to occur within black-tailed prairie dog towns within the evaluation area. The project area occurs within open ponderosa pine habitat, and it is highly unlikely that black-tailed prairie dogs or black-footed ferrets occur within the project area.

Black-tailed prairie dog. Although considered as a candidate for listing under the Endangered Species Act, the black-tailed prairie dog (*Cynomys ludovicianus*) does not receive any special federal protection. However, impacts to black-tailed prairie dog towns may trigger potential effects to the black-footed ferret (see above paragraph). One black-tailed prairie dog town was observed during the site visit. The potential for black-tailed prairie dog towns is greatest in the eastern portion of the evaluation area where sagebrush and grassland habitats are present. Due to the presence of open ponderosa pine habitat, it is unlikely that black-tailed prairie dogs occur within the proposed project area.

Interior least tern. The interior population of the least tern (*Sterna antillarum*) is listed as endangered under the Endangered Species Act. The least tern breeds on bare sandbars associated with rivers and some reservoirs. In Montana, this species breeds well to the north of the proposed project area, but may pass through the area rarely as a transient or a migrant.

The Montana Fish Wildlife and Parks (MFWP) and the Montana Natural Heritage Program (MNHP) have created a list of Montana Animal Species of Concern (MASC) (Carlson 2003). The USFWS (2002) has also listed 24 birds of conservation concern which occur within the prairie and badland province. Most species on these lists are thought to be in decline throughout or within portions of their range or sufficient data are not present to determine population status. Most of the MASC species are not listed under the Endangered Species Act, rather, the purpose of the list is to bring attention to and increase monitoring of species which are declining or species which little is known concerning populations status or distribution. Some species on the MASC and the USFWS birds of conservation concern may migrate through or breed within the project area.

STATE WILDLIFE ISSUES AND UNIQUE HABITAT

State Wildlife Issues. We examined the potential for contentious state wildlife issues to occur within the project area by examining game species distribution data available from MFWP. The project occurs within the potential range of elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), sharp-tailed grouse (*Tympanuchus phasianellus*), Hungarian partridge (*Perdix perdix*), ring-necked pheasant (*Phasianus colchicus*), and wild turkey (*Meleagris gallopavo*). The project also occurs on the edge of the potential distribution for sage grouse (*Centrocercus urophasianus*).

State wildlife agencies often place a high priority on protecting habitats important to game species, particularly winter ranges and migration routes. The MFWP has mapped elk winter range as occurring within the project area (Figure 2). Within winter range designations, state agencies often place higher priorities on protecting areas designated as crucial. According to MFWP data, the elk winter range within the proposed project area is not designated as crucial. Due to relatively high hunting pressure on reservation lands, elk rarely occur within the designated winter area (S. Denson, MFWP, pers. comm.).

The sage grouse has recently been petitioned for listing as threatened or endangered under the Endangered Species Act by some environmental groups. State agencies often place a relatively high priority of protecting important sage grouse habitat, particularly lek sites. Although the proposed project area occurs just outside the MFWP mapped range for sage grouse, potential habitat for the species is present within the southeastern portion of the project area. The MFWP has no records of sage grouse leks within or bordering the evaluation area (S. Denson, MFWP, pers. comm.). Due to the presence of ponderosa pine habitat it is unlikely that sage grouse leks are present within the project area. There is a low probability that sage grouse leks may occur within sagebrush habitats within the evaluation area.

Unique Habitat. Because wildlife may be attracted to relatively unique habitats within a landscape, we assessed the relative uniqueness of the proposed project area. Many of the ridges within the proposed project area are located within open ponderosa pine habitats. This habitat type is found throughout much of the surrounding area, and likely does not pose an extraordinary attractant for wildlife. Less common habitats in the project are relatively more unique and provide habitat for a variety of species. These habitat types include riparian areas and cliffs or rocky outcrops.

We queried the Montana Natural Heritage Program (MNHP) database for rare plant and animal sightings within and surrounding the project area. The MNHP has no records of rare animals or plants within the project area, likely due to a lack of surveys on Northern Cheyenne land. Most MNHP records are located on public land where scientists can gain access for surveys. The MNHP has one record for a rare plant just north of Jimtown. Barr's milkvetch (*Astragalus barrii*) is species considered sensitive by the U.S. Forest Service and is on the BLM watch list. The plant was located within sandstone and shale outcrops within ponderosa pine forest (Figure 2).

BATS

Several species of bat may occur within the proposed project area, including little brown myotis (*Myotis lucifugus*), long-legged myotis (*Myotis volans*), northern myotis (*Myotis sptentrionalis*), long-eared myotis (*Myotis evotis*), California myotis (*Myotis californicus*), western small-footed myotis (*Myotis ciliolabrum*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), Townsend's big-eared bat (*Plecotus townsendii*), spotted bat (*Euderma maculatum*), big brown bat (*Eptesicus fuscus*), and pallid bat (*Antrozous pallidus*) (Genter and Jurist 1995). Bat habitat can be divided in to several types, including foraging areas, maternal and winter hibernacula. Species breeding within the project area will forage more often close to hibernacula sites. Potential hibernacula within the evaluation area include abandoned mines and snags. Due to recent burns within ponderosa forest, many snags which could serve as potential hibernacula are present within the project area. Abandoned mines are present within the evaluation area, but no known locations are present within the project area. Some bat species, including the Townsend's big-eared bat, have hibernacula within caves or abandoned mines. Several abandoned mines are present within and surrounding the evaluation area (Figure 2).

However, it should be noted that we do not know if these mine locations are suitable for bats, i.e. some mine entrances may be completely blocked, preventing entrance by bats. Other unevaluated factors may also influence use of mines by bats, including temperature and humidity.

No bat species within Montana receive federal protection. However, some species of resident or non-migratory bats are considered sensitive by the MNHP, including the Townsend's big-eared bat. Bat casualties are found more often than birds during carcass searches at some wind plants in the U.S. Most of the bat casualties at wind plants to date are migratory species which conduct long migrations between summer roosts and winter hibernacula such as hoary bats, silver-haired bats and eastern red bats. The high number of migratory bat deaths at wind plants may be related to the lack of echolocation during migration (Johnson 2003). Based on bat casualties found at other wind plants, it is likely that migrating hoary bats, silver-haired bats and eastern red bats will make up the majority of casualties within the proposed wind plant. Bat fatality rates may be similar to those at other wind plants in the U.S., ranging from 0.1 – 2.85 bats / turbine / year (Johnson et al. 2003).

BIRD MIGRATION

Many species of songbirds and waterfowl migrate at night and may collide with tall man-made structures. Large numbers of songbirds may collide with structures at lighted communication towers and buildings when foggy conditions and spring or fall migration coincide. Birds appear to become confused by the lights during foggy or low ceiling conditions, flying circles around lighted structures until they become exhausted or collide with the structure. To date, no large mortality events have been documented at wind plants in North America (Erickson et al. 2001). Some scientists suggest that many songbirds migrate above turbine height, reducing the risk of collision with wind turbines (Richardson 1998). However, preliminary results from Montana may indicate that more birds migrate within turbine blade heights than previously thought (R. Hazelwood, Montana USFWS, pers. comm.). Based upon the results of studies at other windplants, some migrating songbirds will collide with turbines, however, large mortality events similar to those witnessed at large communication towers are not expected.

McEneaney (1993) presents a very general map of bird migration corridors within the state of Montana. One of the corridors described as a major bird migration corridor appears to follow the Tounge River north through the state, and may include the proposed project area. By examining the topography of southeast Montana at a very small scale, it appears as if birds migrating along the front range of the Rocky Mountains may follow the Tounge River and associated valley when flying north and south (Figure 5). The degree to which birds, and in particular raptors will utilize ridges within the project area will depend largely on weather conditions and wind direction. Migrating raptors may utilize updrafts on ridges running north and south within the project. If the Tounge River is actually a major migratory corridor for raptors and songbirds, birds may follow ridgelines within the project area.

DISCUSSION:

Four issues may pose potential conflicts between wildlife and turbines: potential for raptor nests, threatened and endangered species, bats and a potential bird migration corridor (Table 2).

Existing and recently burned ponderosa pine provide potential nesting habitat for raptors in close proximity to ridges likely targeted for turbine placement. The presence of ponderosa pine may pose two potential conflicts 1) the presence of forest stands increases the amount of potential nesting habitat and may increase potential raptor nest densities and 2) the presence of ponderosa in close proximity to potential turbine locations may increase the amount of use of ridges targeted for development by some species of breeding raptors, such as northern goshawk and Cooper's hawk. Other important nesting habitats within the project area include cliff habitats and riparian area. The Tounge River and associated cottonwood riparian area provides excellent nesting habitat for raptors, including the bald eagle. Additionally, excellent hunting areas for many raptor species are present within prairie dog towns in the southeast portion of the project area. The current project area is located from 2 – 8 miles from the Tounge River, cliff habitats and prairie dog towns, decreasing the potential risk to breeding raptors within the project area.

The proposed project should pose relatively few conflicts with the Endangered Species Act. While bald eagles may occasionally fly through the project area, most nesting and winter habitat near the project area exists along the Tounge River. By placing turbines away from the Tounge River, potential impacts to bald eagles will be minimized. Black-tailed prairie dog towns are also present within the evaluation area. While prairie dogs currently receive no special protection under the Endangered Species Act, the towns may provide potential habitat for the black-footed ferret. If the proposed project area is moved, prairie dog towns will need to be mapped and evaluated for potential black-footed ferret habitat. Factors determining ferret habitat include town size and burrow density. If potentially affected towns meet ferret habitat requirements, the U.S. Fish and Wildlife Service may request black-footed ferret surveys be conducted on all affected prairie dog towns. However, it should be noted that it is highly unlikely that a wild population of black-footed ferret exists within Montana or anywhere within the U.S.

The presence of burned ponderosa pine forest and abandoned mines may increase potential use of the project area by resident bat species. Based on studies at other wind plants, most bat fatalities are migratory species which may not use echolocation during migration (Johnson 2003). However, it should be noted that we are unaware of any windplants located near well used hibernacula, such as abandoned mines. Overall, we feel the risk to resident bat species to be low, but the potential exists for increased resident bat fatalities if turbines are placed near well used hibernacula. It is likely the majority of bat fatalities will be comprised of hoary bats, red bats and silver-haired bats based on studies at other wind plants. These species inhabit forested areas. Due to the presence of ponderosa pine forest within the project area, potential fatality rates for these species may be within the upper range of observed bat mortalities documented at other wind sites.

The potential presence of a major migratory bird corridor may pose the largest potential conflict for the proposed project area. Increased use of ridges in the project area by raptors may potentially result in an increased number of potential fatalities. Other factors may also increase risk to raptors and other large birds, including topography and turbine placement. However, based on results at other windplants, no large mortality events of songbirds similar to those documented at large communication towers are expected.

It should be noted that the presence of a "major migratory corridor" was described within McEneaney (1993) on a very general map of Montana. The presence of a migratory corridor along the Tounge River and within the project area should be further investigated. If the proposed project proceeds, we recommend baseline studies be conducted to determine if the proposed project area is in fact heavily used by raptors and songbirds. McEneaney (1993) describes approximately half the state of Montana as a "major migratory corridor", yet the author provides no definition or criteria for delineating these areas. It may be that the project area, while used by migrating raptors and other birds, does not receive high amounts of use relative to other areas in the state.

Well designed studies conducted before development can determine if the area receives increased use by raptors and songbirds. Surveys can also be used to identify raptor nest sites. The results of these studies may be used to site turbines away from high use areas and raptor nests and decrease the risk of fatalities. A similar approach was used at the Foote Creek Rim windplant in Carbon County, Wyoming. Pre-development studies identified areas that received high use by raptors and songbirds. Project developers placed turbines away from the high use areas, and documented fatality rates were much lower than those expected by U.S. Fish and Wildlife Service officials.

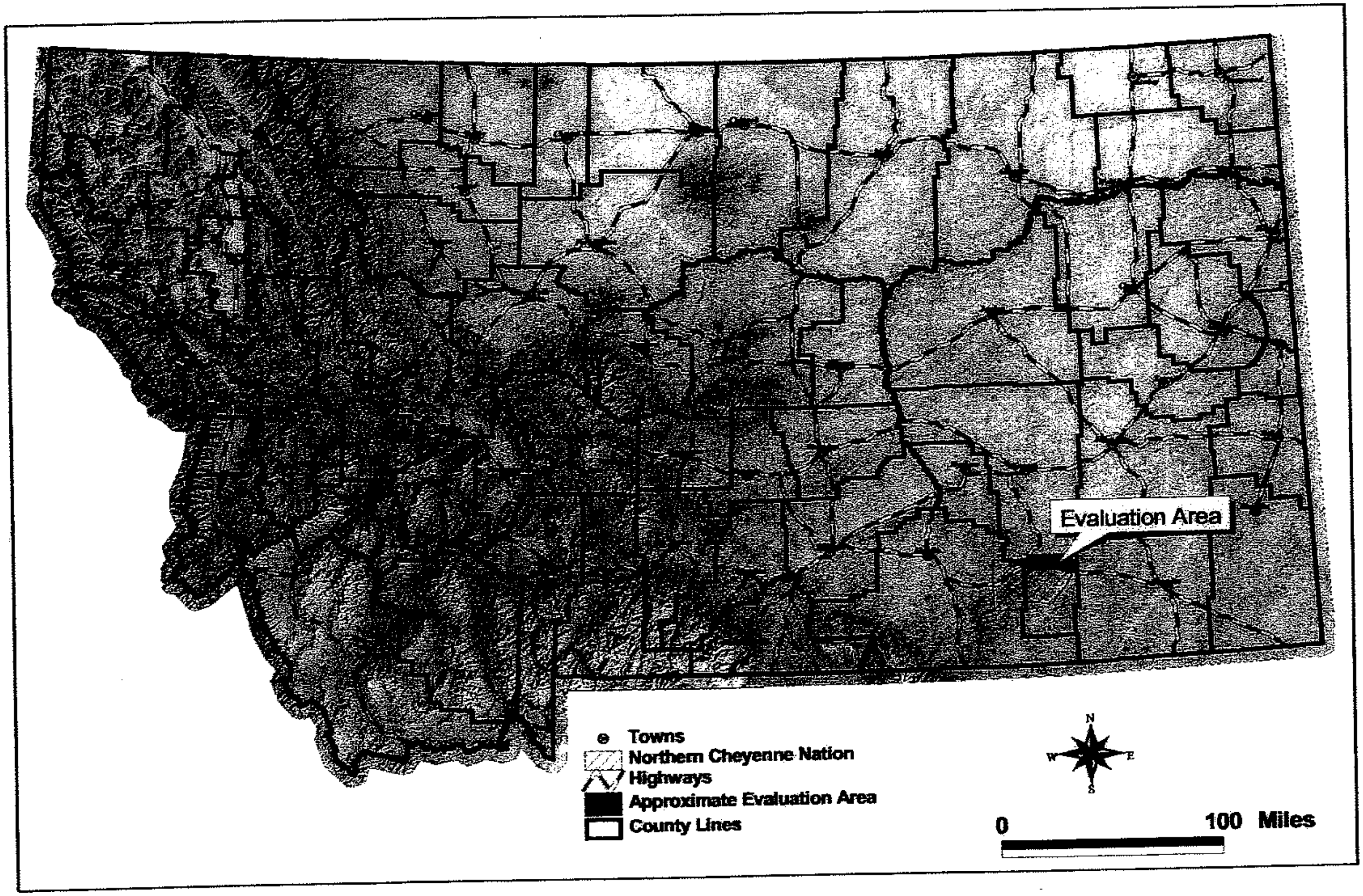

Figure 1. A map showing the approximate location of the evaluation area.

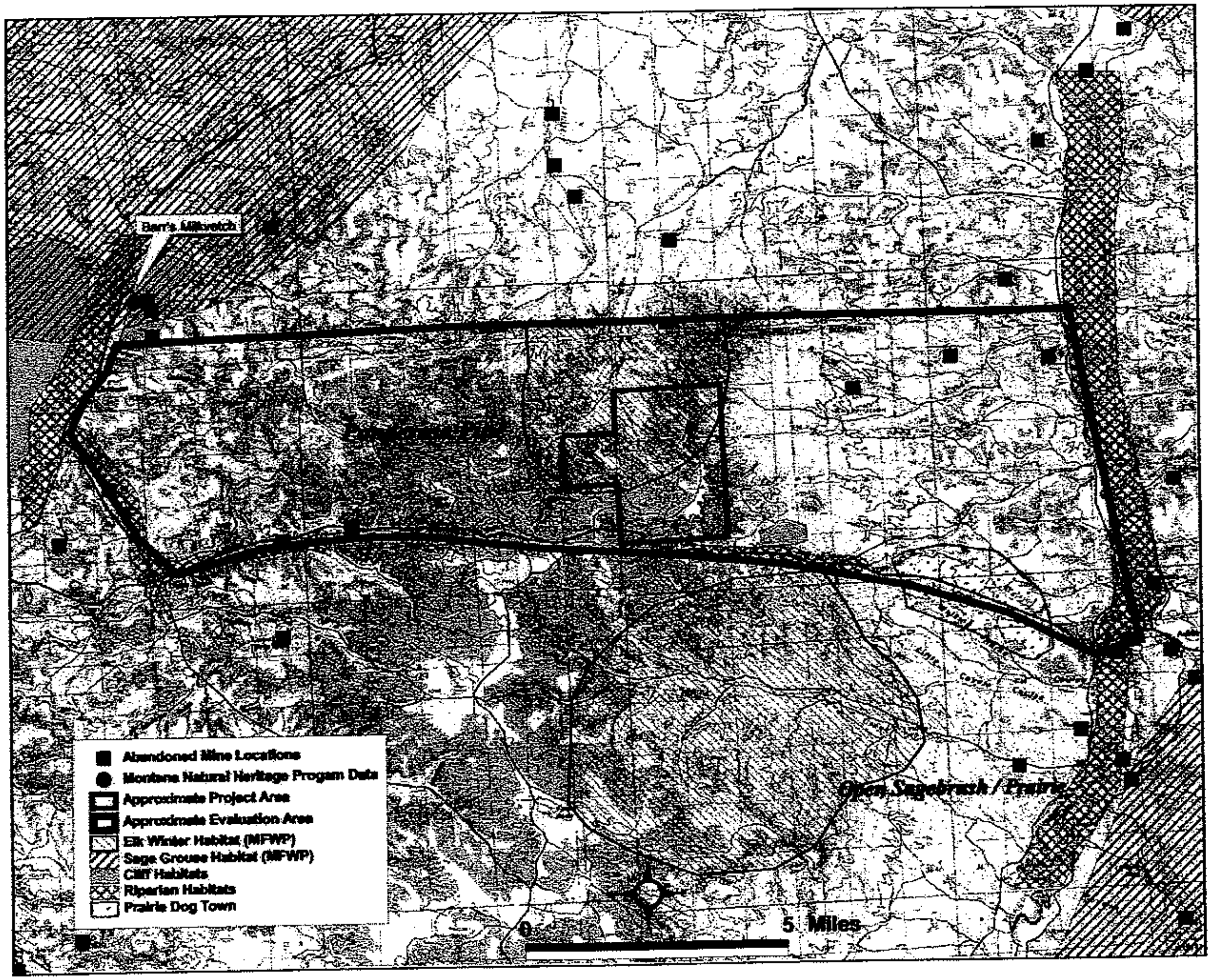

Figure 2. A map of the evaluation and project areas. Habitats shown on this map are incomplete, thus other riparian areas and cliffs may exist within the project or evaluation area.

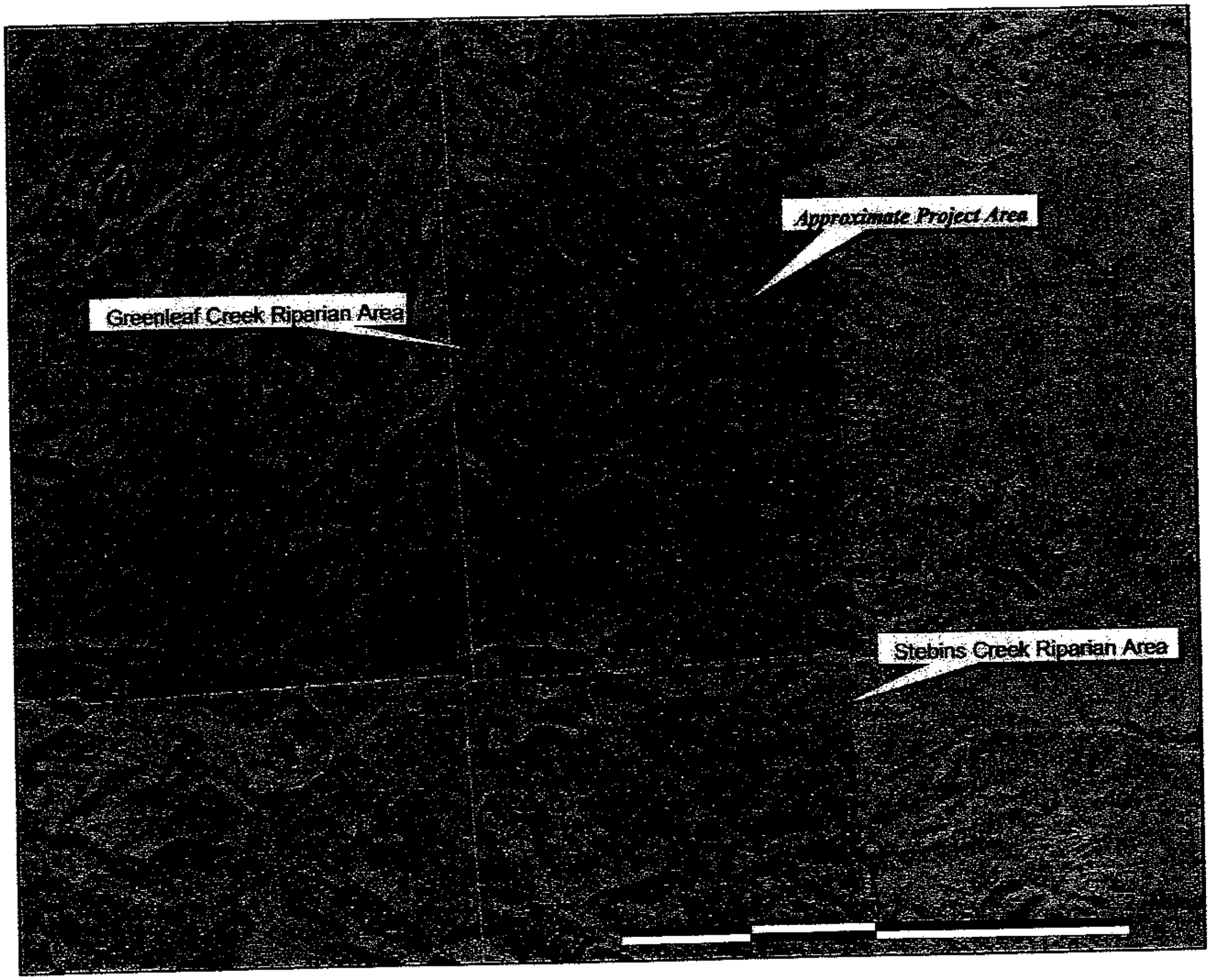

Figure 3. An aerial photo of the project area.

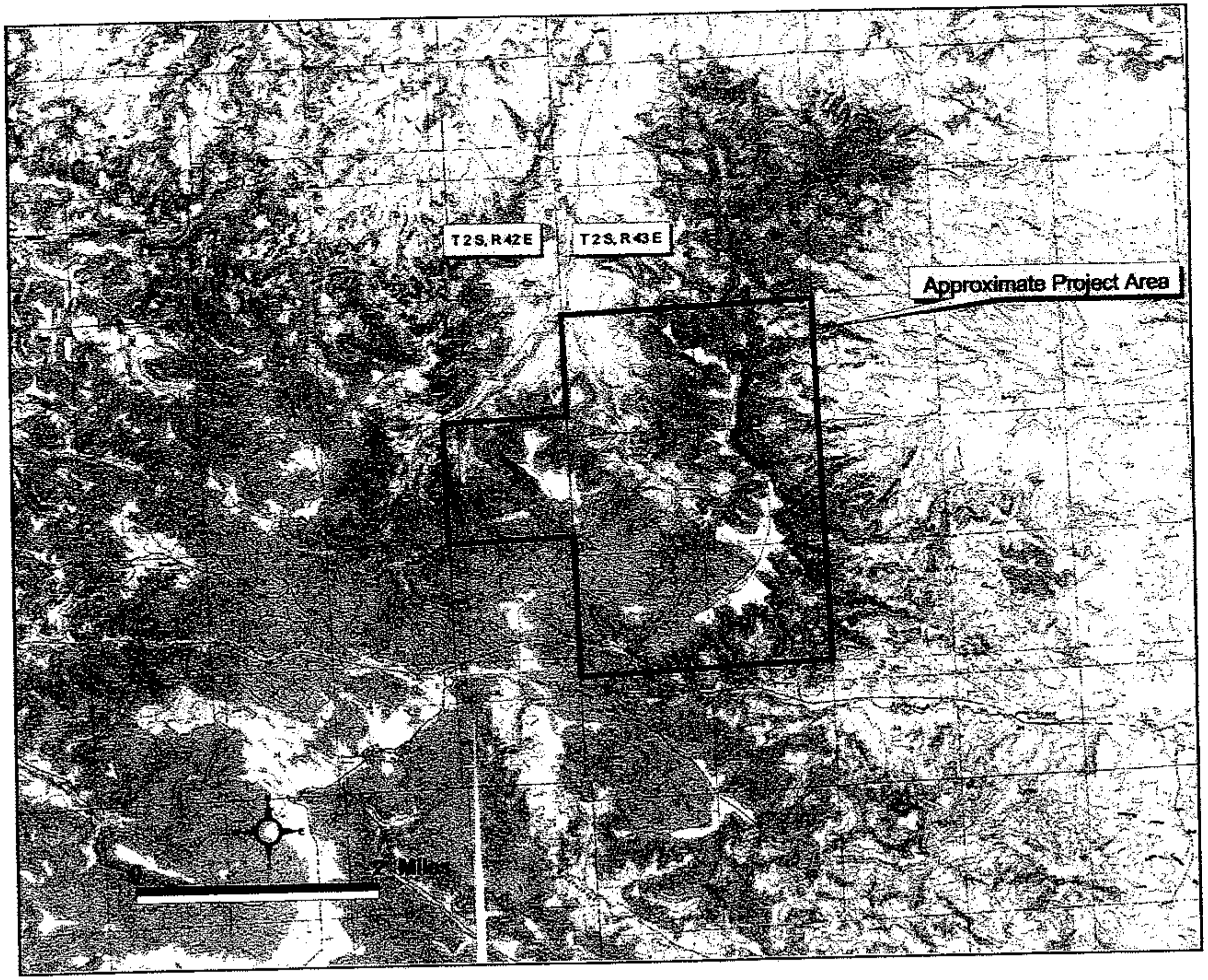

Figure 4. A topographic map of the project area.

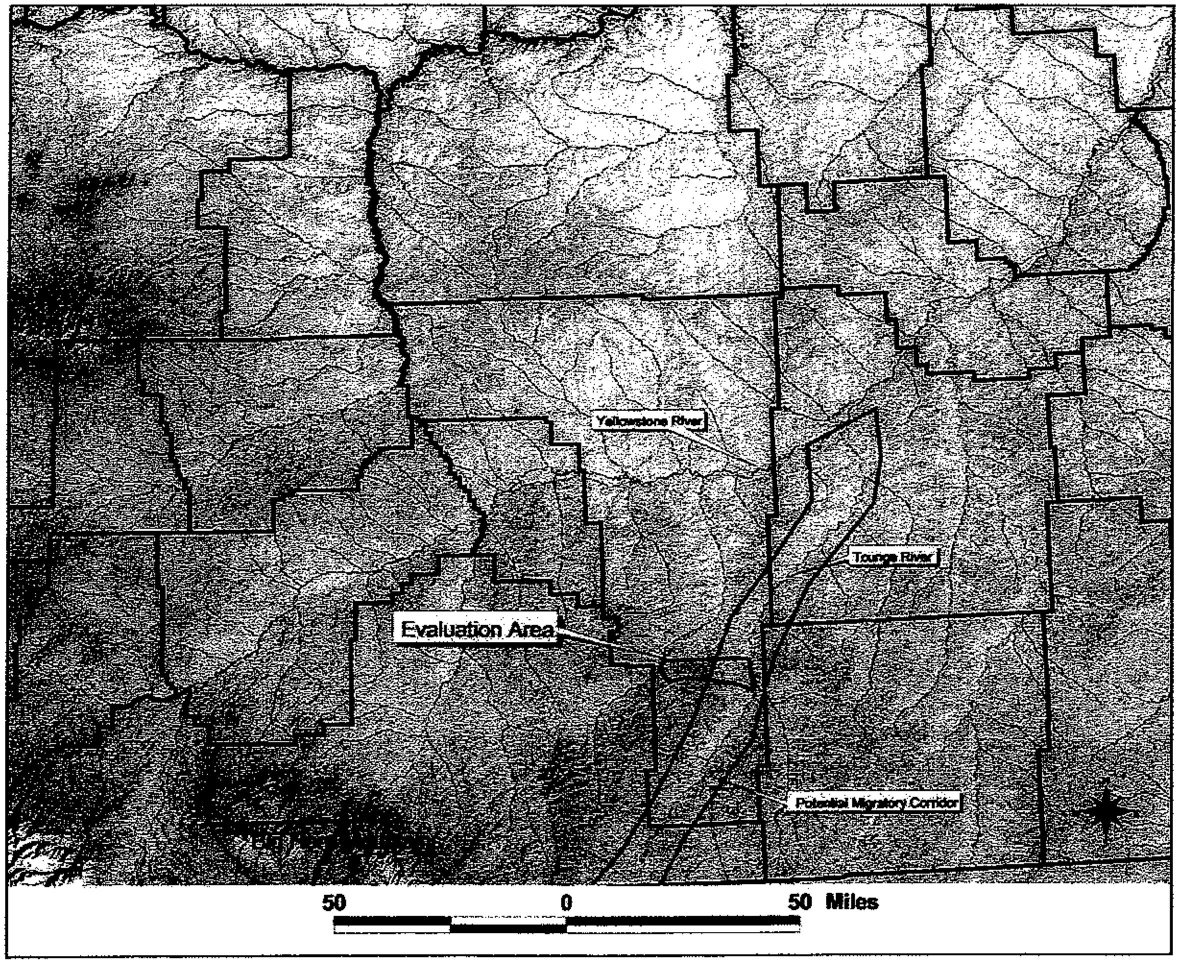

Figure 5. Potential migratory pathway near the proposed project area. Pathway location was derived from McEneaney (1993).

Table 2. A summary of the potential for wildlife conflicts in the proposed wind development area. VH = Very High, H = High, M = Medium, and L = Low.

Issue	VH	H	M	L	Notes
Potential for raptor nest sites [1]		✓			Due to presence of ponderosa pine in the project and evaluation area
Raptor flight potential		✓			Ridges within project area are well defined and raptors may use updrafts
Potential for raptor and songbird migratory pathway		✓			Based on McEneaney (1993). Presence should be verified.
Potential for raptor prey species[1]			✓		Prairie dog towns are present in eastern portion of project area.
Potential for protected species to occur[1]				✓	Low probability as long as project stays away from Tounge River and prairie dog towns
Potential for Big Game Issues[1]				✓	One elk winter range may be present
Uniqueness of habitat at wind plant				✓	Habitat within the project area is not unique
Potential for rare plants to occur			✓		One rare plant was documented within the evaluation area
Potential for use by bats		✓			Snags and mines provide potential hibernacula
Other issues			✓		

[1] Summarized for the project area as a whole but the habitat of the evaluation area varies throughout in its ability to support species of concern.

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Potential Impact Index – Northern Cheyenne Wind Site

Rosebud County, Montana

Draft

August 2003

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Checklist Summary

We attempted to apply the USFWS guidelines for calculations of the site evaluation score for the proposed Northern Cheyenne Wind Project site in Rosebud County, Montana. The following report contains documentation of our evaluation. Appendix A contains the details of the calculations, and Appendix B contains a discussion of the mathematics of the procedure.

Calculations of the PII index vary greatly depending on the "Master" list of criteria used. Due to the large amount of confusion in the USFWS guidelines on this issue, three sets of scores were calculated for the proposed wind site. The first two scores were calculated using a Master Species List for Montana provided by Al Harmata, Montana State University. One score was calculated using the apparent method used in developing the graph that was included in the USFWS guidelines. The 2nd score was calculated using the correct mathematics for the method based on the Harmata Master's Species List. The 3rd score we calculate is based on the Master List provided by Harmata and additional species from the USFWS Birds of Conservative Concern List, which appears to be the recommended approach in the USFWS guidelines.

Score 1 – Harmata Master List, Total Boxes 145

To make a meaningful comparison to the graph in the USFWS guidelines, the first score was calculated using 92 total species boxes, and a total of 145 total boxes across the three components (physical, species occurrences, and ecological). It is critical that the same number be used in calculation of the divisors to facilitate comparison with 15 other reference sites evaluated by the USFWS in Montana.

The Northern Cheyenne site scores was 145 using the method used in ranking the sites in the graph provided in the USFWS guidance document. The proposed site ranks between the 15th and 16th scores of 28 sites evaluated by the USFWS in Montana. The highest score for a reference site in Montana was 242 (see attached figure). The site ranks in the middle of Montana reference sites.

There is still some confusion regarding the methods used for defining the total number of boxes for the species category. Apparently the figure used in portraying the scores for the Montana sites used 92 as the number of boxes for species and 145 for the total number. This appears inconsistent with the description of the method. In an example sent to me by Dr. Harmata, there are 64 boxes for avian species of concern (32 species x 2), 10 boxes for bats (5 species x 2). In the summary table that includes T&E and candidate species and other species/groups (golden eagles, sage grouse, bats in general), there are an additional 18 rows. The value of 92 seems to come from the 64+10+18=92, although it would appear that you could check 2 boxes for most of the 18 species/groups listed in the summary table. In our calculation, we checked 2 boxes for several species. Also, yellow-billed cuckoo appears to be included twice, once in the species of concern list and once in the T&E and summary list.

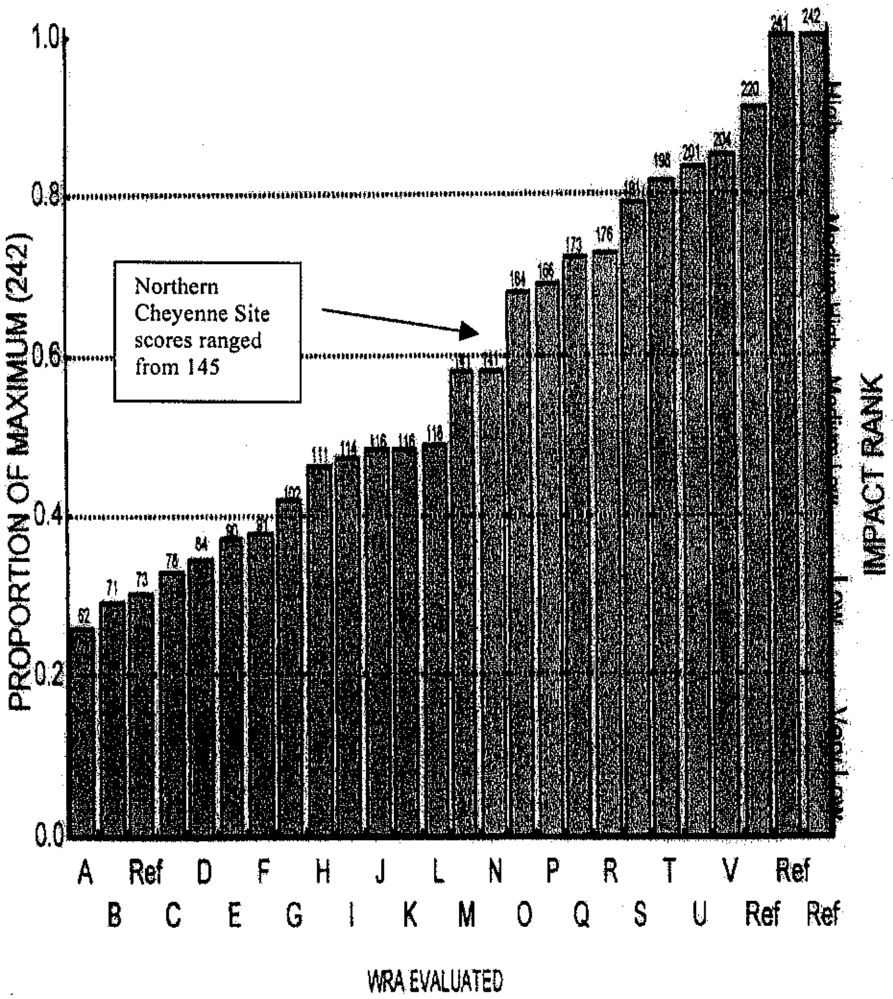


Figure 2. Impact ranks of proposed Wind Resource Areas in Montana. The number above each bar is the PII score. Rank is a function of the proportional relationship of proposed development sites to the maximum score of 4 Reference Sites evaluated.

31

Score 2 – Harmata Master List, Total Boxes 163

The second score was calculated using the same Master List provided by Harmata, but correctly uses 110 for the total number of species boxes in this list. The 2nd method of scoring yielded a value of 156, which is likely also in the middle of the sites considered for Montana, although apparently the scores for the Montana sites using this method (163 total species boxes) are proprietary information.

Score 3 – Harmata Master List and the BCC List, Total Boxes 181

The ranks of the master species list for Montana and an additional list of Birds of Conservation Concern (USFWS 2002). The divisor for the species scores for the calculation using the master species list obtained from Harmata were based on a possible number of 92 species boxes. The 2nd score using the BCC list in combination with the list provided by Harmata uses 120 as the number of possible species boxes. Comparison of this score to the 15 other reference sites is not appropriate. See Appendix A for details of the evaluations.

Site Specific Comments – Proposed Northern Cheyenne Wind Project:

Physical

1. Although a minimum convex polygon placed around the potential turbine locations exceed 1000 acres in size (~1030 acres), the project is only 20 turbines primarily orientated in a north/south direction (parallel to migration, see Figure 1). We believe the USFWS site evaluation procedure does not adequately show differences between variations in project size. Just about any new generation project that is 20 turbines or more will be considered a large project by the criteria (MCP, <640 acres, >=640 – 1000 acres, 1000-1500 acres). Also, we assume the "large project size criteria" should be >1000 acres, not 1000-1500 acres, since any value >1500 acres is not contained in the criteria. A project of 40 turbines compared to 20 turbines in the same area would be expected to kill at least twice the number of birds, and maybe more, if larger projects have more than proportional larger impacts. Turbine numbers and size (e.g., rotor swept area) should be a factor, not just the MCP.

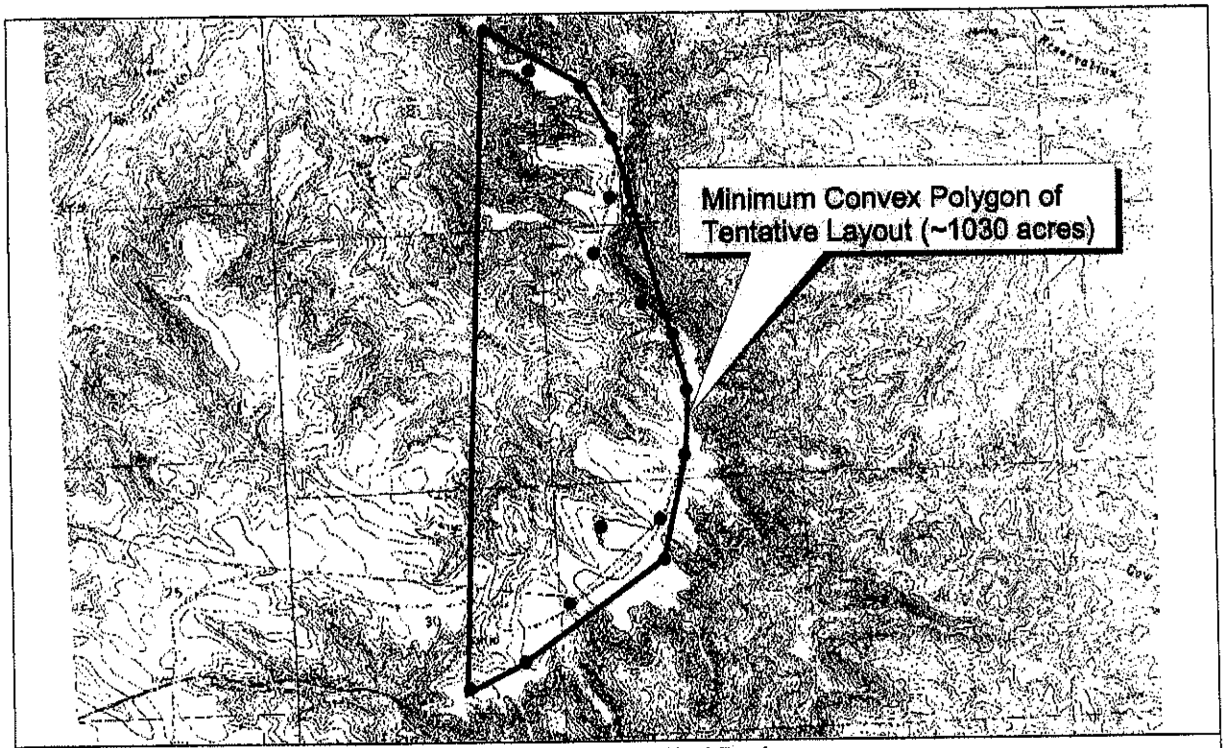


Figure 1. Tentative Layout of Northern Cheyenne Wind Project

Species Occurrence and Status

1. Although the project occurs within a former ponderosa pine forest, several grassland species documented within the latilong of the project (list provided by L. Hanebury, USFWS, Billings) and species documented by Tom Whitford (USFS) within the Custer National Forest were included as potentially migrating through the project area. This approach may be conservative compared to the approach used for ranking the rest of the sites in Montana.
2. Although bald eagles may occur within the project area during the winter and migration, most bald eagle use is expected to be along the Tounge River, approximately 7 miles from the proposed project area. Risks to bald eagles are considered minimal.
3. Interior least terns expected to be a rare migrant through the project area, and risks to the species are considered minimal.
4. The mountain plover was also included as a potential migrant due to the presence of a large prairie dog town ~ 3-4 miles from the project area (see report). However, it is unknown if mountain plovers actually occur within the prairie dog town, and it is highly unlikely mountain plovers will breed within the proposed project area due to the presence of ponderosa pine forest.
5. Black-tailed prairie dogs likely do not inhabit the project area due to the presence of ponderosa pine forest. However, access roads connecting from the highway may potentially impacts prairie dog towns. Habitat mapping and prairie dog surveys should be conducted prior to development to minimize impacts to prairie dog towns from proposed road locations.
6. Although pallid bat, spotted bat and Townsend's big-eared bat are listed as occurring at the site, data regarding these species is sorely lacking throughout Montana. The potential exists for these species to occur on site, however, the relative probability of occurrence is very difficult to evaluate.

Ecological Attractiveness

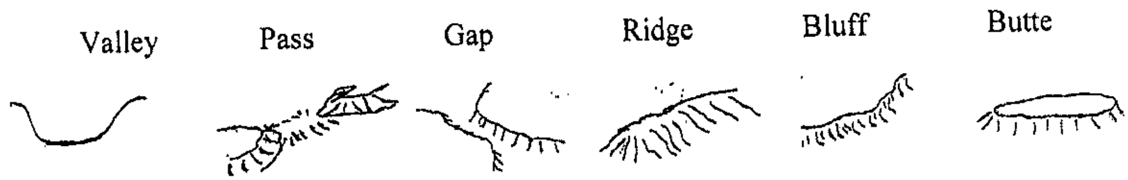
1. The presence of a migration route through the project area is based on a very general map of migration corridors in Montana (McEneaney 1993). See attached report for a discussion. According to T. McEneaney , Ornithologist, Yellowstone National Park (pers. comm.) the corridor does not concentrate migrating raptors, but is used by songbirds.
2. The presence of burned and salvage logged ponderosa forest may result in an increase in woodpecker abundance at the project site (see report).

APPENDIX A
DOCUMENTATION OF USFWS SITE EVALUATION FORMS AND RESULTS

PHYSICAL ATTRIBUTE CRITERIA - 36 categories, max • = 36

Topography - Terrain characteristic within the ecological influence of the proposed wind farm, generally, but not restricted to ± 8 km.

Mountain Aspect - Aspect of topography for site of proposed development. Multiple categories may be checked.



Wind Direction - Compass direction *from* which prevailing winds approach. Multiple categories may be checked.

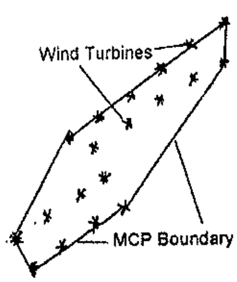
Updrafts - Do updrafts/upslope winds prevail?

Migratory Corridor Potential - Subjective estimate of area to be a potential avian/bat migratory corridor based strictly on topographical characteristics. Multiple categories may be checked.

Wide (>30 km) - Terrain characteristics of approaches to site from each migratory direction, i.e., a large plain, river corridor, long valley. The larger the area that migrant birds/bats are drawn from, the more may be at risk

Funnel Effect - Is the site in or near an area where migrant birds/bats may be funneled (concentrated) into a smaller area, either altitudinally, laterally, or both?

Site Size & Configuration – Size is estimated as if a minimum convex polygon (MCP) were drawn around peripheral turbines.



Successive boxes are checked to convey relationship of larger size = increased impact to birds/bats, *e.g.*, a 700 acre site will have 2 categories checked while a 1200 acre site will have all 3 categories checked.

Configuration of turbine rows is usually perpendicular to prevailing wind direction. Rows aligned perpendicular or oblique to route of migration intuitively presents more risk to birds than rows aligned parallel to movement.

Buildings – Building are categorized by relative size and visitation frequency, *i.e.*, structures that are visited daily are usually larger and present more impact than those that are not. If a "Daily Activity" building is required, all Building categories are checked. If a maintenance structure is required, Storage is also checked.

Increased Activity - Will any type of human activity increase? Sites in urban-suburban or otherwise developed areas (oil, gas, mines) will have less impact on vertebrate wildlife than those in remote or undeveloped areas.

PHYSICAL ATTRIBUTE CHECKLIST

Physical Attribute				Site: Northern Cheyenne			
Topography	Mountain Aspect*	Side	W				
			E				
			N				
			S				
		Top					
		Foothill	W	X			
			E	X			
			N				
			S	X			
	Valley*						
	Pass*						
	Gap*						
	Ridge*			X			
	Bluff*						
	Butte*						
Wind* Direction	S			X			
	N						
	E						
	W			X			
	Updrafts*			X			
Migratory* Corridor Potential	Latitudinal (N • •S)			X			
	Longitudinal (E • •W)						
	Wide Approaches (>30 km)*			X			
	Funnel Effect*	Horizontal					
		Vertical					
Site Size (acres) & Configuration*	<640			X			
	>640 <1000			X			
	>1000 <1500			X			
	Turbine Rows not Parallel to Migration						
Infrastructure To Build	Transmission						
	Roads			X			
	Buildings*	Storage					
		Maintenance		X			
		Daily Activity		X			
	Substation						
Increased Activity*				X			
Total				16			

ECOLOGICAL ATTRACTIVENESS CRITERIA - 16 categories, max• = 17

Migration Route - Indicates predominate direction of movement of seasonal migrations. Multiple categories may be checked.

Local - Some avian populations move only altitudinally & direction may be East-West (sage grouse, owls, bald eagles).

Continental - Some migratory corridors experience mass movements in only one season/direction annually (*e.g.*, Bridger Mountains autumn eagle migration).

Ecological Magnets - Special, unique, unusual, or super ordinary habitats or conditions within the vicinity of the site that may attract vertebrate wildlife. Lotic systems include small perennial or seasonal creeks to major rivers. Lentic systems include stock ponds to lakes. Multiple categories may be checked.

Vegetation/Habitat - Unique or exceptionally diverse vegetation or habitat in the vicinity may indicate exceptional diversity and abundance of avian species or bats.

Significant Ecological Event - Special, unique, unusual, or super ordinary events that occur or are suspected to occur in the vicinity of the site, *e.g.*, up to one third of the Continental population of Trumpeter Swans visit Ennis Lake, < 4 km from a proposed Wind Resource Area; the Continental migration of shorebirds passes over (many stop) @ Benton Lake National Wildlife Refuge) and up to 2000 golden eagles pass over the Bridger Mountains in autumn. If unknown but suspected a "?" is entered. Specifics regarding the cell are then addressed in the appropriate box of the SITE SPECIFIC COMMENTS sheet to focus follow-up investigation and assist in definition of study objectives.

Site of Special Conservation Status - Any existing or proposed covenants, conservation easements, or other land development limitations intended to conserve, protect, or enhance wildlife or habitat. This criterion is weighted (2 entered if true) because of previous financial or other investment in ecological values. Specifics regarding the easement are then addressed in the appropriate box of the SITE SPECIFIC COMMENTS sheet to focus follow-up attention.

ECOLOGICAL ATTRACTIVENESS CHECKLIST

Ecological Attractor			Site: Northern Cheyenne			
Migration Route*	Local		X			
	Continental*	N	X			
		S	X			
		E				
		W				
Ecological Magnets*	Lotic System					
	Lentic System					
	Wetlands					
	Native Grassland					
	Forest		X			
	Food Concentrated		X			
	Energetic Foraging					
	Vegetation/ Habitat	Unique				
		Diverse				
Significant Ecological Event*						
Site of Special Conservation Status*						
Total			5			

Avian Species of Special Concern Checklist
Harmata Master List: 32 species max • ⇐ 64
Harmata Master List & BCC List: max 46 species, max • ⇐ 92)

Column totals of this list are added to appropriate cells in the SPECIES OCCURRENCE & STATUS CHECKLIST. Appropriate avian field guides (*e.g.*, Sibley 2000) and species accounts (*e.g.*, Rauscher 2000) should be consulted for confirmation of species distribution and habitat associations. Montana Natural Heritage Program (http://orion2.nris.state.mt.us/mtnhp/animal/index.html) also provides species accounts in Vertebrate Characterization Abstracts (VCA) which include additional information useful in completing checklists.

In addition to species lists (rows), season of occurrence is also indicated (columns). "B" indicates breeding or summer occurrence and "M/W" indicates presence during migration or as wintering species. If occurrence within or in the vicinity (• •7 km) of a proposed site is confirmed or suspected, an "X" is entered.

Avian Species of Special Concern Checklist – Harmata Master List
32 species and 64 total boxes
(Complete prior to SPECIES OCCURRENCE & STATUS CHECKLIST)

Birds (n = 32)	Site											
	Northern Cheyenne											
Occurrence[1]	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**
Common Loon												
Clark's Grebe												
American White Pelican												
Black-crowned Night-heron												
White faced Ibis												
Trumpeter Swan												
Harlequin Duck												
Northern Goshawk	X	X	2									
Ferruginous Hawk		X	1									
Peregrine Falcon												
Columbian Sharp-tailed Grouse												
Yellow Rail												
Black necked Stilt												
Franklin's Gull												
Caspian Tern												
Common Tern												
Forster's Tern												
Black Tern												
Yellow-billed Cuckoo												
Flammulated Owl	X	X	2									
Burrowing Owl	X		1									
Great Gray Owl												
Boreal Owl												
Black Swift												
Blackbacked Woodpecker	X		1									
Alder Flycatcher												
Cassin's Kingbird	X		1									
Blue-gray Gnatcatcher												
Dickcissel												
Baird's Sparrow		X	1									
Le Conte's Sparrow												
Nelson's Sharp tailed Sparrow												
Subtotals	5	4	9									
Total			9									

Avian Species of Special Concern Checklist – Additional Species Based on USFWS BCC List
14 species and 28 total boxes
(Complete prior to SPECIES OCCURRENCE & STATUS CHECKLIST)

Site

Birds (*n* = 14)	Northern Cheyenne											
Occurrence[1]	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**
American Golden Plover												
Upland Sandpiper												
Long-billed Curlew												
Marbled Godwit												
Sanderling												
Black-billed Cuckoo		X	1									
Lewis' Woodpecker	X		1									
Red-naped Sapsucker												
Sprauge's Pipit												
Brewer's Sparrow		X	1									
Grasshopper Sparrow		X	1									
McCown's Longspur		X	1									
Chestnut-collared Longspur		X	1									
Prairie Falcon	X	X	2									
Subtotals	2	6	8									
Total			8									

Bat Species Of Special Concern Checklist (5 species, max • ═ 10).

Column totals of this list are added to appropriate cells in the SPECIES OCCURRENCE & STATUS CHECKLIST. Appropriate bat field guides and references (Barbour and Davis 1969, Harvey et al. 1999, Rauscher 2000) should be consulted for confirmation of species distribution and habitat associations. Montana Natural Heritage Program (http://orion2.nris.state.mt.us/mtnhp/animal/index.html) also provides species accounts in Vertebrate Characterization Abstracts (VCA) which include additional information useful in completing checklists.

In addition to species lists (rows), season of occurrence is also indicated (columns). "B" indicates breeding or summer occurrence and "M/W" indicates presence during migration or as wintering species. If occurrence within or in the vicinity (• •7 km) of a proposed site is confirmed or suspected, an "X" is entered.

Bat Species Of Special Concern Checklist
5 species and 10 total boxes
(Complete prior to SPECIES OCCURRENCE & STATUS CHECKLIST)

	Site											
Bats (n = 5)	Northern Cheyenne											
Occurrence	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**	**B**	**M/W**	**• •**
Fringed Myotis												
Northern Long-eared Myotis	X		1									
Spotted Bat	X	X	2									
Townsend's Big-eared Bat	X	X	2									
Pallid Bat	X	X	2									
Subtotals	4	3	7									
Total			7									

SPECIES OCCURRENCE & STATUS CHECKLIST

Checklist totals for each column in "Avian Species of Special Concern List" and "Bat Species of Special Concern List are inserted in this checklist.

Threatened & Endangered Species - Species include in the Federal List of Endangered and Threatened Species (USFWS 2001a).

Candidate Species - Species being investigated for inclusion in the Federal List of Endangered and Threatened Species (USFWS 2001b).

Species of Special Concern - MTNHP (2001) maintains an inventory of the elements of biological diversity in Montana. Species included in this checklist are those *listed by MTNHP* that are known or suspected to be rare, endemic, disjunct, threatened or endangered. The list has been developed largely from information in the scientific literature, unpublished reports, agency databases, field research, and field inventories from a variety of cooperating local, state and federal agencies, private organizations and businesses, academic researchers, and interested individuals.

Golden eagles are included in this checklist because of special protective status afforded under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Sage grouse are included because of recent (*ca.* Y2K) concern over population declines range wide (citation). Bats (other than bat Species of Special Concern) are included due to generally unknown impacts of wind farms on individual and populations.

SPECIES OCCURRENCE & STATUS CHECKLIST
Master List & BCC List Only (correct max • =22+8+92+10+6=138)

		Site											
	Species	Northern Cheyenne											
	Occurrence	B	M/W	• •	B	M/W	• •	B	M/W	• •	B	M/W	• •
Threatened & Endangered (max • =22)	Bald Eagle		X	1									
	Whooping Crane												
	Piping Plover		X	1									
	Interior Least Tern												
	Grizzly Bear												
	Gray Wolf												
	Black-footed Ferret												
	Pallid Sturgeon												
	Woodland Caribou												
	White Sturgeon (Kootenai River)												
	Bull Trout												
Candidate* (max • =8)	Mountain Plover	X		1									
	Yellow billed Cuckoo												
	Black-tailed Prairie Dog	X		1									
	Swift Fox												
Special Concern*	Birds (max • =92)	7	10	17									
	Bats (max • =10)	4	3	7									
Other Species/Groups of Concern (see below, max • =6)													
Golden Eagle*		X	X	2									
Sage Grouse*				0									
Bats*		X	X	2									
	Subtotals	15	17	34									
	Total			34									

SPECIES OCCURRENCE & STATUS CHECKLIST

Master List Only (correct max • =22+8+64+10+6=110)

		Site											
	Species	Northern Cheyenne											
	Occurrence	B	M/W	• •	B	M/W	• •	B	M/W	• •	B	M/W	• •
Threatened & Endangered (max • =22)	Bald Eagle		X	1									
	Whooping Crane												
	Piping Plover		X	1									
	Interior Least Tern												
	Grizzly Bear												
	Gray Wolf												
	Black-footed Ferret												
	Pallid Sturgeon												
	Woodland Caribou												
	White Sturgeon (Kootenai River)												
	Bull Trout												
Candidate* (max • =8)	Mountain Plover	X		1									
	Yellow billed Cuckoo												
	Black-tailed Prairie Dog	X		1									
	Swift Fox												
Special Concern*	Birds (max • =64)	5	4	9									
	Bats (max • =10)	4	3	7									
Other Species/Groups of Concern (see below, max • =6)													
Golden Eagle*		X	X	2									
Sage Grouse*				0									
Bats*		X	X	2									
	Subtotals	13	11	24									
	Total			24									

POTENTIAL IMPACT INDEX
SCORE 1
Harmata Master List
Method Using in Graph in USFWS Guidance

	Site							
	Northern Cheyenne – Master List- method used in USFWS graph							
Checklist (*p*)[1]	• •	• *ƒp*	• •	• *ƒp*	• •	• *ƒp*	• •	• *ƒp*
Physical (divisor = 36/145 = 0.25)	16	64.4						
Species Occurrence & Status (0.63)	24	37.8						
Ecological (0.12)	5	42.7						
Totals	45	144.9						

[1]Proportion of total (145) checklist scores.

POTENTIAL IMPACT INDEX
SCORE 2
Harmata Master List

Checklist (p)[1]	Site: Northern Cheyenne – Master List-method used in USFWS graph							
	• •	• /p	• •	• /p	• •	• /p	• •	• /p
Physical (divisor = 36/163 = 0.22)	16	72.4						
Species Occurrence & Status (0.68)	24	35.6						
Ecological (0.10)	5	47.9						
Totals	45	155.9						

[1]Proportion of total (163) checklist scores, which appears to be the intended value in the USFWS document. Comparison's not available due to apparent proprietary issues related to correct MT scores.

POTENTIAL IMPACT INDEX
SCORE 3
Harmata Master List and BCC list

	Site							
	Northern Cheyenne – Master and BCC Lists							
Checklist (p)[1]	• •	• /p	• •	• /p	• •	• /p	• •	• /p
Physical (divisor = 36/181 = 0.20)	16	80.4						
Species Occurrence & Status (0.71)	34	48.1						
Ecological (0.09)	5	53.2						
Totals	55	181.7						

[1]Proportion of total (181) checklist scores. This score is not comparable to the other sites scores in Montana, due to the differences in the lists considered for species.

Appendix B
Mathematical Review of USFWS Site Evaluation Procedure

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The following is my interpretation of the mathematics of the USFWS site evaluation procedure guidelines. There is some confusion regarding the example in the guidelines (page 24 – page 30), and hopefully this below will help to clarify the confusion. Apparently, the example is not based on the same data in the figure that lists the scores.

I use the following notation in reviewing the mathematics:

Define:

B_p= # boxes considered for the physical attribute table. This may vary from region to region. In the example, the value of B_p=36 (page 24).

B_e = # boxes considered in the ecological attractiveness criteria. This may vary from region to region. In this example, the value of B_e=16 (page 24). I believe this is a mistake, since the max score for this category is 17. One of the criteria, "Site of Special Conservation Status", is given a value of 2 if it is checked for your site.

B_s = # boxes considered in the species of concern lists. This number appears to be the number of boxes in a master list of species that are of concern in a region. This is apparently developed using the Birds of Conservation Concern list, Threatened and Endangered Species Lists, local species or groups of concern. This "master" list would appear to need to be the same when comparing different sites, and should be included in the example. Some species may only occur in the geographic region considered during breeding season, or during both breeding and fall/winter, so may contribute a value of 1 or 2 to B_s. The value given in the example for is B_s = 91 (page 24). Apparently the value used for generating the scores in the figure was 92. It is not clear where the 91 or 92 are derived. It appears to be the number of species times 2 considered in the avian species of concern list and the bat list, plus the number of species/groups considered in the summary table (T&E, candidate and other species). We are not sure why the T&E, candidate and other species are not multiplied by 2 for both breeding and fall/winter migration.

C_p=# boxes in the physical attribute table that are checked for your specific site. The value given in the example for C_p=15 (page 30).

C_e=# boxes in the ecological attractiveness table that are checked for your specific site. The value given in the example for C_e= 7 (page 30).

C_s=# boxes in the species of concern list that are checked for your specific site. Some species may receive 2 check marks, one for breeding and one for migration/winter. The value given in the example for C_s= 20 (page 30).

The total possible number of boxes considered ($B_p + B_e + B_s$) is used in the index formula. In the example, the value of this sum is 143. The value of the sum used for the data listed in the Figure (Figure 2) is 145.

Define P_p as the proportion of total boxes comprised by the physical factors:
$P_p=B_p/(B_p + B_e + B_s)$.
In a similar fashion, calculate:

$P_e=B_e/(B_p + B_e + B_s)$, and
$P_s=B_s/(B_p + B_e + B_s)$.

The PII score as written in the guidance is calculated by

PII score = $C_p/P_p + C_e/P_e + C_s/P_s$.

Rearranging the right side of the equation yields:

$$PII = \frac{C_p}{\left(B_p \big/ B_p + B_e + B_s\right)} + \frac{C_e}{\left(B_e \big/ B_p + B_e + B_s\right)} + \frac{C_s}{\left(B_s \big/ B_p + B_e + B_s\right)}$$
$$= (B_p + B_e + B_s) \cdot (\frac{C_p}{B_p} + \frac{C_e}{B_e} + \frac{C_s}{B_s})$$

Further rearranging the formula by multiplying and dividing by the value 3 provides a form that may be more intuitive:

$$PII = 3 \cdot (B_p + B_e + B_s) \cdot \left((\frac{C_p}{B_p} + \frac{C_e}{B_e} + \frac{C_s}{B_f})/3 \right)$$

The component on the far right of the equation is the average proportion of total boxes checked for your site among the three lists (physical, species and ecological). The factor of 3 multiplied by the sum of the total number of boxes considered [3*($B_p + B_e + B_s$)] is effectively an arbitrary constant. In the example, PII is calculated by:

$$PII = 3 \cdot (36 + 91 + 16) \cdot \left((\frac{15}{36} + \frac{20}{91} + \frac{7}{16})/3 \right)$$
$$= 3 \cdot (143) \cdot ((0.417 + 0.220 + 0.438)/3)$$
$$= 429 \cdot (0.358)$$
$$= 154$$

At this site, average proportion of the total boxes checked among the three groups (physical, species of concern and ecological attractiveness) treating each group with equal weight is 0.358 or 35.8%. The PII value reported in the example in the USFWS guidance document is 156, but the difference (156 compared to 154) is due to rounding error. It is very important that if the PII score is used to compare sites, that the same values for B_p, B_e ,B_s be used for all sites.

APPENDIX B

Cultural Resource Report

Northern Cheyenne Tribe
North Cheyenne Reservation

THE RESULTS OF CULTURAL RESOURCE INVESTIGATIONS UNDERTAKEN FOR THE GARFIELD PEAK WIND TURBINE PROJECT, NORTHERN CHEYENNE INDIAN RESERVATION, ROSEBUD COUNTY, MONTANA

November 20, 2003
(Draft Report)

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ACKNOWLEDGMENTS

The author would like to thank the Northern Cheyenne Tribe (especially Diana McLean, Procurement Department) and the tribe's Department of Energy (especially Darlene Wooden Legs, DOE Coordinator) for the opportunity of participating in the cultural resource efforts being undertaken for the Garfield Peak Wind Turbine Project.

Special thanks also to Gilbert Brady, Sr., Tribal Historic Preservation Officer (THPO), for his willingness to share the knowledge and experience he's gained while residing on the reservation. Gilbert and I began working together on cultural resource management issues in 1994 on two large projects undertaken in Boulder County, Colorado. For close to a decade now we have continued our passion and dialogue towards identifying and preserving America's native cultural and natural resources. His council and expertise is greatly appreciated and I look forward to working with Gilbert for many years to come.

Several tribal members were asked to provide information regarding past and present uses of the project area, including, Ray Brady, Sr., LeForce (Lee) Lone Bear, Gilbert Brady, Sr., and Steven Brady.

I would also like to express my thanks to Marvin Keller, Bureau of Indian Affairs (BIA) Regional Archaeologist, Billings, Richard Bear Quiver, BIA, Lame Deer, and M. Damon Murdo, Cultural Resources Manager, Montana State Historic Preservation Office (SHPO), Helena, for their prompt response and assistance in undertaking the Class I file and literature search. And, Christopher William Bergen, Manager of Environmental and Regulatory Affairs, Distributed Generation Systems (DISGEN), Lakewood, Colorado, for his assistance throughout the project.

ABSTRACT

The cultural resource activities undertaken on behalf of the Garfield Peak Wind Turbine Project consisted of a Class I file and literature search, a Class III inventory (i.e., 100 per cent) of approximately 250 acres, and several interviews with Northern Cheyenne tribal members regarding past and present use of the project area or Area of Potential Effect (APE). The result of these investigations suggest the presence of prehistoric and historic cultural resources surrounding the project area, especially on the west side in the Greenleaf Creek area (i.e., the bottomlands more favorable to occupation). Piercing sites, Native American Church Lodge locations, and burials are well known to some tribal members in the Greenleaf vicinity.

Cairns and stacked rock features representing potential burial locations, fasting or vision questing, observation points, markers, or other functions are not uncommon and two such rock features are located within the APE: sites 24RB1292 (previously recorded; see Appendix A) and 24RB_____ (newly recorded; see Appendix B). Both sites 24RB1292 and 24RB_____ are recommended eligible for the National Register of Historic Places (NRHP) under criteria (d). No subsurface testing has been undertaken at either site, and no cultural material observed. In addition, a contemporary use area (CUA) and/or site with intangible spiritual attributes (ISA) was observed at an unnamed spring towards the southern end of the APE.

All three sites should be avoided of any adverse impact resulting from development, maintenance, and operation of the Garfield Peak Wind Turbine Project. It is recommended a clearly demarcated buffer zone be established around these sites for a minimum of 200 feet prior to any ground disturbing activities taking place. It is also recommended a Northern Cheyenne tribal member (and possibly several more) be present during all ground disturbing activities to monitor for previously undetected surface and subsurface cultural remains, including human remains. This monitor can also ensure the integrity of the buffer zones are maintained during construction activities.

INTRODUCTION

The Northern Cheyenne Tribe, Lame Deer, Montana, proposes to develop a thirty (30) Megawatt (MW) wind power project on their reservation (see Map 1 and Map 2). The BIA is the lead federal agency overseeing implementation of the National Environmental Policy Act (NEPA). Distributed Generation Systems, Inc. (DISGEN), Lakewood, Colorado, is assisting the Northern Cheyenne's Department of Energy (NC-DOE), in developing the project, including, a Feasibility Study and Environmental Assessment (EA). The proposed 30 MW project consists of 20 1.5MW wind turbines placed on a single string along the ridge line spaced roughly 630 feet apart. The transmission and communication lines will be buried between the turbines and the 69kV transmission line traversing the project area which is owned by the Tongue River Electric Cooperative.

In early October 2003, the author contracted with the NC-DOE to perform a cultural resource investigation of the Garfield Peak Wind Turbine Project in the reservation's northeast corner. The project is located in Rosebud County on a high, generally-trending north/south ridge roughly half way between Rosebud Creek to the west and the Tongue River to the east. The project area is part of a dramatic southwest/northeast trending mountain range. Lame Deer is about nine miles west of the project area while Ashland is about 14 miles to the east.

As per the scope of work, as amended, the cultural resource investigations consist of three parts: (1) undertake a Class I file and literature search for the project's APE; (2) undertake a Class III non-collection pedestrian inventory (inventory) of approximately 250 acres (i.e., that portion of the APE east of the north/south two-lane gravel access road) recording all prehistoric and historic resources, including Northern Cheyenne cultural heritage sites, traditional cultural properties (TCPs), CUAs, and ISAs; and (3) undertake oral interviews with Northern Cheyenne tribal elders knowledgeable about the past and present activities undertaken within the APE.

All field notes (Burney 2003), 64 color photographs, Montana Cultural Resources Information System (CRIS) form for site 24RB_____, and one copy each of the draft and final reports are on file with the author and Gilbert Brady, Sr., THPO, Northern Cheyenne Tribe, Lame Deer, MT. In addition, one copy each of the draft and final reports will be provided to Darlene Wooden Legs, the NC-DOE, Lame Deer, MT; Marvin Keller, BIA, Billings, MT; and Christopher William Bergen, DISGEN, Lakewood, CO. One copy of the final report will be provided to M. Damon Murdo, SHPO, Helena, MT; and Rochelle Bennett, Archaeology Records, Department of Anthropology, University of Montana, Missoula, MT.

Map 1. Location of the Northern Cheyenne Indian Reservation, Rosebud and Big Horn Counties, Montana (from Caywood et al. 1986:1-2)

Map 2. The Northern Cheyenne Indian Reservation in 1900 and the Garfield Peak Wind Turbine Project Area (Svingen 1993:56)

PROJECT LOCATION & NATURAL SETTING

The Garfield Peak Wind Turbine project area is located in the northeast corner of the Northern Cheyenne Reservation approximately nine miles east of Lame Deer and 14 miles west of Ashland, Rosebud County, Montana. The legal location for the APE is Township 2S, Range 43E, Sections 17, 18, 19, 20, 29, and 30, USGS, Garfield Peak, Montana, 7.5 minute series (1:24,000) topographic map, contour interval 20 feet (1958; photorevised in 1978). The approximately 250 acres inventoried east of the north-south ridge top access road falls within Sections 17, 20, 29, and 30. Elevation varies from about 4,200 feet to 4,300 feet (see Map 3).

The Northern Cheyenne Reservation is in the Yellowstone River drainage basin. This area of southeastern Montana is within the Missouri Plateau section of the Great Plains physiographic province. The two major streams draining the area are Rosebud Creek to the west, a perennial prairie stream, and the Tongue River which has its headwaters in the Big Horn Mountains (Caywood 1986:2-5). Four general vegetation zones are identified for the Northern Cheyenne Reservation: (1) eastern Montana ponderosa pine forest; (2) ponderosa pine savanna; (3) foothill grassland; and (4) stream and lake bottom vegetation (BIA 1980:2-1 - 2-2). The ponderosa pine forest/savanna most closely defines the project area (see Figure 1).

The APE is on a relatively flat wooded ridge top and the surrounding terrain is rugged and steep with deeply dissected seasonal drainages, several of which are listed below. The views from the project area are breathtaking, encompassing a vast territory to the north and east towards the Tongue River and Ashland. A short distance west is a small pleasant valley where Hollowbreast and Ash creeks join Greenleaf Creek. Much of this area burned in the Early Bird Fire during the week of June 5, 1988, affecting approximately 23,000 acres (Moore 1988:1).

The project area on the divide between Rosebud Creek and the Tongue River is known as the pine breaks or prairie and pine breaks (Deaver and Deaver 1988:29-30) (see Figure 2). Also noted by Caywood (1986:D-3),

> Pine breaks refer to 'edge' areas, or transition zones, between the mountains and the major river valleys. These area[s] are often heavily dissected and are characterized by sparsely or patchily distributed ponderosa pine, juniper, and other dry land shrub species. Topographically, the area is characterized by steeply eroded, free-standing buttes and ridges, with large outcroppings of sandstone.

Deaver and Deaver (1988:29) note "Workable lithic materials are abundant and diverse. High quality vitreous porcellanite is widespread and common. Isolated outcrops of petrified wood, TRSS and brown chalcedonies also occur." Scoria outcrops are common across the landscape. Scoria and procellanite are created by coal beds igniting naturally creating intense underground heat resulting in the metamorphose of nearby sediments (Moore 1988:1).

Due to the rugged topography, hunting and habitation activities were thought to be conducive to the area. Good hunting for deer and bear in the Garfield Peak area was confirmed by Ray Brady, Sr. (p.c., October 13, 2003, Lame Deer); and the author spoke with one hunter while working in the area.

Detailed discussions regarding the geology, soils, fauna, flora, and climate for the Tongue River drainage and Northern Cheyenne Reservation are available in Aaberg and Crofutt (2001:7-18); Caywood et al. (1986:2-1 - 2-11); Deaver and Deaver (1988:14-28); and Koostra-Manning (1993:24-29).

The 20 proposed wind turbines will be placed along a north/south ridge top over three and one-half miles in length. The northern half of the project area is the narrowest (e.g., .1 mile or less) while the southern end widens considerably exceeding .6 mile in width. The southern end of the inventory area is at about 4,200 feet in elevation to the north of U. S. Highway 212 connecting Lame Deer and Ashland (see Figure 3). Garfield Peak

(4,316 feet), at the northern edge of the reservation, is a short distance to the north-northeast of the northern end of the inventory area (see Figure 4).

The headwaters of Stebbins Creek originate (about 4,300 feet in elevation) just to the west of the southern end of the project area and flows parallel to U. S. Highway 212 until reaching the Tongue River. Several additional seasonal drainages originate on the east side of the ridge, including (from north to south), Burning Creek, Reservation Creek, Lake Creek, and Cow Creek. On the west side of the ridge are Hollowbreast Creek, Greenleaf Creek, and Ash Creek. A number of springs are also identified throughout the Garfield Peak area although their viability is unknown.

A single spring at the southern end of the project area is shown on the USGS Garfield Peak map (see Map 3) but no surface water was readily apparent during the inventory. Many of these springs have been developed for watering livestock. During the inventory a number of cattle were observed throughout the APE and were concentrated around the spring area located towards the southern end of the inventory area. The author daily observed personnel in the area associated with the livestock (e.g., herding, building or mending fence, and the like). A small cattle facility is located on the north side of the main access road from U. S. Highway 212 where various working vehicles were parked and some activity was taking place.

Map 3. USGS Garfield Peak Topographic Quadrangle Showing APE, Area Inventoried, and Sites 24BR1292 and 24BR____.

Figure 1. View Southeast Showing Grass Covered Broad Ridge in Southern End of APE Sparse with Ponderosa Pine.

Figure 2. View West Looking Down on Confluence of Greenleaf and Ash Creeks.

Figure 3. View South Looking Down on U. S. Hwy. 212 and Four Converging Brush-Lined Seasonal Drainages Flowing into Stebbins Creek.

Figure 4. View Northeast from Project Access Road Showing Garfield Peak (4,316 feet elev.) in Left-Center of Photo.

CLASS I FILE & LITERATURE SEARCH

The Class I file and literature search relied primarily on information housed with the BIA, Billings, MT, and the SHPO, Helena, MT. The author, accompanied by Gilbert Brady, Sr., THPO, Northern Cheyenne Tribe, Lame Deer, MT, met with Marvin Keller, BIA Regional Archaeologist, Billings, MT on October 14, 2003. The author met with M. Damon Murdo, SHPO, Cultural Resources Manager, on October 16, 2003.

As a result of meeting with the BIA and SHPO, ten reports were identified documenting earlier archaeological projects within or adjacent to the project area. That is, the southwest quadrant of the USGS Garfield Peak, Montana, topographic quadrangle (Township 2S, Range 42E and 43E) (Aaberg and Crofutt 2001; Bearquiver 2003; Caywood et al. 1986; Cochran 1999; Deaver & Deaver 1988; Keller 1989; Moore 1987 and 1988; Pratt and Aaberg 1996; Tucker and Newberry 1990; Wood 1982).

Aaberg and Crofutt (2001:i) performed a Class I file and literature search of the proposed *Tongue River Watershed Conservation Plan* project area on the Northern Cheyenne Indian Reservation. Their research indicated 63 archaeological projects undertaken with 366 sites recorded.

Richard Bear Quiver, BIA Forestry, Lame Deer, MT, recently inventoried (October, 2003) two wind turbine locations towards the north end of the APE with negative results (p.c., November 14, 2003). Caywood et al. (1986:i) inventoried 70 randomly selected quarter-section sample units, approximately 200 miles of proposed road corridor, and 85 spring locations. The inventory encompassed about 11,300 acres recording 139 sites for a site density of one site for every 106 acres, on the average. Moore (1987) and Cochran (1999) inventoried roads for the Diamond R Logging Project with negative results.

The prehistoric cultural overview of southeast Montana by Deaver and Deaver (1988:1-3) may be dated but remains a valuable reference for prehistoric cultural resources. Their study encompasses 25.3 million acres, including the Northern Cheyenne Indian Reservation. At the time of their compilation there were 700 prehistoric sites recorded for Rosebud County, including seven cairns, 60 rock rings, and 43 rock art sites. Nearby, Big Horn County had a total of 867 sites, including 73 cairns, 84 rock rings, and 18 rock art sites. Rock art sites occur in their highest percentages in Big Horn, Rosebud, and Powder River counties (Deaver and Deaver 1988:131).

Keller (1989) and Moore (1988) both refer to the Early Bird Fire the week of June 5, 1988. Although the fire is estimated to have affected approximately 23,000 acres, only between 12,000 and 12,500 acres were inventoried for cultural resources. Keller (1989:8) reports 51 sites were recorded in the burned area. This includes 27 sites recorded by Historical Research Associates (HRA) in 1987 (?) (Caywood et al. 1986 ?) and 24 sites (?) recorded in the 1988 Early Bird inventory. Moore (1988:4), however, reports her inventory recorded 21 sites and 15 minimal activity loci (Mal). The Caywood et al. 1986 undertaking recorded 139 sites.

The Class III inventory undertaken by Pratt and Aaberg (1996:11) consisted of the investigation of about 1.25 linear miles of proposed U. S. Highway 212 realignment, amounting to about 60.6 acres, with negative results. Tucker and Newberry (1990:16) inventoried about 12.2 miles of U. S. Highway 212 beginning immediately west of Lame Deer (about 432 acres) recording six sites and four isolated finds (IFs). Lastly, Wood (1982) inventoried about 10 acres as part of the ARCO/Northern Cheyenne Tribe 2-19 Project with negative results.

Although over 166 prehistoric and historic sites were recorded as a result of these ten studies, only one previously recorded site is known within the project area. This is site 24RB1292, first recorded in 1986 by HRA, Missoula, MT (Caywood et al. 1986; Keller 1989:5). Site 24RB1292, a roughly circular rock feature marking a potential burial location or fasting site (G. Brady, p.c., 10/18/03; Keller 1989:5),

> ...is a circular stone feature of stacked scoria cobbles, measuring three meters in diameter, with stone walls stacked approximately 40cm high. Harry Littlebird identified the structure as a possible fortification site, but no formal determination could be made and it was not known who had constructed the site. The size and configuration of this feature is within the range features others have identified as fasting sites (Conner 1982; Fredlund 1969) (see Figures 5 and 6).

At least 27 sites are known for the area encompassed by Township 2S and Range 42E and 43E. Although chipped stone sites predominate there is a range of cultural activities representitive of the prehistoric and historic periods (e.g., Native American Church Lodges, fire hearths, scarred trees, historic Indian agency, homesteads, farmsteads, and the like). A number of these sites are located just to the west and north of the project area along Ash, Greenleaf, and Hollowbreast creeks, hundreds of feet below the proposed project.

It should be noted, Aaberg and Crofutt (2001:Appendix A) provide a *Table of Previous Archaeological Projects in the Tongue River Watershed Project Area* of which 14 projects fall, at least in part, within Township 2S, Range 42E and 43E. Naturally, the bulk of these projects have been reported on by Marvin Keller, BIA archaeologist, Billings, MT, in response to timber, spring, and gravel undertakings.

Other important sources of information include the Archaeology Records, Department of Anthropology, University of Montana, Missoula, MT. This office also provides Smithsonian Trinomial site numbers for newly located cultural resources. Dull Knife Memorial College in Lame Deer, MT, was originally chartered in September, 1975, by Tribal Ordinance as the Northern Cheyenne Indian Action Program, including the John Woodenlegs Memorial Library housing the "Cheyenne Collection." This collection consists of a written data base specific to the Cheyenne Culture, Northern and Southern. The library also has the Human Relations Area Files (HRAF) on CD Rom. There is also the Northern Cheyenne THPO and the five-member Culture Committee, Donlin Her Many Horses, Chairwoman, and Phillip Fisher, Vice Charwoman. Northern Cheyenne tribal records also provide an invaluable source of information about their people and culture (Marquis 1978:283). The Culture Committee is responsible for the enhancement and preservation of the Northern Cheyenne Culture.

Figure 5. Site 24RB1292. View North Showing Circular Rock Feature.

Figure 6. Site 24RB1292. View East Showing Circular Rock Feature.
Gilbert Brady, Sr. to Right of Vehicle in Background.

ORAL INTERVIEWS & TRADITIONAL VALUES

Several Northern Cheyenne tribal members were interviewed to solicit information regarding the past and present uses of the project area, including, Ray Brady, Sr. at the Shoulder Blade Senior Citizens Center, Lame Deer, Gilbert Brady, Sr., Steven Brady, LeForce (Lee) Lone Bear, and Mike Running Wolf. Future potential candidates for information were Martin Kills Night and Bisco Spotted Wolf at the Heritage Living Center, Ashland, MT. These interviews document the use of the project area, primarily for good hunting (e.g., deer and black bear). The Greenleaf Creek area to the west is known for its piercing and Native American Church activities and burials (Burney 2003:1,558-1,559).

The Early Bird Fire of June, 1988, impacted these piercing locations and earlier recorded cultural resources. Nearby Garfield Peak (4,316 feet), north-northeast of the project area, is reported to have been part of the organized native communication system the Northern Cheyenne used to receive word of the Battle of the Little Big Horn <u>on</u> June 25, 1876. The Reservation Fire swept up the east side of the ridge which is much steeper.

Regarding the Early Bird Fire west of the APE both Keller (1989:4-7) and Moore (1988:4) provide valuable information regarding past and present uses of this part of the reservation, including, specialized site types: piercing sites, fasting sites or vision questing sites, Native American Church Lodges, and burials. Moore (1988:4) observed the following about the country adjacent to the west side of the APE, including, Greenleaf:

> In historic times this area was important to the Northern Cheyenne as an area with a variety of vegetable foods, deer, and plentiful firewood. The area has numerous springs and is used for camping in the summer months. In the 1920s land was allotted to each tribal member to farm or to raise cattle. Allotted lands in the project area [Early Bird Fire] were owned by Harry Little Roach and Edward Foot. This area was not a common place for the Cheyenne people to put historic burials and very few were found during the survey.

> Recent ceremonial use of this area was evidenced by the presence of a peyote ceremony site. This consisted of a hearth within a tipi circle. Around the hearth powdered sandstone had been placed. The sandstone was natural in color, and about 10cm from the hearth, being halfway around the hearth. The site appears to have been used early in the summer of 1988 [see also, Keller 1989:6]. Prehistoric sites indicate the project area was used for camping and associated activities with most of the action being in the bottomlands. Historic sites suggest homesteading, trapping, wood gathering, hunting and the holding of ceremonies.

Multi-colored prayer cloths were placed in the area of a spring in the southwest corner of the project area above Stebbins Creek (Figure 7). Hot and cold springs are known for their special emphasis by native peoples and are considered potent spiritual locations (Burney 1994:258). Deaver (1988:29) reports the Northern Cheyenne believe spirits reside in springs and they frequently leave offerings honoring these beings. Furthermore, "Springs also provide clays and healing waters which are important to medicinal and ceremonial traditions. Alteration or damage to springs can cause irreparable damage to the spirits associated with them" (Kooistra-Manning et al. 1993:29). This type of present-day activity has been characterized by Kooistra-Manning et al. (1993:86) as a site with spiritual attributes (ISA) and contemporary use area (CUAs):

> ...prayer and offering locales which are currently in use for ceremonial purposes, or locations from which resources are gathered for medicinal and ceremonial uses. Occasionally, current use can be recognized by offerings left at a site or a location. Offerings may include tobacco, prayer cloths, feathers and braided sweetgrass. Impacts to contemporary religious practices are addressed in compliance with the AIRFA and NEPA.

Northern Cheyenne tribal members providing their expertise on the Early Bird Fire were Bill Tallbull, Harry Littlebird, Dill Madrigal, Charles Brady, Steve Brady, Martin Killsknife, and Francis Killsknife (Keller 1989:3; Moore 1988:3). George Elkshoulder, Sr. and Bill Tallbull were interviewed for the Tongue River Dam Project (Kooistra-Manning 1992); and at least 24 Northern Cheyenne tribal consultants, in addition to Arapaho, Arikara, Crow, and Sioux, were utilized in preparation for possible coal development near Colstrip and Decker, Montana (Kooistra-Manning et al. 1993:15).

Figure 7. View Northeast Showing Multi-Colored Prayer Flags Near Spring at Southern End of APE

TRADITIONAL CULTURAL PLANTS

The author did not inventory the vegetation occupying the project area as part of this cultural resource effort. Vegetation typical for the area, however, would include, ponderosa pine, Douglas Hawthorne, Oregon grape, sagebrush, wild rose, juniper, thistle, and several mixed upland grasses. An extensive plant inventory undertaken during the entire growing season for the Tongue River Reservoir ethnobotanical project yielded 278 plant species, including 62 Northern Cheyenne cultural/economic species (Aaberg and Tallbull 1993:9-16). This topic has also been highlighted in Caywood et al. (1986:2-7 - 2-10); Kooistra-Manning et al. (1993:Appendix B [Appendix C: Traditional Animal, Bird, and Fish Uses]); and Pratt and Aaberg (1996:8-9).

CULTURAL OVERVIEW

Southeastern Montana is included in the Northwestern Plains subarea of the Plains Culture Area. Mulloy (1958) advanced the earliest outline for Montana's prehistory giving rise to several chronological schemes now employed when describing the prehistory for the Northwestern Plains, including the project area (Frison 1991; Reeves 1969). The Reeves chronology generally adheres to Mulloy's dividing prehistory into the Early, Middle, and Late periods. However, Reeves refined Mulloy's taxonomy adding additional terminology to define prehistoric cultural traditions and phases based on the archaeological record.

Frison (1991) also divides the prehistoric into three periods but with further subdivisions, including, the Paleoindian, Archaic (Early Plains, Middle Plains, and Late Plains Archaic), and the Late Prehistoric period. The Protohistoric period was coined to identify the period when EuroAmerican settlement and trade were indirectly influencing Northern Plains native peoples prior to direct contact (adapted from Pratt and Aaberg 996:10).

For detailed descriptions of these time periods the reader is referred to Aaberg and Crofutt (2001:18-32); Beckes and Keyser (1983:264-306); Caywood et al. (1986:3-1 - 3-34); Deaver and Deaver 1988:50-69); Kooistra-Manning et al. (1993:58-69); and Tucker and Newberry (1990:11-14). Important information regarding the Northern Cheyenne Indian Reservation, specifically, can be found in Aaberg and Crofutt (2001:30-32); and Caywood et al. (1986:3-17 - 3-34).

CLASS III INVENTORY METHODOLOGY

The Class III non-collection pedestrian inventory was undertaken by the author assisted by Gilbert Brady, Sr. Gilbert had previously walked roughly 210 of the 250 acres locating site 24RB_____ (Gilbert Brady, Sr., p.c., October 18, 2003). The dates of investigation occurred October 13, 17, 18, 19, 20. Field conditions were extremely favorable. The nights were cool (in the 40s) and the days were warm, or even hot (in the 80s). Only one of the field days experienced moderately high winds (30-50 mph) and there was little precipitation to hinder the inventory.

The objectives of the inventory were threefold: (1) undertake a 100 percent investigation of approximately 250 acres in the attempt to locate all cultural resources, especially resources 50 years old or older. Prehistoric and historic cultural resources include, Northern Cheyenne cultural heritage sites, TCPs, CUAs, minimal activity loci (Mal), and isolated finds (IFs); (2) propose NRHP eligibility recommendations for all pre-1950 cultural resources; (3) assess the potential impacts of the Garfield Peak Wind Turbine Project to the recorded cultural resources.

As noted above, although traditional cultural plants, animals, birds, and fish, can also be perceived as both natural and cultural resources, these categories have not been addressed. One exception may be the CUA/ISA observed at the spring located towards the southern end of the inventory area where prayer flags were observed to have been placed.

An attempt was made to provide equal inspection to all of the 250 acres (e.g., 30m transects were employed, when feasible). Due to the extreme cover of vegetation (primarily a dense mat of grasses frequently exceeding 14 inches in height) (see Figure 8) and forest litter/duff (see Figures 9 and 10) special attention was given to areas providing greater visibility of mineral soil.

Due primarily to the intensive cattle grazing undertaken within the APE, there are a number of narrow cattle paths (Figure 11), at least one large salt lick where over eight blocks of salt are available, and cattle wallows, dirt roads (Figure 12), erosional areas, burrowing animal back dirt (see Figure 13), ant hills, and vertical rock surfaces potentially yielding rock art (see Figure 14). Previous forest fires have also dramatically affected the canopy of the APE. Few snags are left standing (see Figure 15) as most have fallen or been blown down leaving conspicuous exposed root fall throughout the inventory area (see Figure 16).

Site 24RB_____ was recorded on a Montana CRIS Form, plotted on the USGS Garfield Peak topographic quadrangle, a sketch map (not to scale) made illustrating the feature, and color photographs taken. No artifacts or other features were observed associated with this site. No subsurface testing was undertaken. Gilbert Brady, Sr. placed green surveyor's flagging at the site's location so the area could be avoided of adverse impact. The author added additional green flagging during his two visits to the site.

Figure 8. View North Showing Dense Grass Cover and Staked Wind Turbine Location With Red Surveyor's Flagging.

Figure 9. View South Showing Thick Secondary Growth Typical in the More Heavily Forested Southern Portion of the APE.

Figure 10. View South Showing Deadfall on Forest Duff in the More Heavily Forested Southern Portion of the APE.

Figure 11. View Northeast Showing a Segment of Cow Path Providing Visibility to Mineral Soil.

Figure 12. View North Showing Project Access Road Through North End of APE.

Figure 13. Close-up Photograph of Burrowing Animal Backdirt Providing Inspection of Subsurface Mineral Soil.

Figure 14. View Southwest Showing a Typical Exposed
Rock Face I Inspected for Rock Art.

Figure 15. View Northwest Showing One of the Remaining Snags in the APE.

Figure 16. View Northeast Showing One Example of the Common Root Fall Resulting From Wind-Blown Trees.

CLASS III INVENTORY RESULTS: SITE 24RB_____ AND ONE CONTEMPORARY USE AREA (CUA) OR SPRING SITE WITH INTANGIBLE SPIRITUAL ATTRIBUTES (ISA)

The Class III pedestrian inventory of approximately 250 acres yielded one prehistoric east/west linear rock feature with an associated cairn, site 24RB_____ and one CUA or spring site with intangible spiritual attributes (ISA). Site 24RB_____ is located at about 4,300 feet elevation on the eastern edge of the project's ridge top overlooking the pine breaks to the northeast and east. The views from this location are spectacular giving the sense of being above everything in a more ethereal place: "Mountain tops and other high places have powerful spiritual qualities because they reach the realm of Nearer-Sky Space" (Kooistra-Manning 1993:70). This feature may be a burial or fasting site. The east/west orientation of the feature with the cairn at the east end may be representative of the burial of a spiritual or medicine person (Gilbert Brady, Sr., p.c., October, 2003).

The feature is composed of between 45-50 small to medium size rocks (e.g., 2" x 7", 3" x 7", 5" x 10", 5" x 13", 12" x 14", and 12" x 16") arranged on the ground's surface in a linear fashion approximately 16 feet four inches in length and four feet in width. The rock cairn at the east end of the feature is about five feet east/west by four feet six inches north/south. The cairn measures about 15 inches in height on the east side and seven inches on the west side. It appears the cairn could have been larger at one time observing the rock fall around the cairn's base. The feature appears to remain intact and in very good condition (see Figures 17 - 20). A light green lichen covers most of the feature suggesting some antiquity (see Figure 21). No prehistoric or historic cultural material was observed associated with this feature. The rocky and gravely soil appears shallow (i.e., less than 30cm) in and around the feature and it was not disturbed. Lichenometry may be employed to chronologically place this feature.

Multi-colored prayer flags were observed at the spring site towards the southern end of the APE suggesting this area to qualify as a CUA and/or ISA. No other cultural material was observed other than the prayer flags.

Figure 17. Site 24RB_____. View North Showing This Linear Rock Feature With the Cairn to Right of Photograph (Scale is 13 inches or 33 centimeters).

Figure 18. Site 24RB_____. View East Showing Full Length of This Rock Feature. Cairn at Far End of Tape and Toe of Feature is Nearest the Viewer. Pine Breaks in Background Going Towards Ashland.

Figure 19. Site 24RB_____. View North-Northeast Showing Rock Cairn at East End of Linear Feature. Possible Rock-Fall From Cairn on Ground to Right (Scale is 13 inches or 33 centimeters).

Figure 20. Site 24RB_____. View North-Northwest Showing Rock Cairn at East End of Liner Feature (Scale is 13 inches or 33 centimeters).

Figure 21. Site 24RB_____. View North-Northeast Showing Dense Lichen Grown on Rock Cairn at East End of Liner Feature (Scale is 13 inches or 33 centimeters).

NRHP ELIGIBILITY RECOMMENDATION

As per the Section 106 process of the NHPA, as amended, any resource 50 years or older requires evaluation as per 36 CFR 800.4c, and reference to the appropriate NRHP criteria per 36 CFR 800 60.4, parts (a), (b), (c), and (d). These criteria, which form the basis for assessing both historic and scientific significance, are identified below:

> a. That are associated with events that have been made a significant contribution to the broad patterns of history;
>
> b. That are associated with lives of persons significant in our past;
>
> c. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> d. That have yielded, or may be likely to yield, information important to understanding history or prehistory.

Using the above criteria Pratt and Aaberg (1996:5-6) devised five general guidelines for significance assessments. Guideline number five reads, "Historic or prehistoric sites may contain well preserved features such as buildings, roads, trails, tipi rings, cairns, effigies, pictographs, or petroglyphs. Such features may be representative of a period, an architectural style, an artistic style, or a unique or specialized activity."

Additionally, Kooistra-Manning et al. (1993:85) identify "eight site types recognized by archaeologists which are the most likely to have sacred attributes or have traditional cultural value for the Native American communities in the area (Deaver 1986, 1988; Tallbull and Deaver 1991)." These site types include: (1) burials; (2) rock art; (3) vision questing and fasting sites; (4) monumental, anthropomorphic and zoomorphic rock features, including large cairns, medicine wheels, and animal effigies; (5) dance grounds and associated lodges; (6) large or complex tipi ring sites with specialized ring features, including relatively small rings and large rings with diameters greater than seven meters; (7) sweat lodges; and (8) historic battle sites. Lithic scatters, homesites/camp locations, and buffalo kill sites are also site types of particular concern to the Northern Cheyenne (Kooistra-Manning et al. (1993:73-74).

Both sites 24RB1291 and 24RB_____ most likely represent the remains of burials, rather than vision questing and fasting sites (Gilbert Brady, p.c., October, 2003), and would appear to fall within criteria (d) and guideline number five supporting a recommendation they both be found eligible for the NRHP. These locations are deemed sacred as archaeological sites and Northern Cheyenne cultural heritage sites. These sites are recommended to be avoided of any adverse impact.

No NRHP recommendation is being given for the CUA/ISA spring site. Preservation of this area is better addressed through AIRFA. Regardless, it is recommended this location be protected and avoided of any adverse impact similar to sites 24RB1291 and 24RB_____.

If a cultural resource is found to meet any one or more of the above criteria the permitting or managing agency is required to determine the effect of the proposed activity on the resource. Three determinations are possible and they are as follows:

> (1) No Effect: The agency has determined the proposed undertaking will have no effect on the cultural resource;
>
> (2) No Adverse Effect: The agency has determined there will be an effect but not an adverse effect; and,
>
> (3) Adverse Effect. The agency determines the effect on NRHP eligible resources will be adverse. When an undertaking has been determined to have an adverse effect on a cultural resource eligible for the NRHP, the agency must consider strategies for mitigating these adverse impacts. There are several mitigation options available that can be employed from project redesign, excavation, and avoidance (adapted from Pratt and Aaberg 1996:4-5).

SUMMARY AND RECOMMENDATIONS

The Class I inventory, Class III inventory, and oral interviews, demonstrate prehistoric and historic utilization of the project area and surrounding environs, particularly the Greenleaf Creek vicinity to the west (see Historical Research Associates 1980). Much of the recent historic activity included numerous piercing activities beginning in the 1920s through 1958 and 1998 through 2002. Prayer cloths placed at a spring were observed by the author during mid-October illustrating the present-day use of the area for spiritual purposes. Burials are also reported for the Greenleaf area.

Previously recorded site 24RB1292 and the newly discovered rock feature with associated cairn, site 24RB_____, are recommended eligible for the NRHP. Both prehistoric site locations are significant requiring a suitable buffer (e.g., a minimum of 200 feet) and on-site Northern Cheyenne tribal member(s) to prevent adverse impacts. Similarly, the spring area marked with multi-colored prayer cloths is recommended as a CUA and/or ISA requiring a suitable buffer to prevent any adverse impacts.

Due, primarily, to the density of vegetative ground cover throughout the project (grasses and forest duff/litter) preventing visibility of mineral soil, Northern Cheyenne tribal monitors are recommended to be on-site during ground disturbing construction activities (e.g., road maintenance and new construction, trenching to bury electrical cable, wind turbine tower foundations, equipment and project inventory storage areas, and the like).

In the event of cultural remains being exposed and disturbed by ground disturbing activities, the area of the find must be secured immediately preventing further disturbance. Depending on the nature of the find, a buffer zone between 100 feet and 200 feet may be appropriate to allow construction activities to continue without jeopardizing the exposed cultural remains.

No on-site personnel should, in any manner, further disturb the find prior to authorization from the Northern Cheyenne Tribal Historic Preservation Officer (THPO) (currently, Gilbert Brady, Sr.) and/or the Cultural Commission. If human remains are encountered the Rosebud County Coroner will require immediate notification to determine if the remains are the result of a crime. Once the remains are determined not to be part of a crime scene, the THPO and Cultural Commission need to provide direction as to how to proceed.

GLOSSARY

Cairn - A cairn is generally used to imply a pile of rocks deliberately piled by humans for a variety of reasons (e.g., markers for trails, burials, fasting sites, sheep herders monuments, and hiker's monuments on tall peaks (e.g., Colorado's 14,000+ feet high peaks) (Fladmark 1978:149).

Contemporary Use Area (CUA) - Contemporary use areas are contemporary prayer and offering locales (Kooistra-Manning et al. (1993:85).

Fasting Site - A fasting site (a.k.a., vision quest site) is usually an isolated location where individuals stayed and fasted over a period of several days in order to communicate with spirits in the surrounding universe (Keller 1989:5).

Isolated Find (IF) - An isolated find (a.k.a., Isolated Occurrence) usually means a location consisting of a single artifact without any apparent context. It is much like the minimal activity loci (Caywood et al. 1986:4-14).

Lichenometry - The study of lichen growth as an aid to dating surface rock features and rock art (Fladmark 1978:155).

Limited Data Loci (LDL) - Limited data loci contain from two to 10 pieces of lithic material, no more than two material types, and contain no subsurface deposits (Caywood 1986:4-15). They are similar to minimal activity loci (Keller 1989:8).

Lithic Scatter - A lithic scatter contains lithic debris (i.e., chipped stone) from stone tool manufacturing and some occasional expedient and formal tools, but no other artifacts permitting identification of the site's age or function (Keller 1989:8).

Medicine Wheel - The term, medicine wheel, was apparently first defined in the literature by Thomas Kehoe (1954:133) "who described medicine wheels as a surface stone alignment that consists of a number of stones or stone cairn from which a number of stone lines radiate outward." The term first appeared in print when S. C. Simms (1903) of the Field Columbia Museum, discussed the Big Horn Medicine Wheel in Northern Wyoming (Quigg et al. 1996:9).

Minimal Activity Loci (Mal) - Minimal activity loci are those locations with less than seven or eight artifacts. Mal are not considered to have prehistoric or historic significance (Moore 1988:4).

Native American Church Lodges - The location where a tipi is placed for the purposes of conducting a native American Church service. Keller (1989:6) notes even though the tipi is temporary the area in which the service was conducted may continue to have a strong spiritual value.

Piercing Site - A piercing site is a location where individuals have made offerings to a particular tree. The act of piercing is a flesh sacrifice to the tree and when these trees are destroyed they are a personal loss to the individual (Deaver and Tallbull 1988; Keller 1989:4).

Site - A site is meant to be any location with detectable evidence of past human activity (Fladmark 1978:160).

Sites with Intangible Spiritual Attributes (ISA) - These special places have spiritual attributes but "do not meet the requirements of a 'property' because they contain no specialized features which indicate ceremonial use or which can be associated with traditional cultural practices, events or important individuals" (Kooistra-Manning et al. (1993:85-86); Parker and King 1990).

Tipi Rings - A circle of rocks on the ground surface thought to hold down the edges of a skin lodge. They may occur alone or in large numbers (Fladmark 1978:161).

Traditional Cultural Properties (TCP) - A traditional cultural property is "one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1990).

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APPENDIX A

Site 24RB1292: Site Form

Site Number: 1292

Compartment Number, Name: 1-17, Ash Creek

Map Reference: USGS Garfield Peak, Mont., Quad.

Cultural Affiliation: Unknown

Chronological Placement: Unknown Prehistoric

Topographic Setting: Upland mesa

Vegetative Type: Grassland

Aspect: Flat

Distance to Water: About 160 m to intermittent drainage

Elevation: 4,350 ft.

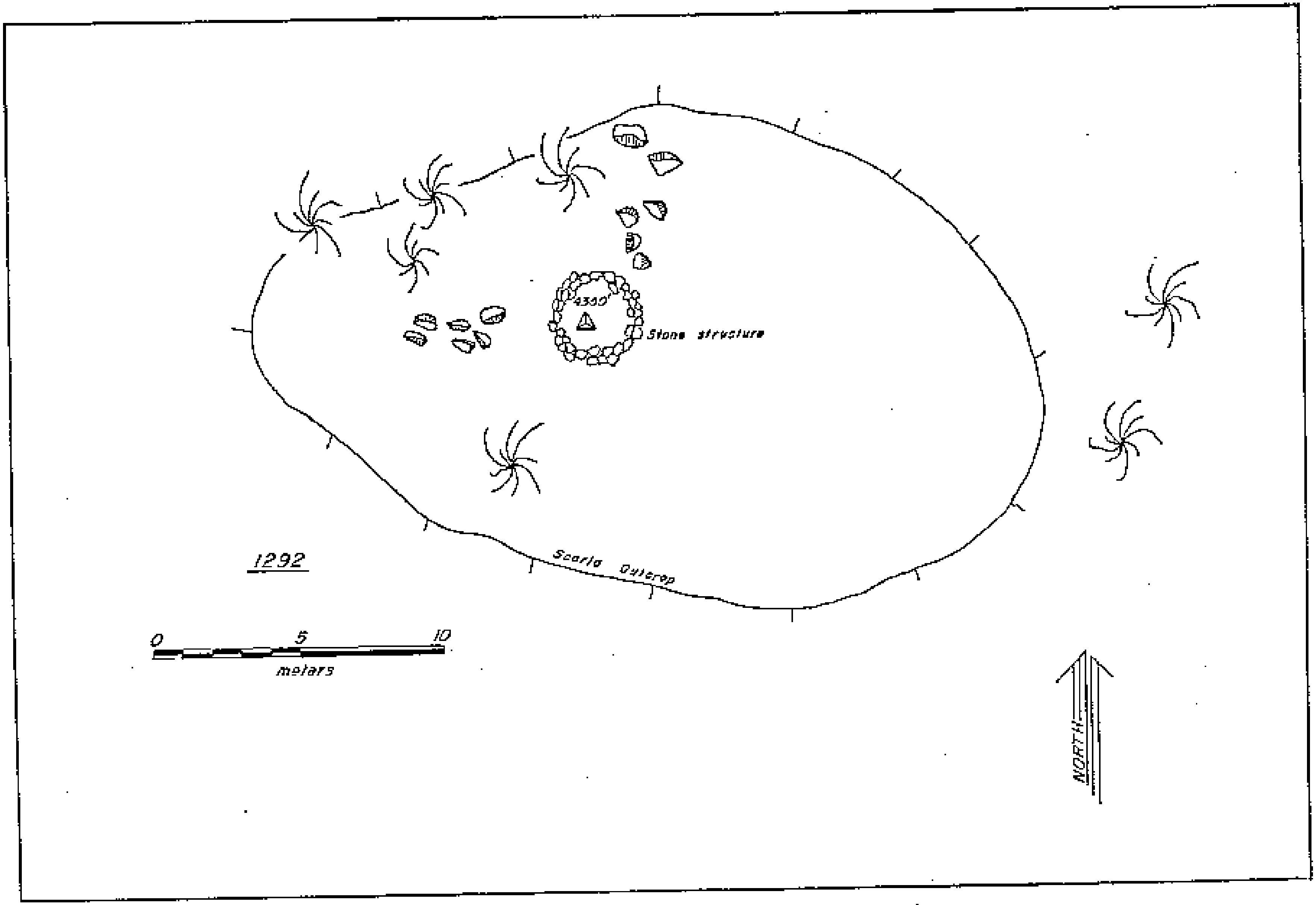
Site Size and Depth: The entire structure takes up an area of approximately 9 square meters.

Description: The site lies on the high point of an open, grassy mesa above the Ash Creek drainage. The mesa is part of the major divide between drainages that flow southeast into the Tongue River and those that flow northwestward toward Rosebud Creek. The ridge top is open and grass-covered for the most part, with a few scattered ponderosa pine. Dense ponderosa pine forest is found below the edge of the ridge.

The site consists of a circular stone structure built of scoria on top of a natural outcropping of the same material. 47 pieces of scoria ranging in size from less than 40 cm to greater than 1 m in length were stacked to form a hollow structure about 3 m in diameter, with walls that are approximately 17 cm thick and about 40 cm in height. A currant-like bush is currently growing inside the feature.

The condition of this feature is fairly good. It appears that a few pieces of scoria have fallen off the top of the walls of the structure, but it is probably mostly intact.

Preliminary Recommendation of Significance: It does not appear that the site has the potential to yield further significant information. Final determination will require subsurface testing.


4300'
Stone structure
Scoria Outcrop
1292
0
5
10
meters
NORTH

APPENDIX B

Site 24RB___: Montana Cultural Resources Information System Form (CRIS)

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Recommended Site Form (CRIS)

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM FORM

FORM NO. 1 - LOCATIONAL INFORMATION

1.1 Smithsonian Number: **1.2 Field Designation** N/A **1.3**
County: ROSEBUD

1.4 Township/Range/Section: T2S, R43E, SECT. 29

1.5 UTM Coordinates: Zone 13 **Easting** **Northing**

1.6 Property Type/Types:

1.7 Recording status: ✓ **surface examination** ✓ **photo** ✓ **map** ✓ **tested**____

Comments and recommendations: This site was not subsurface tested so as to not disturb the feature in any way. It has very good integrity and should not be adversely impacted in any way.

1.8 Administrative/surface ownership:(Forest/Region/District/Office:) NORTHERN CHEYENNE TRIBE, LAME DEER, MONTANA.

1.9 Mineral Ownership: Northern Cheyenne Tribe.

1.10 Project Name: GARFIELD PEAK WIND TURBINE PROJECT (a.k.a., Northern Cheyenne Wind Project)

Project Number:

1.11 General Narrative Description of Property: The APE is a North/South trending ridge on the Divide North of U.S. Hwy. 212 roughly halfway between Lame Deer to the West and Ashland to the East. The Greenleaf and Hollowbreast Creek area is below to the immediate West. Garfield Peak is a short distance to the North-Northeast. Ponderosa Pine [illegible] with dense forest at South End.

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1.12 Map Reference (Attach 8-1/2 x 11 USGS Photocopy) : USGS Garfield Peak, Montana, 7.5 Min. Series (1:24000), 1958 (Photorevised in 1978), T2S, R43E, Sect. 29, Rosebud County. Contour Interval 20 Feet. Attached.

1.13 City/Town: N/A

Vicinity of: Roughly halfway between Lame Deer to the west and Ashland to the east on North side of U.S. Hwy. 212 and Stebbins Creek.

1.14 Narrative of access: This site can be easily reached from Lame Deer or Ashland on U.S. Hwy. 212. Lame Deer is about 9 miles west of the access road turn-off and Ashland is about 14 miles east of the turnoff. From U.S. Hwy. 212 take the dirt access road north of U.S. Hwy. 212 for about 2.4 miles. The site is on your right (SE) across broad grass-covered ridge to about 423 meters away on east edge of ridge.

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MONTANA CULTURAL RESOURCES INFORMATION SYSTEM FORM

Form No. 2 - Environmental Setting

Site No. ______________________

2.1 Geographic Setting: PINE BREAKS - MISSOURI PLATEAU SECTION OF THE GREAT PLAINS PHYSIOGRAPHIC PROVINCE.

2.2 Elevation: 4,300 FEET

2.3 View/aspect (estimated direction and distance) : 360°

2.4 Major River Drainage: Yellowstone River Drainage Basin

2.5 Minor Drainage: TONGUE RIVER

2.6 Available water sources:

Names	Distance	Elevation Change	Type
1. UNNAMED	1 mile	90 FEET (4,180 FEET)	SPRING
2.			

2.7 Vegetation - regional: EASTERN MONTANA PONDEROSA PINE FOREST / SAVANNA

2.8 Vegetation - local: PONDEROSA PINE AND MIXED CONIFER, MIXED UPLAND GRASSES, YUCCA, WILD ROSE, SAGEBRUSH,

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2.9 Sediments/ Deposition: Soil appears shallow, Rocky and gravely.

2.10 Surface Visibility / season of survey: Fair to good around site location but very poor overall for inventory area with dense grasses, forest duff, and timber cover

2.11 Other environmental factors pertaining to site: The site sits near the east edge of a North/South trending ridge top east of Greenleaf and Hollowbreast Creeks with steep [illegible] to the North and East.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM FORM

Form No. 3 - Assessment, Recording and Management Documentation

Site No. ____________________

3.1 Condition /Integrity : The sites condition is very good and integrity intact. Some indication of natural degradation through rock fall off cairn on east side of the feature.

3.2 Evaluation: Does this property meet National Register criteria for eligibility?

___X___ Yes ________ No

Evaluation Procedures / Justification: Recommended eligible for the NRHP under criteria (a) & (d) per 36 CFR 800 60.4. Although graves are not typically NRHP eligible this site has sacred attributes and traditional cultural values for the Northern Cheyenne. That is, a Northern Cheyenne Cultural Heritage Site.

3.3 Possible impacts to site: Although a number of cattle currently graze within the project area they have not impacted the site. Development of the Garfield Peak Wind Turbine Project consisting of 20 towers could adversely impact this site.

3.4 Recommendations :

Establish a minimum 200 feet buffer around site and employ on-site Tribal Monitor during all ground disturbing activities.

11/17/03

3.5 Site Located by: Gilbert Brady, Sr.

Date: October, 2003

3.6 Site recorded by: Michael S. Burney

Date: October 18 & 19, 2003

3.7 Site form update and revisions by: N/A

Date:

3.8 Federal and State Permit No.: N/A Northern Cheyenne Tribe, Lame Deer, Montana

3.9 Publication(s)/ Report(s) where site is described:

THE RESULTS OF CULTURAL RESOURCE INVESTIGATIONS UNDERTAKEN FOR THE GARFIELD PEAK WIND TURBINE PROJECT, NORTHERN CHEYENNE INDIAN RESERVATION, ROSEBUD COUNTY, MONTANA

By: Michael S. Burney [Assisted by Angela M. Scarlata]

3.10 Artifact Repository: No artifacts observed or collected.

3.11 Field notes/ maps/ photos repository:

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Also: Gilbert Brady, Sr., THPO, Northern Cheyenne Tribe, Lame Deer, MT (406) 477-6035

3.12 Photo and accession numbers: Garfield Peak CRM Color Roll #2, Photos 15-24; Garfield Peak CRM Color Roll #3, Photos 17-25.

************************************** FOR OFFICE USE **************************************

3.13 Management Data: Formal Determination of Eligibility:

__________ undetermined Date:__________

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________________ formally determined ineligible for NRHP Date: ____________

________________ formal consensus determination, eligible for NRHP Date: ________

________________ listed on NRHP Date: ______________

Updated Management Information: ______________________________ **Date:** ____________

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM FORM

Form No. 4 - Prehistoric Site Description

Site No. ________________

4.1 Site Dimensions: 16' 4" E/W x 4' N/S. Cairn is about 15" high at its highest point and five feet east/west by 4'6" north/south.

____________ estimated ____✓____ measured

4.2 Feature Descriptions:

The feature is composed of between 45-50 small to medium size rocks (e.g., 2" x 7", 3" x 7", 5" x 10", 5" x 13", 12" x 14", and 12" x 16") arranged on the ground's surface in a linear fashion approximately 16 feet four inches in length and four feet in width. The rock cairn at the east end of the feature is about five feet east/west by four feet six inches north/south. The cairn measures about 15 inches in height on the east side and seven inches on the west side. It appears the cairn could have been larger at one time observing the rock fall around the cairn's base. The feature appears to remain intact and in very good condition (Figures 17 - 20). A light green lichen covers most of the feature suggesting some antiquity (Figure 21). No prehistoric or historic cultural material was observed associated with this feature. The rocky and gravely soil appears shallow (i.e., less than 30cm) in and around the feature and it was not disturbed. Lichenometry may be employed to chronologically place this feature.

4.3 Artifact Descriptions/ Collections: No artifacts were observed or collected.

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4.4 Subsurface Testing: None undertaken.

4.5 Cultural / temporal classification: Native American. Chronological placement unknown. Lichenometry may be of some use. Estimate the site was constructed within past 100± years.

Assessment based on: Oral testimony provided by Gilbert Brady, Sr. Northern Cheyenne THPO, Lame Deer, MT.

4.6: Site function / interpretation: May be burial location of spiritual person with cairn located on east end and linear rock feature oriented east/west. Located on high point overlooking pine breaks to north and east.

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MONTANA CULTURAL RESOURCES INFORMATION SYSTEM FORM

Form No. 5 - Description of Historic Sites

Site No.________________

5.1 Property boundaries and justification: Rocks on Ground's Surface and Cairn at East End.

________estimated ____✓____measured

5.2 Physical description of buildings/ structures/ features; Dates of construction and major alterations; Contribution of building /structure to property significance:

Please see 4.2 Feature Description.

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5.3 Artifacts observed, collected: NO ARTIFACTS OBSERVED OR COLLECTED.

5.4 Subsurface Testing Methods and Results: NO SUBSURFACE TESTING UNDERTAKEN.

5.5 Historical information and context (footnote sources) :

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11/17/03

5.6 Sources, files, people consulted:

Several Northern Cheyenne tribal members were interviewed soliciting information regarding the past and present uses of the project area, including, Ray Brady, Sr. at the Shoulder Blade Senior Citizens Center, Lame Deer, Gilbert Brady, Sr., Steven Brady, LeForc (Lee) Lone Bear, and Mike Running Wolf. Future potential candidates for information were Martin Kills Night and Bisco Spotted Wolf at the Heritage Living Center, Ashland. These interviews document the use of the project area, primarily, for good hunting (e.g., deer and black bear). The Greenleaf Creek area to the west is known for its piercing and Native American Church activities and burials (Burney 2003:1,558-1,559).

Additional Northern Cheyenne tribal members providing their expertise on the Early Bird Fire were Bill Tallbull, Harry Littlebird, Dill Madrigal, Charles Brady, Steve Brady, Martin Killsknife, and Francis Killsknife (Keller 1989:3; Moore 1988:3). George Elkshoulder, Sr. and Bill Tallbull were interviewed for the Tongue River Dam Project (Kooistra-Manning 1992); and at least 24 Northern Cheyenne tribal consultants, in addition to Arapaho, Arikara, Crow, and Sioux, were utilized in preparation for possible coal development near Colstrip and Decker, Montana (Kooistra-Manning et al. 1993:15).

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM FORM

Form No. 6 - Site Sketch Map Please refer to next page.

DRAFT

Michael S. Burney
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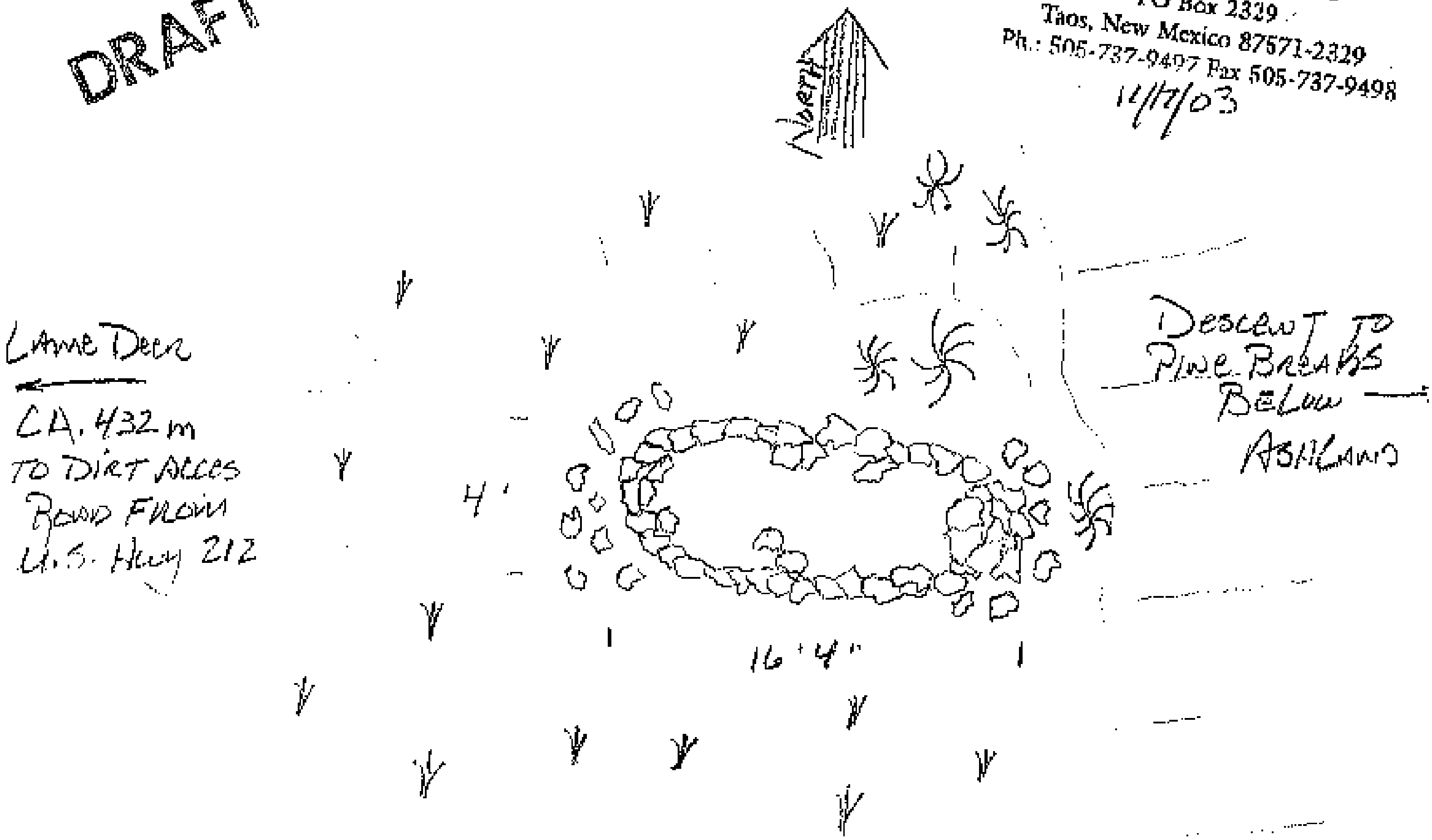
11/17/03

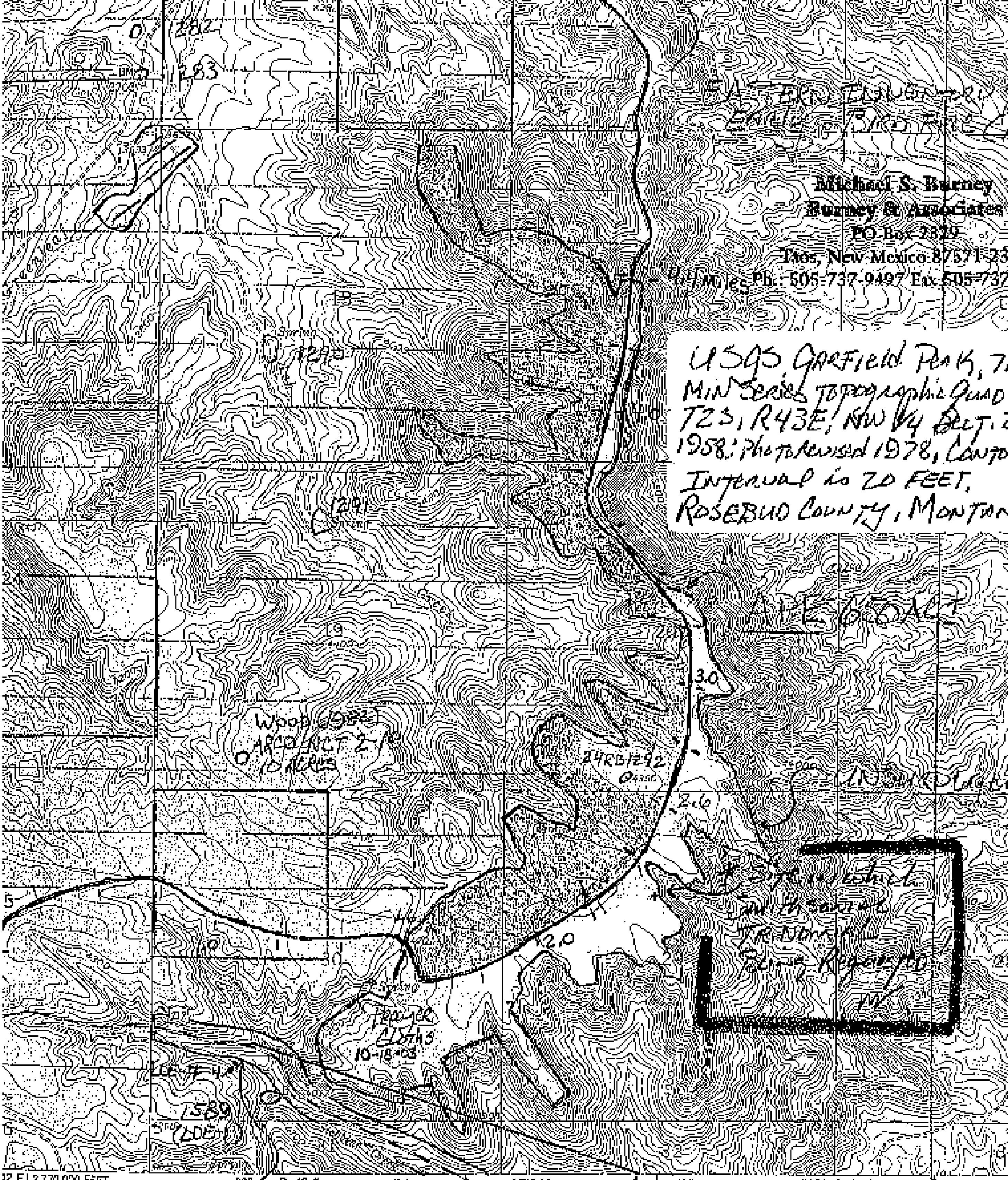


Legend Ponderosa
Rock
mixed upland grasses

Scale Not To Scale.

Map Drawn By: M. S. Burney

Date 11-10-03



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published by the Geological Survey
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NATIONAL GEODETIC VERTICAL DATUM OF 19

DRAFT

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY

APPENDIX C

Ordinance No. 18(83): An Ordinance of the Northern Cheyenne Tribal Council Establishing the Protection [of] Cultural Resources of the Northern Cheyenne Tribe (Caywood et al. [Appendix C])

TRIBAL COUNCIL OF THE NORTHERN CHEYENNE
NORTHERN CHEYENNE RESERVATION
LAME DEER, MONTANA

ORDINANCE NO: 18(83)

[Type version adapted from the original, November 17, 2003. A.M.S.]

AN ORDINANCE OF THE NNORTHERN CHEYENNE TRIBAL COUNCIL ESTABLISHING THE PROTECTION OF CULTURAL RESOURCES OF THE NORTHERN CHEYENNE TRIBE.

SECTION 1. TITLE.

This Ordinance shall be known as the Northern Cheyenne Cultural Resources Protection Ordinance.

SECTION 2.

2.1 Under the Federal Archaeological Resources Protection Act of 1979, 16 U.S.C. 470cc(c), federal officials must notify the Tribe whenever a permit application is being considered which might adversely affect any religious or cultural off-reservation site.

2.2 Under the Federal Archaeological Resources Protection Act of 1979, 16 U.S.C. 470cc(g) (2), no federal permit for excavation or removal of any archaeological resources located within the Northern Cheyenne Indian Reservation cannot be issued without the consent of the Tribe.

2.3 There can be no exchange or disposition of archaeological resources from the Northern Cheyenne Indian Reservation without the consent of the tribe pursuant to the Federal Archaeological Resources Protection Act of 1979, 16 U.S.C. 470 dd.

2.4 The National Historic Preservation Act, 16 U.S.C. S. 470 et sea., declares a national policy to work in partnership with Indian tribal governments to protect cultural resources and provides a mechanism by which tribal governments may carry out the provisions of that Act, 16 U.S.C. S. 470-1; 470a (c).

2.5 The Northern Cheyenne Tribal Council finds an orderly procedure must be established for considering and acting upon such notifications, request and reviews functions.

2.6 The National Historic Preservation Act does not confer upon state governments the power to nominate sites within Indian reservations to the National Register.

2.7 The Northern Cheyenne Tribal Council finds that the power to make such nominations to the National Register must be exercised by the Tribe, and that an effective procedure must be established to carry out this activity.

2.8 The Northern Cheyenne Tribal Council hereby declares its intent to preempt the field of nomination to the National Register of archaeological and historical sites located within the Northern Cheyenne Indian Reservation.

SECTION 3. DEFINITIONS.

As used in this ordinance the following words and phrased shall have the designated meaning, unless a different meaning is expressly provided for, or from the context a different meaning is clearly indicated.

3.1 "Board" means the Northern Cheyenne Cultural Resources Board.

3.2 "Department" means the Northern Cheyenne Cultural Department or the Northern Cheyenne Archaeology and History Program.

3.3 "Archaeological resources" means any remains of past human life or activities which are of archaeological or historic interest. Such material remains shall include, but not be limited to: pottery, basketry, bottles, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, talus slide depressions, cairns, graves, human skeletal remains, or any portion or piece of any foregoing items. Such material or remains may also include non-fossilized or fossilized Paleontological specimens, or any portion or piece thereof, whether or not found in an archaeological context. No item shall be treated as an archaeological or historic resource unless such an item is at least fifty years of age.

3.4 "Effect" means any condition of the undertaking that causes or may cause any change, beneficial or adverse, in the quality of the historical, architectural, archaeological, or cultural characteristics that qualify the property to meet the criteria of the Northern Cheyenne Register or the National Register. An effect occurs when an undertaking changes the integrity of location, design, setting, materials, workmanship, feeling or association of the property that contributes to its significance in accordance with the Northern Cheyenne Register or the National Register criteria. An effect may be direct or indirect. Direct effects are caused by the undertaking and occur at the same time and place. Indirect effects include those caused by the undertaking that are later in time or farther removed in distance, but are still reasonably foreseeable. Such effects may include changes in the pattern of land use, population density or growth rate that may affect properties of historical, architectural, archaeological, or cultural significance.

3.5 "Historical Property" means any prehistoric or historic district, site, building, structure, or object significant in tribal history, architecture, archaeology, culture or religion. The term includes all artifacts, records, remains, and reburial sites designated by the Northern Cheyenne Tribe.

3.6 "Northern Cheyenne Register or Historic and Archaeological Properties" or "Northern Cheyenne Register" means the tribal register of districts, sites, buildings, structures and objects significant in tribal history, architecture, archaeology, or culture, as determined by the Board and maintained by the Department.

3.7 "National Register" means the National Register of Historic Places.

3.8 "Reservation" means the Northern Cheyenne Indian Reservation, including all land within the exterior boundaries thereof.

3.9 "Undertaking" means any governmental, governmentally assisted or licensed action, activity, or program or the approval, action, assistance, or support of any non-governmental action, activity, or program. Undertakings include new and continuing projects and program activities that are: (1) directly undertaking by governmental agencies; (2) supported in whole or in part through governmental contracts, grants, loans, subsidies, loan guarantees, or other forms of direct and indirect funding assistance; (3) carried out pursuant to a governmental lease, permit, license, certificate, approval, or other form of entitlement or permission; or (4) proposed by a Federal State or other governmental agency for legislative authorization or appropriation. Site-specific undertakings affect areas and properties that are capable of being identified at the time of approval by the governmental agency. Non-site specific undertakings affect areas and properties that are capable of being identified at the time of approval by the governmental agency. Non-site specific undertakings have effects that can be anticipated on the Northern Cheyenne Register or National Register and eligible properties but cannot be identified in terms of specific geographical areas or properties at the time of approval. Non-site specific undertakings include Federal or State approval of Federal or State plans pursuant to legislation, development of comprehensive or area wide plans, agency recommendations for legislation and the establishment or modification of regulations and planning guidelines.

3.10 "ARPA" means the Archaeological Resources Protection Act of 1979, 16 U.S.C. S 470aa et seq.

3.11 "NHPA" means the National Historic Preservation Act of 1966, 16 U.S.C. S 470 et seq.

SECTION 4. "ESTABLISHMENT OF THE NORTHERN CHEYENNE CULTURAL RESOURCES BOARD."

4.1 Membership. The Board shall be composed of the Director of the Cultural Department, the Chairperson of the planning committee, the Director of the Natural Resources Department, a tribal staff attorney designated by the Executive Director and the Tribal Archaeologists.

4.2 Officers. The Northern Cheyenne Cultural Resources Board shall name one of the Board members as Chairman of the Board. The Board shall elect from among its members a Vice-Chairman and a Secretary. In the absence of the Chairman, the Vice-Chairman shall preside, and in the absence of both the Chairman and Vice-Chairman, the Secretary shall preside.

4.3 Vacancies-quorum. A vacancy on the Board shall not affect its powers. Three (3) members of the Board shall constitute a quorum.

4.4 Meetings. Meetings of the Board shall be held at regular monthly intervals. Emergency meetings may be held upon twelve (12) hours actual notice, and business may be transacted provided that not less than a majority of the full Board concurs in the proposed action.

4.5 Principle Office. The Principal office of the Board shall be at Lame Deer, Montana.

4.6 Oath of Office. Each member of the Board shall take the following oath before beginning his duties:

> "I promise to faithfully execute all provisions of the Northern Cheyenne Cultural Resources Protection Ordinance and any regulations promulgated in furtherance thereof, and to be bound by the Northern Cheyenne Tribal Law and Order Code, the jurisdiction of the Tribal Court and the Tribe and to otherwise faithfully perform my duties as outlined by the law."

SECTION 5. POWERS AND DUTIES OF THE BOARD.

5.1 Undertakings Off-Reservation. The Board is empowered in the review or permitting process where a federal or state officer has or should notify the tribe pursuant to ARPA, 16 U.S.C. S 470cc(c), the NHPA, or the American Indian Religious Freedom Act, 42 U.S.C. S 1966, that an undertaking is proposed or an application is being considered for a permit which might adversely affect any off-reservation archaeological resource or historic property.

5.2 Undertaking On-Reservation. The Board is authorized and directed to review any proposed undertaking that might adversely affect any on-reservation archaeological resource or historic property included on or eligible for inclusion on the Northern Cheyenne Register or the National Register. The Board is also empowered to consider requests for consent to on-reservation excavation or removal of archaeological resources and an initial application or as referred by officials acting pursuant to ARPA 16 U.S.C. S 470cc (g) (2), the NHPA, or the American Indian Religious Freedom Act.

5.3 Disposition of Archaeological Resources. The Board is empowered to consider requests for exchanges or dispositions of archaeological resources, see 16 U.S.C. S. 470dd, and to determine what conditions, if any, should be attached if consent I given.

5.4 Governmental Rulemaking. As directed by the Northern Cheyenne Tribal Council, the Board is empowered to initiate, comment and participate in federal, state or other governmental rulemaking process concerning matters pertaining to its expertise. See 16 U.S.C. S 470s; 470ii.

5.5 Annual Reports. The Board shall prepare a comprehensive annual report for submission to the President of the Northern Cheyenne Tribe, which shall report on the activities carried out under the provision of this Ordinance, and shall make such recommendations as the Board deems appropriate as to changes or improvements needed in the provisions of this Ordinance. Such report shall include a summary of actions, permits, and nominations for the Northern Cheyenne Register and the National Register.

5.6 Records. The Board shall maintain records of its proceedings.

5.7 Cooperation with Agencies and Organizations. The Board is authorized and directed to consult and cooperate, to the extent feasible, with other tribal and non-tribal government departments and agencies, and with private organizations involved in historic and archaeological protection activities, including the National Trust for Historic Preservation, the International Centre for the Study of Preservation and Restoration of Cultural Property, museums and organizations of professionals. Cooperation activities shall include providing assistance to other agencies and organizations, and coordinating the planning and conduct of historic preservation programs.

5.8 Comprehensive Plan. The Board is authorized and directed to review the comprehensive reservation wide archaeological and historic preservation plan prepared by the Department. The Board id further authorized to approve the plan and submit it to the President of the Northern Cheyenne Tribe or to direct the Department to change the plan until it meets with his approval.

5.9 Northern Cheyenne Register. The Board is authorized and directed to review nominations of properties to the Northern Cheyenne Register submitted by the Department and to approve those that qualify as significant in tribal history, architecture, archaeology or culture.

5.10 National Register. The Board is authorized and directed to review forms or reports proposing to nominate properties to the National Register, assure adequate public participation in the nomination process, and to recommend to the President of the Northern Cheyenne Tribe those properties it deems appropriate for nomination for listing on the National Register.

5.11 Education. The Board is authorized to develop and operate a program of information and education, for tribal members and or the general public, concerning cultural resources and protection of properties listed on the Northern Cheyenne Register or the National Register.

SECTION 6. POWERS AND DUTIES OF THE DEPARTMENT.

The Northern Cheyenne Cultural Department shall have the following duties and powers, which shall be in addition to such powers and duties proved by prior resolutions of the Northern Cheyenne Tribal Council as are not inconsistent with this Ordinance.

6.1 Nomination to the Northern Cheyenne Register. The Department is directed to nominate to the Board all sites, buildings, districts and objects within the Northern Cheyenne Indian Reservation that appear to qualify for listing on the Northern Cheyenne Register. The Department shall, in order to compile the information needed to make the nominations;

a. Conduct a comprehensive survey of all historic properties on the reservation pursuant to Section 13 of this Ordinance.

b. Compile an inventory that includes basic information about the location and history of each such property.

c. Evaluate each property surveyed with regard to its historic, architectural, archaeological, anthropological, religious and cultural significance.

d. Based on the evaluation described in Section 6.1 (c), place each surveyed property into one of four categories of significance.

e. Recommend modification or limitations for each historic property according to its category of significance.

6.2 Nominations to National Register. The Department shall prepare nomination forms for those properties that appear to be eligible for placement on the National Register, and present them to the Board.

6.3 Assistance to the Board. The Department shall assist and consult with the President of the Northern Cheyenne Tribe and the Board on issues relating to the conservation of historic and archaeological resources and on other matters within the scope of their duties.

6.4 Records – Salvage. The Department shall initiate measures to ensure, at a minimum, that where a property listed on the Northern Cheyenne Register is to be substantially altered or affected, timely steps be taken to make or have made records including measured drawings, photographs and maps of the property, and that a copy of such records then be deposited in the Tribal archives for future use and reference. The Department shall use its best efforts to assure adequate surveying and testing, to salvage, analysis and curation of artifacts, where such is feasible.

SECTION 17. REVIEW BY TRIBAL COURT.

The Director, the Tribal Prosecutor, or any applicant or permittee aggrieved by any decision of the Board may petition the tribal court for a hearing to review such decision. A written notice of appeal must be filed with the tribal court within twenty (20) days of such adverse decision; provided however, that such limitation period shall not apply to bar the petition of the tribal prosecutor or the direct of the department where such would be contrary to the Tribal interest in preservation of archaeological resources or historic properties.

SECTION 18. SEVERABILITY.

If any provision of this Ordinance or its application to any person or circumstance is held to be invalid, the remainder of this Ordinance or the application of the provision to other persons or circumstance shall not be affected.

PASSED, ADOPTED, AND APPROVED by the Northern Cheyenne Tribal Council by 12 votes for passage and adoption and 0 votes against passage and adoption this 20th day June, 1983.

Allen Rowland, President
Northern Cheyenne Tribal Council

ATTEST:

Evelyn Gardner, Secretary
Northern Cheyenne Tribal Council

APPENDIX D

Northern Cheyenne Cultural Resource Inventory Site Record
(Caywood et al. [Appendix C])

NORTHERN CHEYENNE

CULTURAL RESOURCE INVENTORY RECORD FORM

NAME OF RECORDER:______________________________

DATE:______________________________

SITE NUMBER:______________________________

SITE LOCATION: T________, R________, ______ ¼ of the ______ ¼ , Sec.______

PHOTO NUMBER:______________________________

SITE DESCRIPTION

LANDFORM TYPE:________________VEGETATIVE TYPE:________________

ASPECT:____________________DISTANCE TO WATER:______________

NARRATIVE DESCRIPTION OF SITE LOCATION:______________________

____

____

____

____

(Sketch of site on backside of page)

SITE ENVIRONMENTAL SETTING:______________________________

____

____

____

SITE FUNCTION:______________________________

____

____

____

CULTURAL AFFILIATION/HISTORICAL THEME:______________________

____

____

CHRONOLOGICAL PLACEMENT ____________________

SITE SIZE AND DEPTH: ____________________

SITE CONDITION: ____________________

ARTIFACTS:

<u>KIND</u>	<u>NUMBER</u>	<u>CONSTRUCTION MATERIAL</u>

Appendix C

Environmental Assessment

Northern Cheyenne Tribe
North Cheyenne Reservation

Draft Environmental Assessment

Northern Cheyenne Wind Power Project

Chris Bergen
Distributed Generation Systems, Inc. (DISGEN)
June 2005

Chapter 1. Purpose of and Need for Action

Who, What, Where, When

The Northern Cheyenne Indian Tribe (NCT) in southeastern Montana (USA) wants to install a 30 Megawatt (MW) wind power project for tribal trust land on the Garfield Peak ridgeline on the northeastern area of their reservation. Installation is planned for year 2006.

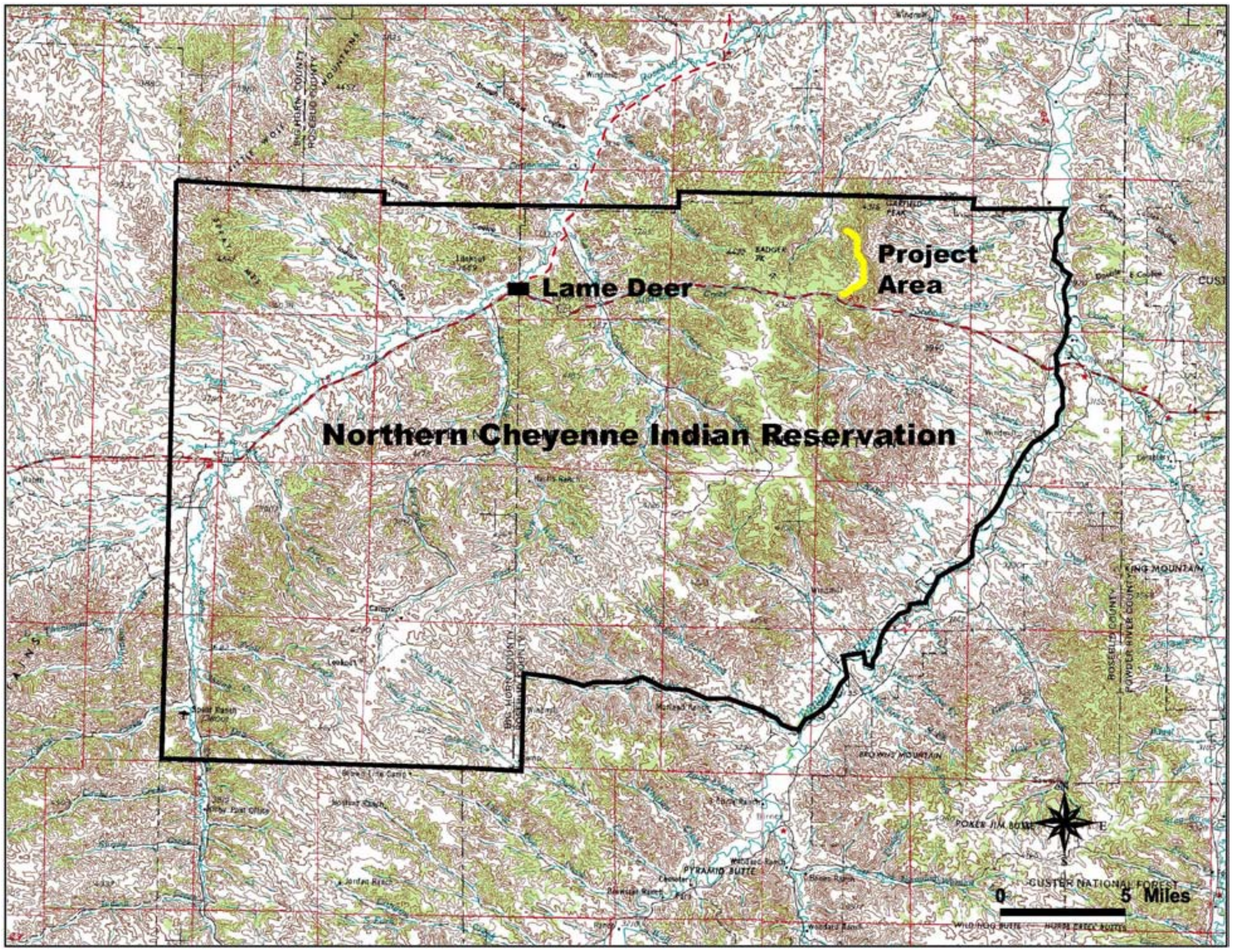

Figure 1. Project Area Location within the Northern Cheyenne Reservation

Need
The Northern Cheyenne Tribe needs to improve the economic conditions on the reservation and believes that this can be accomplished by developing the renewable energy resources on their reservation.

Purpose
The Northern Cheyenne propose to install a 30 Megawatt (MW) wind project on tribal trust land to create revenue and economic development opportunities for the tribe as a whole. The development of renewable energy projects is consistent with the tribe's Comprehensive Economic Development Strategy adopted in 2001 and revised in 2005.

Decision(s) of Lead and Cooperating Agencies
The Bureau of Indian Affairs (BIA) has trust responsibility on actions related to Tribal Trust Land. The proposed project is located entirely on Tribal Trust Land. The BIA will issue a lease for this land to the project owner, whether the owner is tribal, a tribal entity, or private individual. As a result the BIA is the lead agency for the proposed action. The Northern Cheyenne Tribal Council, Economic Development Authority (EDA), Tribal Historic

Preservation Office (THPO), NCT Natural Resources Department, and the U.S. Fish and Wildlife Service (FWS) are all participating consulting agencies.

The BIA determination will either be a decision document with a Finding of No Significant Impact (FONSI), or request for further review through and Environmental Impact Statement (EIS). The BIA determination would result in the future approval of a land use lease for the proposed action contingent on management and mitigation constraints indicated in this EA.

The Tribal Council and EDA, as representatives of the members of the Northern Cheyenne Tribe, will determine whether this project is in the best interest of the tribe as a whole.

The FWS has enforcement responsibilities regarding the ESA, MBTA, BPA, and will make recommendations to the BIA regarding the significance of potential impacts to wildlife.

The THPO is responsible for compliance with Section 106 of the NHPA, and advises the Tribal Council regarding the potential cultural and ethnographic impacts of the proposed action.

The Tribal Natural Resources Department reviews and administers the Water and Air quality compliance requirements through the United States Environmental Protection Agency (EPA).

Issues Uncovered During Scoping and Public Involvement

A public scoping meeting was held on November 21, 2003 followed by a two-week public comment period. Several community meetings were held in the Lame Deer and Busby districts to update the tribe on the status of the projects development. Comments were solicited and many were handwritten on the 'Public Comment' sheets in appendix **X.** Disgen regularly presented updates the Tribal Council and EDA committee as the project progressed. Key stakeholders were specifically interviewed including forestry, public safety, TERO, Chief Dull Knife College. In addition, several Elders were interviewed during the ethnographic overview as part of the cultural resource inventory. The results of the cultural resource inventory can be viewed in appendix **X.**

Agency Scoping

Disgen, Western EcoSystem Technology, Inc. (West) and the BIA consulted the FWS on several occasions in 2002-2003 to discuss potential wildlife concerns and outline a Baseline Study Protocol for pre-construction wildlife monitoring.

Disgen and Archaeologist Michael Burney consulted with the THPO BIA, and State Historic Preservation Office (SHPO) during the Class I File and Literature Search and prior to and after the Class III Inventory.

The scoping identified potential concerns related to avian and wildlife impact, cultural resource, ethnographic, and socioeconomic concerns. A summary of the comments received throughout the scoping process in appendix "__".

Tribal, Federal, State, Permits, Licenses, and Other Consultation Requirements

Bureau of Indian Affairs (BIA) Landuse Lease

Tribal Employment Rights Office (TERO) Licenses
National Environmental Policy Act (NEPA) Finding of No Significant Impact (FONSI)
National Historic Preservation Act (NHPA) Section 106 Consultation
Archaeological Resource Protection Act (ARPA) Compliance
National Ambient Air Quality Standards (NAAQS) Compliance
National Electric Safety Code (NESC) Compliance
National Electric Code (NEC) Compliance
Endangered Species Act (ESA) Section 7 Consultation
Migratory Bird Treaty Act (MBTA) Compliance
Bald Eagle Protection Act (BPA) Compliance
Federal Aviation Administrations (FAA) Lighting Regulation Compliance
Noise Control Act of 1972

Table 1. Entities Responsible for acquiring permits, consultation, and compliance.

Permit/License/Consultation/Compliance	Responsible Entity
BIA Land Use Lease	Project Owner (Tribe, tribal entity, or private entity)
TERO License	Balance of Plant (BOP) Contractor
NEPA FONSI	Developer (NCT through Disgen)
Sec 106 of NHPA Compliance	Developer (NCT through Disgen)
ARPA Compliance	Developer (NCT through Disgen)
Determination of need for EPA PSD Permit	Developer (NCT through Disgen) or BOP contractor
NAAQS Compliance	BOP contractor/ Developer
NESC Compliance	BOP contractor/ Developer
NEC Compliance	BOP contractor
Section 7 ESA Consultation	Developer (NCT through Disgen)
MTBA Consultation	Developer (NCT through Disgen)
BPA Compliance	Developer (NCT through Disgen)
FAA Lighting Compliance	Developer (NCT through Disgen)

Chapter 2. Alternatives Including the Proposed Action

Introduction

This chapter describes two alternatives: Alternative A: No Action Alternative, and Alternative B: Proposed action. Each alternative is described in terms of their potential environmental impacts and their achievement of the purpose and need.

Proposed Location

The proposed location is in the southeastern corner of the State of Montana in southern Rosebud County inside the Northern Cheyenne Indian Reservation. The site is located near the northern boundary and the eastern corner of the Reservation (Figure X). The nearest major highway access is US HW 212, which runs east-west one quarter mile south of the first turbine. The access point is from HW 212 approximately 9 miles east of Lame Deer, MT and 12 miles west of Ashland, MT.

Turbines are sited on the Garfield Peak ridgeline, which encompasses Section 25 of Township 2 South, Range 42 East, and Sections 30, 29, 20, 17, and 18 of Township 2 S, Range 43 East. Garfield Peak is a prominent ridgeline oriented north south, with an average site elevation of 4310 feet above mean sea level. For reference the elevation of Lame Deer is 3354 feet and Ashland is 2930 feet. The highest point on the reservation is Badger Peak approximately 5 miles west at 4422 feet.

A maintained unpaved road (hereafter referred to at Garfield Peak road), approximately 12 feet in width traverses the Garfield Peak ridgeline through the center of the proposed project area. Access onto this road is from highway 212 on top of the Garfield Peak Pass near mile marker #. The primary project area route would follow this existing road. Turbines would be located on both sides of Garfield Peak road.

The site is located entirely on designated Tribal Trust land—owned by the tribe as an entity and overseen by the Bureau of Indian Affairs (BIA). Tracks of non-trust tribal acquisition land surround and allotted land the project area (Figure X).

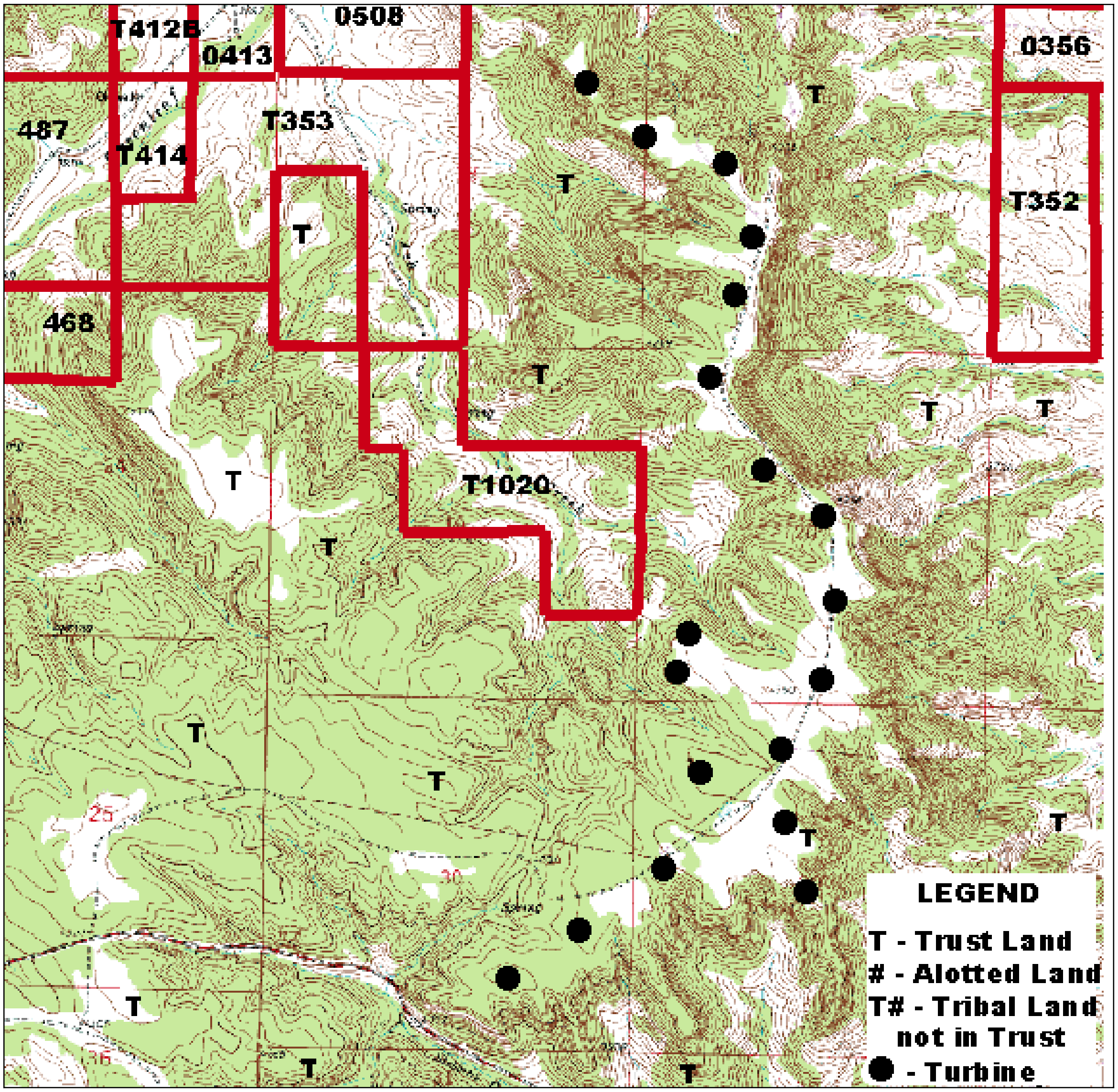

Figure 2. Land use designations for project and surrounding areas

The project was sited on tribal trust land so that the tribe as a whole could manage the development and realize its maximum economic benefits.

An existing 69kV transmission line, owned by the Tongue River Electric Cooperative (TRECO) traverses the site through the northern half of Sections 30 and 29. The future point of interconnection would be located immediately adjacent to this line in either section.

A 50-meter met tower, installed on November 11, 2003, is currently monitoring in the southeast quarter of section 17, and a 20-meter met tower, installed on February 9, 2003, is located on the southern central border of section 20.

Existing Condition and Use of Land

The proposed project area consists of savanna grassland and ponderosa pine forest. A fire known as the Early Bird Fire affected much of this area during the week of June 5, 1988. Approximately 68 percent of the proposed project area is burned ponderosa pine forest habitat. Much of this land was salvage-logged after the fire and the land was left to recover. Snags, stumps, downed timber, and smaller woody vegetation now occupy the burned area. Land in the project area is currently used for cattle grazing, and for hunting. Approximately 200 head of cattle graze the site between April and October (Arnold Larfanier pers. comm.) The nearest manmade structure is unoccupied and is approximately one mile west of the northern end of the project area. No mining or oil and gas wells exist within the project area.

The tribal Air Quality department operates a monitoring station in the northeast quarter of section 18 (T2N R42E) (Figure X). The station is in place to monitor the air quality downwind of the Colstrip coal fired power plant that is approximately 17 miles northwest of the site. The station has been collecting air quality data since the early 1980s. Data on wind speed and direction is being correlated with data monitored for the proposed wind project to support turbine output projections.

Several multicolored prayer cloths of potential cultural significance to the NCT are in the southern half of section 30 (T2S R43E) in the headwaters and spring areas above Stebbins Creek (Figure X). These sites are often referred to as vision questing areas, and are commonly near hot and cold springs because of their spiritual significance (Burney, 2003). Prayer cloths and springs are culturally significant to the NCT and have designated setback requirements of 50 feet (Gilbert Brady pers. com).

Two temporary meteteorological towers "met towers" are monitoring data wind data (Figure #). The towers are metallic tubular guyed structures mounted with anemometers and wind vanes. One 20-meter tower loaned to the tribe by the National Renewable Energy Lab (NREL) currently gathers wind speed and direction data at 20-meters. One 50-meter tower that was installed under a U.S. Department of Energy (DOE) Feasibility Study currently gathers data on wind speed and direction at 50, 40, and 30-meter elevations.

Figure 3. 50-meter met tower in project area

Alternative A: No Action

Under a No Action Alternative the NCT would discontinue development of a wind power project on the Garfield Peak ridgeline, and the ridgeline would remain in its current condition with its current land use practices. The 50-meter met tower installed during the U.S. Department of Energy (DOE)

Feasibility Study would be removed and returned to the DOE. Similarly, a 20-meter met tower on loan from the NREL would likely also be removed and returned.

DOE Feasibility Study Award

In 2002 the DOE awarded the NCT a Feasibility Study grant to determine the feasibility of wind, solar, and biomass energy developments within the reservation. The results of the feasibility study determined that a wind project was the most economic and immediately developable resource on the reservation.

DOE Development Grant Award

In 2003 the NCT was awarded a follow-up DOE Development Grant to fund the necessary developments for a 30 MW wind facility for the Garfield Peak ridgeline. The scope of DOE Development Grant included the actions related to this EA document including the necessary baseline environmental, cultural, and economic studies.

Future Relevant Actions

Currently the NCT proposes to develop only 30 MW of wind energy on its reservation. In the future the NCT could choose to expand the project after construction hereafter referred to as “expansion”, or to “repower” the project with more modern turbines once the normal lifespan for the original turbine technology has ended. The Tribe may also consider “decommissioning” the turbines (removing them) after their projected lifespan is over.

In the future the NCT may also choose to pursue other forms of energy development, including but not limited to solar, biomass, pumped storage hydro. These actions are not currently analyzed as part of the Proposed Action as they are in very early stages of analysis.

Alternative B: Proposed Action

Wind Turbines

The project size is planned to be 30 MWs. A specific wind turbine model has not selected as of the writing of this document. The proposed site plan is intended as an example, and was designed using a 1.5MW turbine with an approximate 65-meter (213 foot) tower and 70-meter (230 foot) rotor diameter, making the maximum turbine height from base to blade tip of 100 meters (328 feet). However, the current trend among turbine manufactures is to increase the rotor swept area and turbine height to maximize the energy output per machine, and to be able to utilize lower wind speeds. As a result it is conceivable that the project would utilize larger turbines when the project is ready for construction. Therefore this report analyses a minimum and maximum turbine height to cover a potential range of conceivable turbine sizes for the NCT wind project. The minimum turbine size would be a one Megawatt turbine with a 60-meter (197 foot) tower and a 61-meter (200 foot) diameter rotor, creating a total height of 91 meters (297 feet) (Mistubishi 2005). The maximum size is a hypothetical turbine that uses a 100-meter (328 foot) tower with a 100-meter rotor diameter, giving a total height of 150 meters (492 feet).

Using the 1 MW turbine the site would require 30 wind turbines for a 30 MW project size. This is the maximum number of possible turbines for the site. The numbers of turbines required for the 30 MW site decreases as larger turbines are used. Currently the largest commercially available onshore turbine is three Megawatts, which would require 10 turbines to reach a 30 MW project size. It is conceivable, though unlikely, that the project could utilize a turbine greater than three megawatts in the future as turbine designs advance.

Commercially available wind turbines designs have eliminated most avian perches. Turbines are mounted on tubular rather than lattice type towers, so potential perches were eliminated from the nacelles and rotor areas.

The rotor diameter of the one Megawatt turbine would be as small as 61 meter (200 foot) with a fixed operational speed of 21 rpm (Mitsubishi 2005). Rotor diameters on currently available 3MW turbines are 90 meters with an operational rotating speed range of 9-19 rpm (Vestas 2005).

Turbine spacing

Wind turbines are spaced 2-3 rotor diameters apart when perpendicular to the prevailing wind direction, and 8-10 rotor diameters when parallel to the prevailing wind direction. Using the 1.5 MW turbines on the site plan the spacing would be 459-689 feet crosswind, and 1837-2297 feet upwind. Using a larger three Megawatt machine, spacing would range from 590-866 feet crosswind, and 2362-2952 feet upwind. Other factors such as topography and setback requirements influence the exact placement of each turbine. Figure # is shows the turbine placements for the 1.5 MW machine.

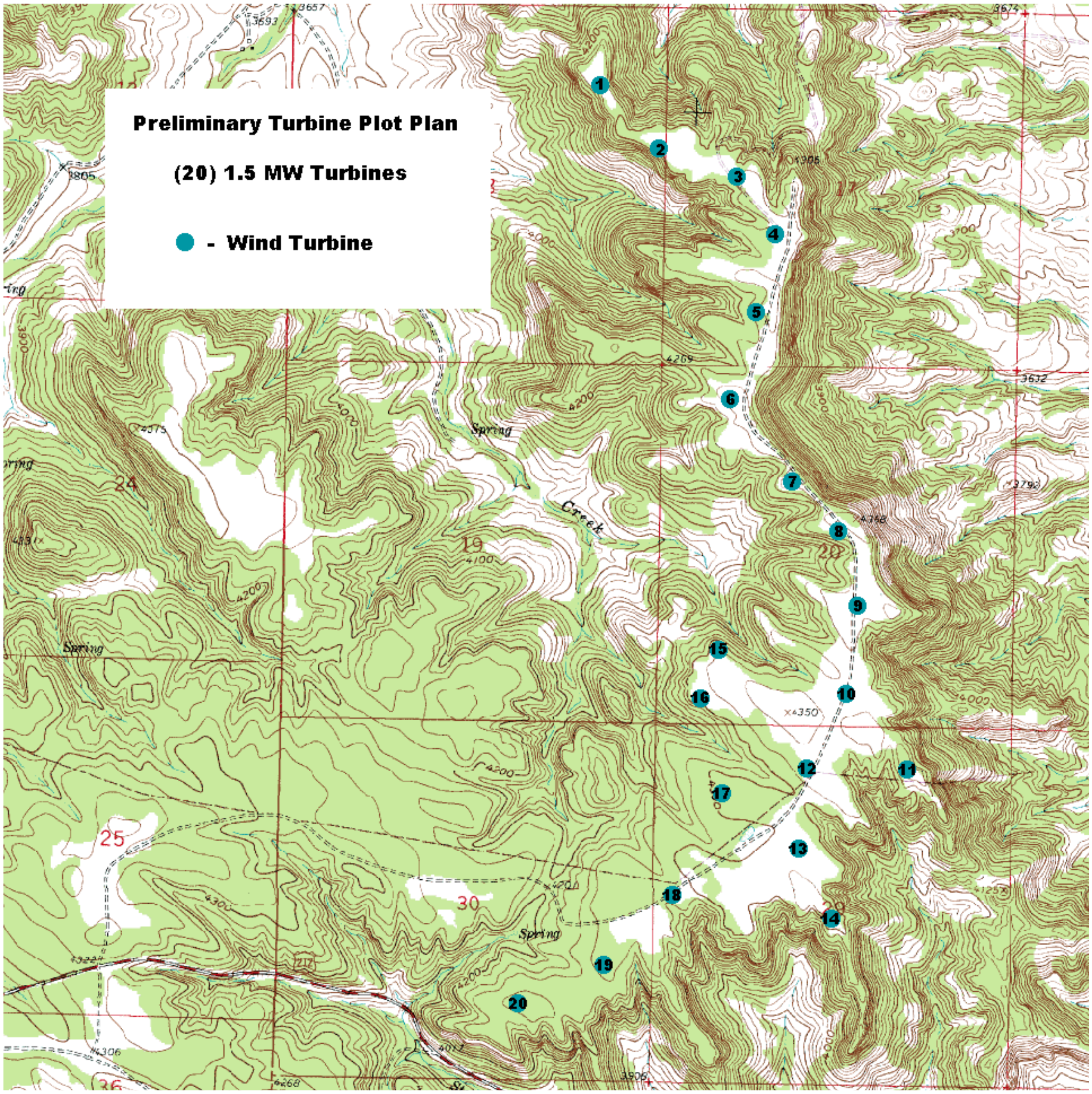

Figure 4. Representative layout assuming (20) 1.5MW turbines

Foundations
Two general turbine foundations exist: a spread footing design and a pier design. The type of foundation used depends on the determinations of a geotechnical study. The spread footing design involves a square or octagonal concrete foundation approximately 50 feet by 50 feet with a depth of approximately three to six feet. The second design, known as the pier design, involves drilling a cylindrical hole no deeper than 40 feet with a width being the diameter of the base of the turbine at 10-17 feet. The center of this foundation would be filled with soil. Foundations would not be visible, as they would be buried after construction.

A temporary concrete batching plant may likely be required due to the remoteness of the site to existing batching facilities. Concrete aggregate and sand would also likely be transported to the site. The expected size of such a plant would be 2-5 acres. Surface vegetation clearing of those acres would be required. The batching plant and all associated materials would be entirely removed after foundation construction is complete and the soils would be reclaimed and revegetated with native vegetation.

Met towers

The two existing met towers would be removed prior to construction, and would be replaced by two permanent met towers. The towers would be located on the northern-most and southern-most ends of the turbine string along Garfield Peak. The permanent met tower heights would be the hub height of the final turbine selected for the site. Currently hub heights range from 60-100 meters (197-328 feet) in height. The towers would be self-supporting structures, would not require guy wires, and would use either a tubular or lattice design. Since both met towers are located on the ends of a turbine string, lighting would be required per specifications of the Federal Aviation Administration (FAA). The regional FAA office covering Montana as of winter 2004-2005 currently requires a red and white medium intensity lighting system for structures within a wind power project.

Roads

An existing maintained unpaved road traverses a majority of the proposed Garfield Peak ridgeline. The width of the road is approximately 12 feet. During construction the road would require modification to accommodate the large delivery vehicles. Gravel or riverbed stone would be added to the surface to stabilize the road for heavy vehicle traffic. The width of the road would be extended to 35 feet during construction and reclaimed to 15feet after construction. All topsoil would be removed and stored separately for reclamation. Any inclines greater than 14 percent would require modification to accommodate the "low boy" trailers used during construction activities. Some grading may also be required to remove sharp changes in incline to allow clearance for long transport trucks. Figure __ notes three areas on Garfield Peak road were road modification to reduce slope would be required.

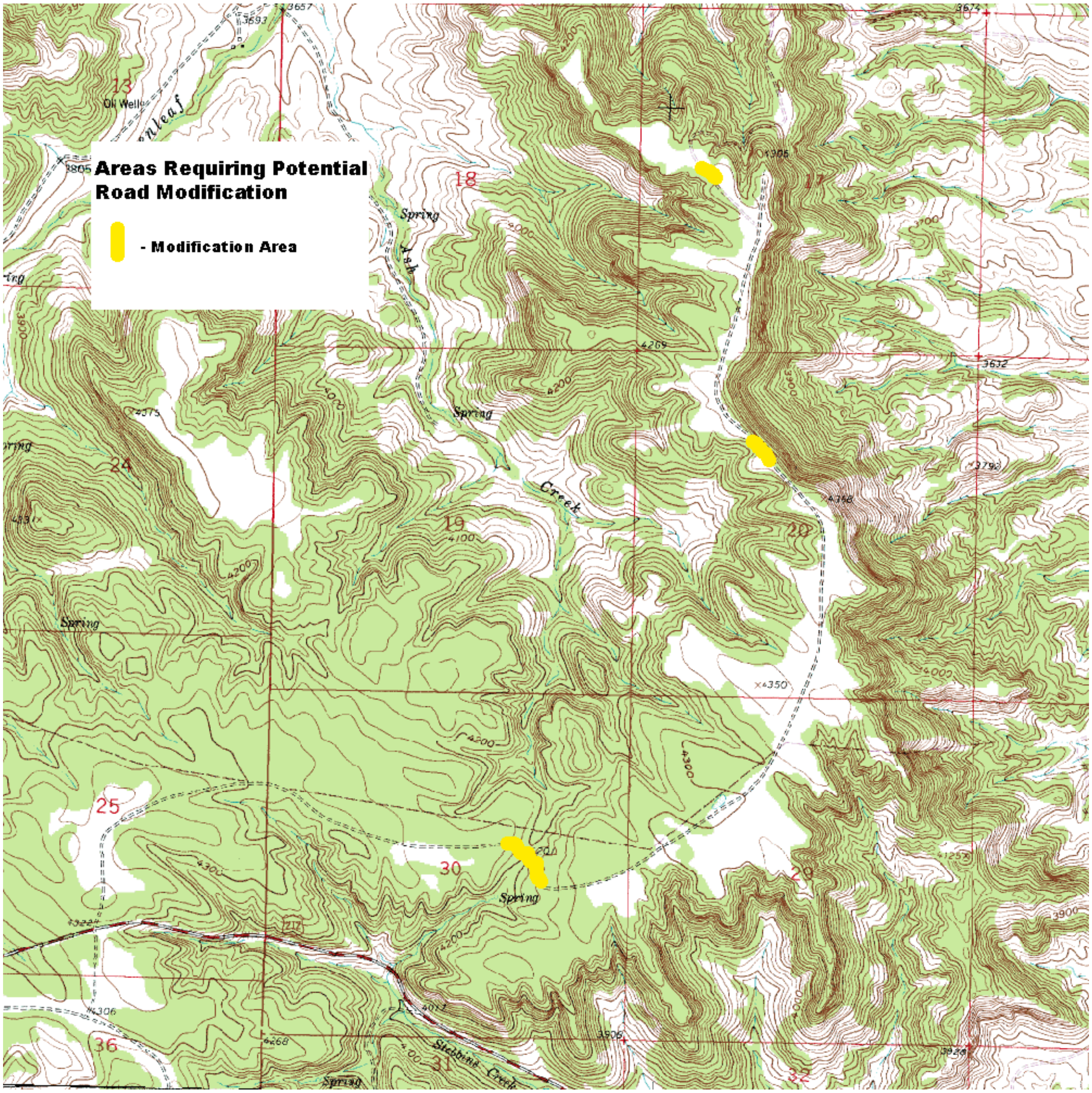

Figure 5. Areas on Garfield Peak Road likely requiring modification to reduce steepness of slope

Service Roads

Service roads to individual turbines would spur from the existing Garfield Peak road. These roads would be designed for efficient access and minimal ground disturbance and would incorporate multiple turbines per spur where possible. During the operation phase roads would be maintained as two-track or other minimal state to be suitable for occasional flatbed trailers and 4X4 maintenance vehicles. An example of how the access roads would serve a 20-turbine project using the 1.5 MW turbines can be seen on Figure __. Using a larger size turbine would reduce the number of turbines needed for 30 Megawatts, and would also reduce the amount of service roads needed.

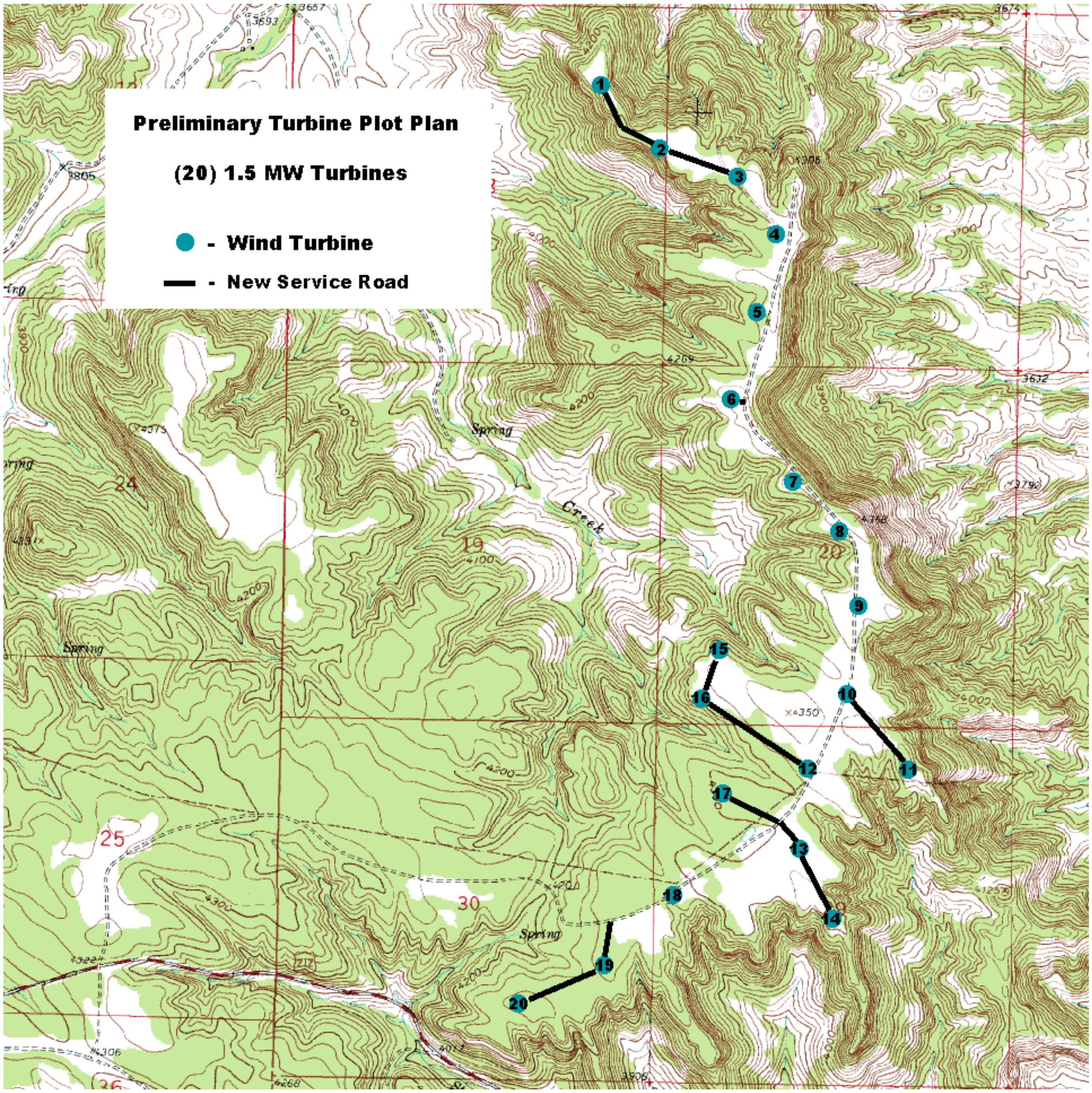

Figure 6. New potential service roads the 1.5 MW turbine sites

Borrow Pits

New borrow pits are not planned for the proposed project. Per recommendation from the NCT Air Quality department, riverbed stone rather than gravel is preferred to stabilize road surfaces. Riverbed stone would be used where feasible; however, if needed any gravel would come from existing already excavated and managed pits in close proximity to the project.

Electrical Collection System and Communication System

Electrical lines would run underground between individual turbines, pad-mounted transformers, and the substation. No overhead lines would be constructed. Trenching would occur adjacent to the 35-foot road construction corridor per requirements of the National Electric Code, and would be dug approximately five feet deep. Surface disturbance would be about four feet wide. Both the electrical collection system and communication system would utilize the same trench. Trenches would be backfilled and reclaimed to original topography and revegetated with native vegetation.

Substation

Electrical lines would feed underground from the turbines into the substation where the project would interconnect into the existing TRECO 69-kV line. Figure __ is a conceptual design of the interconnection proposed for the site. The interconnection equipment would be located adjacent to the 69kV line in the NW1/4 of Section 29 (T2N R43E). Design for the substation would be per National Electric Code standards, TRECO guidelines, and U.S. Fish and Wildlife (FWS) standards to minimize electrocution risks for avifauna. Equipment would be mounted on a concrete foundation that would be poured at the same time as the turbine foundations. The substation area is approximately 1 acre and would be fenced with chain link and topped with barbed wire. A firebreak of gravel or stone would surround the substation within the fenced area. Safety warning signs with emergency contact information would be posted in visible locations.

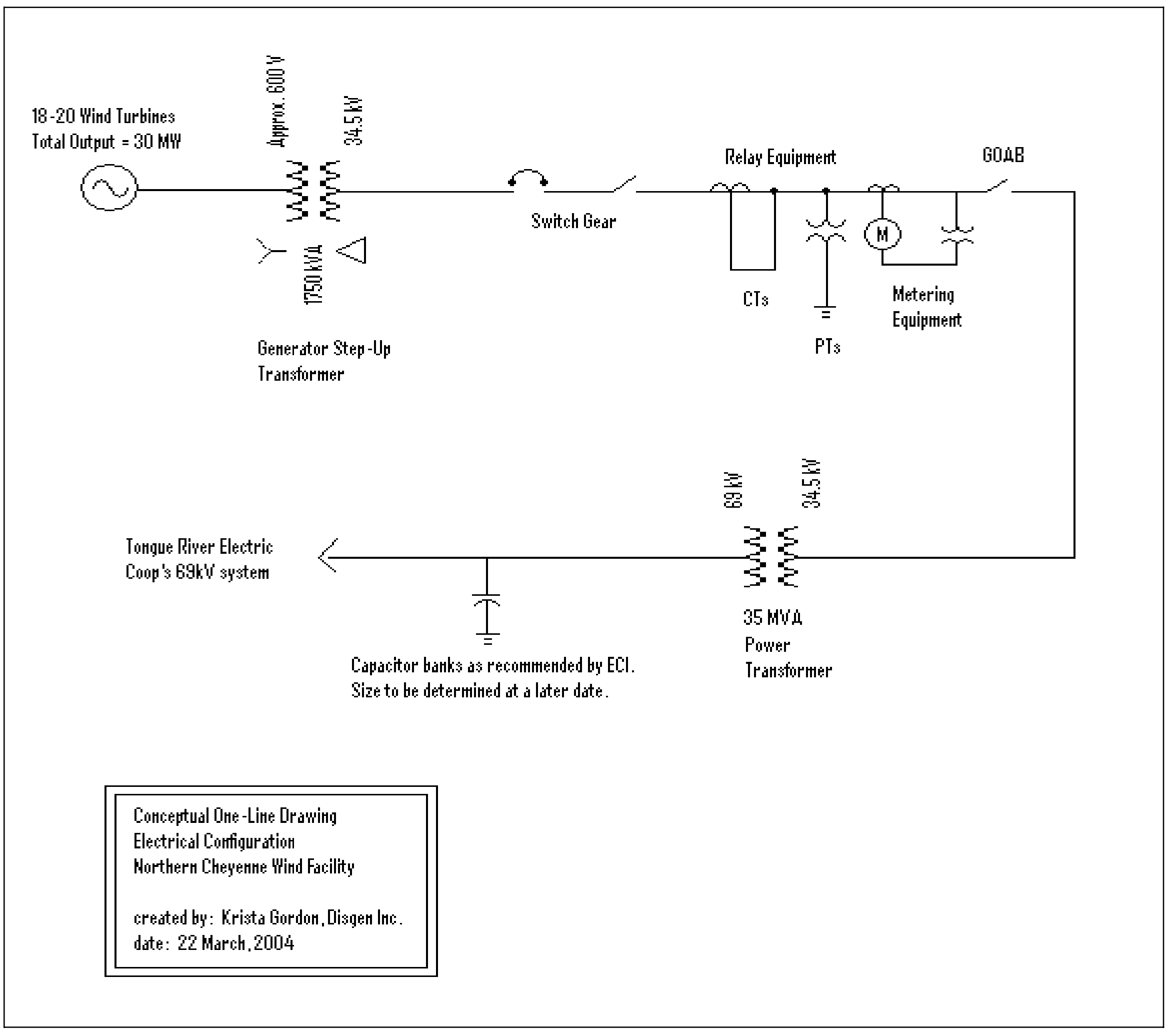

Figure 7. Conceptual electrical configuration of wind project interconnection

Ancillary equipment
A prefabricated control building of approximately 300 ft^2 would be located adjacent to the substation outside the fence. The control building would contain the necessary control and maintenance equipment related to the operations of the site. Running water and a septic system may also be installed at the building. The concrete building foundation would be poured at the same time as the turbine foundations.

Pad mounted transformers for most wind turbines would be located adjacent to each turbine to interface with the collection systems. The transformer would be locked within a metal cabinet enclosure. The concrete pad would be poured during the same construction phase as the turbine pad. Each transformer would cover approximately 100 ft^2 of surface.

Construction and Staging Areas
Turbine construction areas and crane lay-down staging areas would be required. Individual turbines would be delivered to their installation areas or in clustered staging areas, rather than one staging location within the project area. An estimated 1-3 acres of land per turbine would need to be cleared of vegetation and trees for construction clearance and staging. Grading would only occur in areas where excavation and road construction is required. Shrub-sized vegetation would be removed by brush-beating to leave the rootstock for reclamation, and tree stumps would be chipped, cut low, or excavated to allow equipment passage. The clearance needed for crane rigging and turbine hoisting may also require the removal of intervening trees within the vicinity of construction.

At times equipment or spare parts used for operations and maintenance may need to be staged onsite prior to or during a repair. The location of this staging area would be in an onsite area not readily visible by from scenic areas or commonly traveled areas. The staging area would be approximately 1-2 acres.

Reclamation
Reclamation would occur immediately after construction in stages to reduce the amount of disturbed area at any given time. Topsoil would be salvaged during construction and replaced on disturbed areas once construction is complete. Steep slopes and erodible soils would be stabilized using NCT Water Quality and EPA recommended Best Management Practices (BMPs). Any ruts and vehicle tracks would be scarified to the original topography. All disturbed areas would be reseeded using native vegetation.

During decommissioning, all materials within four feet of the surface would be removed. The top four feet of each foundation would be cut, replaced with soil, and revegetated. Decommissioning would follow the same reclamation practices used for post-construction reclamation. In addition, non-primary access roads would be restored back to original topography, and any ruts and vehicle tracks would be scarified and revegetated. All areas would be reseeded and revegetated using a native species composition.

Project Work Force
The NCT would select a Balance of Plant (BOP) contractor or turnkey turbine provider to manage construction of the facility. A tribal member preference would be a condition of the

construction contract. During construction approximately 35 workers would be employed, which is anticipated to last a minimum of 90 days.

After construction the turbine manufacturer would then train individuals for permanent operations and maintenance positions required for the life of the project. Employment of tribal members for the operations and maintenance positions would be a requirement of the turbine purchase contract. Approximately three or four permanent positions would be needed for operations and maintenance depending on the final selected turbine equipment.

Hazardous materials
No hazardous materials including petroleum products and cleaning solvents will be stored onsite. Most modern wind turbines do not use hazardous materials. Mineral or vegetable oils are typically used for lubricants and hydraulics, and transformers use mineral oil for insulation. The selected turbine manufacturer will provide a Material Data Sheet for their turbine per Occupational Safety Health Administration (OSHA) requirements.

Operation and Maintenance
The facility will generally operate with a maintenance staff of two to three people for operating requirements. These technicians would be on call for routine maintenance. Routine maintenance often entails administering lubricants and coolants to mechanical equipment, blade repairs, applying paints and corrosion coatings, and cleaning the tower, blade, and nacelle components, as well as maintaining access routes. Major maintenance activities would require removal of modular components to designated off-site repair facilities. Modular component design and tower design typically allow for replacement of most components without need for large-scale construction equipment.

Re-powering
Projects are often re-powered with more advanced turbines at the end of their useful life. Current wind turbines are designed to have a minimum twenty-year life. If NCT decides to re-power, land disturbances similar to the initial construction stage would occur. Much of the same equipment (i.e. cranes, heavy trucks, and earth moving equipment) would be used. While existing underground infrastructures would be reused, new trenching, cabling, and road modification are likely if the turbine pad locations change. Any significant project modification such as re-powering would likely require additional permitting requirements including a revision of the NEPA documents.

Decommissioning
At the end of the project life all project infrastructure within four feet of the surface would be removed. The concrete foundations would be cut to a four-foot depth below the surface and filled over with soil. All associated electrical equipment; transformers, service buildings etcetera would be removed from the site and disposed of or recycled in appropriate facilities. Service roads specific to the project would be reclaimed to original topography and revegetated using native species. Large equipment similar to that used during construction would be required to decommission the turbines. Roads would be re-modified to accommodate this equipment. All surface disturbances would be reclaimed using NCT Water Quality, and EPA BMPs, and the most recent dust control practices. The original pre-project topography would also be restored, and the entire project area would be revegetated using native species compositions.

Chapter Three: Environmental Consequences of Proposed Action and Alternative.

Introduction

This chapter describes the existing affected environment in detail by resource. Each description is followed by a discussion of the potential direct and indirect impacts from the proposed action and alternative. A discussion on the cumulative impacts on each resource is at the end of each resource discussion. If mitigation measures are needed to ensure no significant impact, then they are added at the end of each respective section.

Air Quality

Affected Environment

The NCT designated its airshed as Class I in 1977. This imposes the most stringent air quality standards under the Clean Air Act administered by the EPA. Typically the Class I designation regulates the air quality of National Parks and Wilderness areas. The redesignation demonstrates the value the NCT places on the pristine air within the reservation, to the point that economic development can be constrained for its protection.

The tribe currently operates several air quality monitoring stations that were the result of an EPA Prevention of Significant Deterioration (PSD) permit requirement for an expansion of the coal fired power plant in Colstrip MT twenty-one miles northwest of the project area. The tribe operates three PSD stations, one of which is on the northern edge of proposed project area on the Garfield Peak ridgeline. These PSD stations monitor SO_2, NO_2, PM^{10}, $PM^{2.5}$, visibility, wind speed and direction, temperature, barometric pressure, solar radiation, precipitation (EPD AQ Fact Sheet, 2004). Underground cable connects the electrical supply and communication links to the PSD stations. The cable for the Garfield Peak PSD station runs off the peak to the west and would not interfere with construction activities.

Figure 8. Existing PSD station on northern end of project area

The affected air environment can be characterized in terms of criteria pollutants carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb). Despite the Class I designation, the Lame Deer area in Rosebud County is a

PM_{10} particulate non-attainment area under National Ambient Air Quality Standards (NAAQS). Non-attainment means that the maximum ambient concentration of particulate matter greater than 10-micrometers (µm) in diameter is exceed to the adequate margin of safety to public welfare. The Lame Deer area is approximately nine miles west of the proposed site. Re-entrained road dust from sanding materials applied to roads in Lame Deer and wood smoke are believed to be the primary cause of non-attainment (Scott Williams pers. com.). Data for CO, Pb, and O_3 is not available.

No Action Alternative

Implementation of the No Action Alternative would avoid the temporary increase in fugitive dust and emissions from construction equipment. On the other hand, the offsets to fossil fuel usage from the wind energy produced from the project would not be realized, resulting in a loss of a positive impact from reduced fossil fuel emissions.

Cumulative Impacts

The cumulative benefits of 30 MW of renewable wind energy generation on the global climate change would not be realized under the No Action Alternative.

Proposed Action

The operating wind power plant would have a positive impact on air quality in the region by offsetting the need for energy created by fossil fuels. Impacts to air quality could occur during construction in the form of fugitive dust and vehicle emissions. Significant impact could occur during the construction phase if PM or other (0_3, Pb, CO, NO_2, SO_3) levels were raised past attainment status for the NCT Class I Airshed. However, any potential emissions and fugitive dust levels would reduce after construction after ground reclamation efforts are established.

Fugitive Dust (PM Particulate Matter)

Fugitive dust would be the only emission worth of quantification from the proposed action. All other emissions (0_3, Pb, CO, NO_2, SO_3) would be negligible as a result of construction and operation of the proposed project.

Heavy construction is a source of dust emissions that may have a substantial temporary impact on local air quality. Road construction, which may be associated with land clearing, ground excavation and cut and fill operations (earth moving) is an example of an activity with high emissions potential.

Construction of the proposed project would result in the release of 15 tons of PM^{10} (particulate matter between 2.5 and 10 micrometers in size) over the course of construction if no particulate matter control plan were in place.

The fugitive dust control plan (See appendix X), which calls for the application of water during all appropriate phases of construction, is expected to reduce the total release of PM^{10} to 5.9 tons (Appendix X).

Vehicular travel on unpaved roads is also a source of fugitive dust. Operations and maintenance activities after construction should result in the annual release of 2 tons of PM^{10}.

To put these numbers in perspective, the threshold for qualification as a major source of PM^{10} emissions is 70 tons per year. See appendix X for the calculations of potential PM10 emissions for both the construction and operations phase.

Cumulative Impacts

The cumulative impacts of a wind power project would be primarily positive, as the energy produce from the operating plant would offset the need for emissions producing fossil fuel based generation.

In the event that the project is expanded, any additional capacity would offset the need for that capacity from nonrenewable energy sources. Tribally owned wind power project that demonstrated successful compliance with the most stringent Class I Airshed requirements could become a model for best management practices for future tribal projects outside of the NCT.

Impacts from potential fugitive dust and construction emissions could have a short-term affect on local and regional air quality, but are not likely to create cumulative air quality impacts.

Mitigations

The project would adhere to the dust control management plan outlined in appendix __.

Biological Resources

Wildlife

Affected Environment

The proposed project occurs on a ridge within a ponderosa pine forest in which much of the forest has burned and was salvage logged after the Early Bird Fire on June 4, 1988. The wildlife species present within the project area are a mixture of those associated with both forested and more open environments. Wildlife potentially present within the project area and discussed here includes birds, mammals, reptiles and amphibians, and threatened, endangered, and sensitive species.

A number of data sources were used to describe wildlife species present within the project area, including available data from the Northern Cheyenne tribe, the Montana Natural Heritage Program, Montana Fish, Wildlife and Parks (MFWP), the U.S. Fish and Wildlife Service (USFWS), and the Bureau of Indian Affairs (BIA). In addition to these sources, a baseline study was conducted to determine the level of use of the project area by birds and species protected under the Endangered Species Act (Good et al. 2005).

Birds

A total of 56 species were documented within the project area (Figure X) during baseline studies conducted from November 13, 2003 – October 26, 2004. The project area includes all proposed facilities and a ½ mile buffer (Figure X). A full description of the study design and analysis, results, tables and figures, and maps of avian-use (raptors), are provided in the final baseline report (Good et al. 2005). From the fixed-point surveys, avian-use estimates of the project area by species and groups were standardized by calculating the number of detections per survey (30 minutes) to a fixed plot (800 m radius) (Table X1). In addition to fixed point surveys, transects in the project area were surveyed during the winter. The results of the winter transects are presented in Table X2.

Table 2. Avian species observed within 800m of the observer and estimated mean use (#/30-minute survey) on the Project site (April 1, 2004 – October 26, 2004).

Large Birds					
Spring		Summer		Fall	
Species/Group	Use	Species/Group	Use	Species/Group	Use
American kestrel	0.486	American kestrel	0.713	sharp-tailed grouse	0.771
Cooper's hawk	0.114	American crow	0.420	red-tailed hawk	0.129
sharp-tailed grouse	0.114	turkey vulture	0.187	American kestrel	0.100
red-tailed hawk	0.086	red-tailed hawk	0.160	American crow	0.086
American crow	0.043	sharp-tailed grouse	0.060	black-billed magpie	0.086
golden eagle	0.029	black-billed magpie	0.060	golden eagle	0.071
northern harrier	0.014	Cooper's hawk	0.013	rough-legged hawk	0.043
black-billed magpie	0.014	northern harrier	0.013	sharp-shinned hawk	0.029
		blue jay	0.007	northern harrier	0.014
				turkey vulture	0.014

Small Birds					
Spring		Summer		Fall	
Species/Group	Use	Species/Group	Use	Species/Group	Use
western meadowlark	0.514	red-headed woodpecker	0.593	American robin	1.029
northern flicker	0.271	Lewis's woodpecker	0.520	horned lark	0.600
mountain bluebird	0.200	western meadowlark	0.333	unidentified passerine	0.543
vesper sparrow	0.200	northern flicker	0.273	mountain bluebird	0.229
American robin	0.143	mountain bluebird	0.200	chipping sparrow	0.114
Lewis's woodpecker	0.100	American robin	0.147	red crossbill	0.114
chipping sparrow	0.071	vesper sparrow	0.140	western meadowlark	0.071
Brewer's blackbird	0.043	rock wren	0.127	northern flicker	0.071
house wren	0.043	Brewer's blackbird	0.107	northern shrike	0.057
rock wren	0.043	chipping sparrow	0.107	vesper sparrow	0.043
mourning dove	0.029	mourning dove	0.087	white-breasted nuthatch	0.043
red-headed woodpecker	0.029	eastern kingbird	0.067	Townsend's solitaire	0.029
Say's phoebe	0.014	lark sparrow	0.067	black-capped chickadee	0.029
green-tailed towhee	0.014	house wren	0.053	Lewis's woodpecker	0.029
lark sparrow	0.014	western kingbird	0.053	Cassin's kingbird	0.014
western kingbird	0.014	grasshopper sparrow	0.047	western kingbird	0.014
western wood-pewee	0.014	violet-green swallow	0.027		
downy woodpecker	0.014	yellow warbler	0.027		
		Townsend's solitaire	0.020		
		eastern wood-pewee	0.020		
		pine siskin	0.020		
		spotted towhee	0.020		

Table 2. Avian species observed within 800m of the observer and estimated mean use (#/30-minute survey) on the Project site (April 1, 2004 – October 26, 2004).

unidentified sparrow	0.020
downy woodpecker	0.020
brown thrasher	0.013
brown-headed cowbird	0.013
Bullock's oriole	0.007
cliff swallow	0.007
mountain chickadee	0.007
western wood-pewee	0.007
yellow-breasted chat	0.007

Table 3. The number of groups and observations found during the Winter Eagle Surveys (November 13, 2003 – March 24, 2004).

Groups/Species	# of Observations	# of Groups
Raptors	**6**	**6**
golden eagle	4	4
great-horned owl	1	1
red-tailed hawk	1	1
Passerines	**260**	**18**
American crow	1	1
American robin	18	5
American tree sparrow	1	1
Cassin's finch	30	1
common raven	1	1
horned lark	2	1
pine siskin	60	1
unidentified passerine	20	2
unidentified waxwing	125	4
western meadowlark	2	1
Upland gamebirds		
sharp-tailed grouse[a]	116	10
Other Birds	**3**	**3**
northern flicker	1	1
unidentified woodpecker	2	2
Total	385	37

[a] There were sightings of 3 or more tracks on 6 occasions, no changes to table.

Avian Use by Species

A total of 1,048 individual bird detections within 779 separate groups were recorded during the fixed-point surveys in the project area between April 1 – October 26, 2004. Cumulatively, eight species (16% of all species), American kestrels, red-headed woodpeckers, Lewis's woodpeckers, western meadowlarks, American crow, American robin, mountain bluebirds and northern flicker, comprised approximately 63% of the observations. Of the remaining species, no individual species comprised more than 5 % of the total observation.

Avian Use by Seasons and Groups

Higher overall avian use occurred in the summer (4.79) and fall (4.37) compared to the spring use (2.67). Avian use was summarized for four groups of birds: raptors, upland game birds, woodpeckers, and passerines. Raptor species include hawks, eagles, falcons and vultures. Upland game birds are composed soley of sharp-tailed grouse. Woodpeckers are comprised of species such as red-headed woodpecker, Lewis's woodpecker, and northern flicker. All other species are considered passerines, and species included in this group include sparrows, thrushes, jays, warblers and other songbirds.

Passerines

Passerines were the most abundant avian group observed during all seasons. Passerines abundance varied through the seasons, fall (3.10), summer (2.15), and spring (1.39). Passerines made up approximately 70.9% of the avian use in the fall, 51.9% in the spring, and 44.9% in the summer. Passerines were observed during 69.3% of the surveys in the summer, 67.1% in the spring and 47.1% in the fall.

Raptors

Raptor use was second highest to passerines in the spring (0.73), third to passerines and woodpeckers in the summer (1.09), and third to passerines and upland gamebirds (all sharp-tailed grouse) in the fall (0.40). Raptor use also varied by season, with the highest use occurring during the summer. American kestrels were the most abundant raptor species. In fall, raptors made up less than ten percent of the avian use, but made up 27.3% in the spring and 22.7% in the summer. Raptors were observed in 51.4% of the spring surveys, 48.0% in the summer and 24.3% of the fall surveys.

A ground based raptor nest survey was conducted within ½ mile of project facilities on June 15-16, 2004 in order to identify those nests most susceptible to construction disturbance and other impacts. Three nests were found during the survey, including two red-tailed hawk nests and one Cooper's hawk nest (Figure X). The northernmost red-tailed hawk nest was located in a snag. The nest was occupied during the nest survey, however, the nest blew down later in the summer during a high wind event. The other red-tailed hawk nest was located within a ponderosa pine and across the highway from the project area. The Cooper's hawk nest was located within the bottom of a steep drainage in an ash tree.

Upland Gamebirds

Upland gamebird use occurred in the fall and winter and consisted of one species, sharp-tailed grouse, which were observed in several groups. Upland gamebirds comprised 17.7% of the bird use in the fall and were second highest behind passerines. In the rest of the seasons they comprised less than five percent of the bird use. Upland gamebirds were observed in less than 12% of the surveys in all seasons.

Two sharp-tailed grouse leks are located within the project area (Figure X). A total of 15 and 17 birds were counted on lek #1 on March 12, 2004 at 0625 H and March 24, 2004 at 0814 H respectively. The NCT obtained counts at lek #1 of 11 birds on May 5, 2003 at 1410 H and 20 birds on April 1, 2004 at 0610 H (J. Whiteman, Northern Cheyenne Natural Resources Department, Unpublished Data).

A total of 28 and 30 birds were counted on lek #2 on March 12, 2004 at 630 H and March 24, 2004 at 0632 H respectively. The NCT observed 31 birds on April 1, 2004 at 0530 H at lek #2 (J. Whiteman, Northern Cheyenne Natural Resources Department, Unpublished Data).

At least two segments of sharp-tailed grouse populations occur in North America: 1) Columbian sharp-tailed grouse that occur west of the Continental Divide and 2) remaining populations. Populations of the Columbian sharp-tailed grouse subspecies are thought to be declining while populations in southern Canada, North Dakota, South Dakota, Nebraska, and eastern Montana are more stable (Connely *et al.* 1998). The project area occurs in eastern Montana and outside the range of the Columbian sharp-tailed grouse.

Woodpeckers
Woodpecker use was second highest behind passerines in the summer (1.41) and third highest behind passerines and raptors in the spring (0.41). During the fall (0.10) they had the lowest use and comprised only 2.3% of the avian use. Woodpeckers made up 29.4% of the use in the summer and 15.5% in the spring. They were frequently observed in the summer (75.3%) and spring (38.6%) but were only observed in 7.1% of the surveys in the fall.

Mammals
Approximately 100 species of mammal are native to the state of Montana (MNHP 2004). Several of these species may occur within the project area, including bats, big game (elk, mule deer, and pronghorn antelope), pocket gophers, mice, voles, squirrels, porcupine, shrews, lagomorphs, and carnivores (weasels, coyote, bobcat).

Factors influencing the possible occupancy of the project area by bat species include the presence of suitable forage and roost sites, and/or the area's location with respect to a migratory pathway. Attributes of these factors vary among species. Fourteen bat species have the potential to occur in the region of the project area. The likelihood of such occurrences, based upon species locality records and habitat affinity, is summarized in **Table X3**.

Table 4. Bat species with potential to occur in the project area.

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
Eastern red bat *Lasiurus borealis*	Wooded riparian zone in arid areas of eastern MT, roost in trees	Possible around riparian zones in project area	MNHP 2004, BCI 2002
Fringed myotis *Myotis thysanodes*	Found in desert shrub, sagebrush/ grassland, ponderosa pine and Douglas fir woodlands; extent of MT range unknown	Possible due to suitable habitat, mostly reported in western MT, though extent of MT range is unknown	MNHP 2004, BCI 2002
Pallid bat *Antrozous pallidus*	Found in deserts, conifer woodlands, shrub-steppe, and grasslands; typically roost in rock crevices or buildings	Likely; specimen captured in Rosebud Co. west of Colestrip in Ponderosa pine savannah and big sagebrush	MNHP 2004, BCI 2002
Spotted bat *Euderma maculatum*	Usually detected in open arid habitats (Utah juniper, sagebrush), also in ponderosa pine savannah, often near cliffs, rocky outcrops, water, roosts in cliff crevices	Possible; range in MT is in south-central part of state	MNHP 2004, BCI 2002
Townsend's big-eared bat *Corynorhinus townsendii*	Caves and abandoned mines used for roosts and hibernacula; habitat in vicinity of roosts includes Douglas fir, lodgepole, and ponderosa pine woodlands and forests	Possible; project area is within range and habitat is suitable if roosts and hibernacula sites are available	MNHP 2004, BCI 2002
Big brown bat *Eptesicus fuscus*	Uses wide range of habitats from lowland deserts to timberline forests, most commonly found in deciduous forests; maternity roosts in trees and buildings; in MT only in summer	Likely; project area is within species range and species uses a wide range of habitats; may migrate through area	MNHP 2004, BCI 2002
Hoary bat *Lasiurus cinereus*	Widespread bat found in variety of habitats from lowland deserts to ponderosa pine forests; spend daytime in densely vegetated areas; in MT only in summer	Possible, project area is within range and some suitable habitat may be present; may migrate through area	MNHP 2004, BCI 2002, Tuttle 1995

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
Little brown myotis *Myotis lucifugus*	Found in mountainous and riparian areas, tree-lined scrub-shrub, aspen meadows; nursery colonies in trees and buildings, forage over water and open areas	Possible; project area is within range and suitable habitat is present	MNHP 2004, BCI 2002
Long-eared myotis *Myotis evotis*	Found in forested areas, may roost in crevices and logs on or near the ground	Possible, project area is within range and some suitable habitat may be present	MNHP 2004, BCI 2002
Long-legged myotis *Myotis volans*	Dependent on coniferous forests, nursery colonies usually in >100 year-old trees with crevices and exfoliating bark	Possible; project area is within range, but suitable roosting habitat may not occur in project area	MNHP 2004, BCI 2002
Western small-footed myotis *Myotis ciliolabrum*	Use cliff crevices, caves, mines, rocks for roosting and hibernacula; little known about preferred habitat	Possible if suitable roost sites are present; project area is within range	MNHP 2004, BCI 2002
Silver-haired bat *Lasionycteris noctivagans*	Common in coniferous, deciduous, and mixed forests, especially old growth; often feed in disturbed areas, migratory	Possible, though suitable forest habitat may be lacking in project area, project area is within range; may migrate through area	MNHP 2004, BCI 2002

Big Game

The project occurs within the potential range of elk, mule deer, and pronghorn antelope. Mule deer and pronghorn were the only species of big game observed in the project area baseline studies. The MFWP has mapped elk winter range as occurring within the project area. However, due to relatively high hunting pressure on reservation lands, elk rarely occur within the designated winter area (S. Denson, MFWP, pers. comm.).

Reptiles and Amphibians

A total of 30 species of reptiles and amphibians occur within the state of Montana. Of those 30 species, the proposed project occurs within the potential range of 18 reptiles and amphibians

(Werner et al. 2004). Examples of species that may occur within the project area include the tiger salamander, boreal chorus frog, and the terrestrial garter snake.

Endangered, Threatened, and Sensitive Wildlife Species

A list of federally protected and state species of concern that potentially occur within the project area was generated to assess the potential for impacts to these species (Good et al. 2005). Species were identified based on lists available from the USFWS (2004), the MNHP Species of Concern lists, and Birds of Conservation Concern (USFWS 2002).

Information about occurrence of these species in the project area is based largely on the following resources:

- Information obtained from the Montana Natural Heritage Program
- Available habitat within the project area
- Baseline field studies being conducted on site (this report), and
- Other published literature where available.

The USFWS lists two species protected under the Endangered Species Act as potentially occurring within the Northern Cheyenne Reservation: black-footed ferret and bald eagle (USFWS 2004). The black-footed ferret relies almost exclusively on prairie dog towns for food and shelter. One prairie dog town, approximately 15 acres in size, is located ¾ mile from the proposed project area in a valley. No prairie dog towns are present within the project area. Due to a lack of prairie dog towns within the project area it is highly unlikely the black-footed ferret occurs within the project area.

Bald eagles are documented as breeding and wintering along the Tongue River, approximately eight miles east of the project area. Bald eagles feed primarily upon fish and carrion and typically occur near large bodies of fish bearing waters during the breeding season and winter. However, bald eagles may utilize other habitats if sufficient sources of carrion, such as calving or sheep operations are present. The proposed project area lacks large, fish bearing waters, however, the area is utilized for cattle grazing. The combination of mature ponderosa pine and cattle grazing in the project area may provide potential winter roosting habitat. Surveys were conducted for wintering bald and golden eagles in the project area during the winter of 2003-2004 (Good et. al. 2005). No bald eagles were observed during the winter surveys or the summer raptor surveys. Thus, although potential wintering habitat for bald eagles is present, the area does not appear to be utilized for winter roosts or during the summer.

The MNHP program lists several bird, mammal, reptile and amphibian species as Species of Concern. While species of concern are not protected as Endangered or Threatened Species under the Endangered Species Act, the MNHP considers species of concern as "at risk" due to declining populations, habitats, or restricted distribution MNHP (2004). A total of 6 bird species of concern were documented within the project area (Table X4). Other species of mammal, reptile or amphibian considered species of concern may also occur in the project area, and these species are described in Table X5.

Table 5. Montana Avian Species of Concern documented within the project area.

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
BIRDS			
Cassin's kingbird *Tyrannus vociferans*	Conifer or Riparian Habitats	Present; a single bird was seen on 9/18/04 at station B.	Good et. al. 2005, MNHP
golden eagle *Aquila chrysaetos*	May occur in any habitat type, however, generally more common in open sagebrush or grassland habitats	Present; 3 groups of individual birds were observed at station D and a group of 2 at station B during the point counts; 4 groups of individual birds were observed during the winter eagle surveys	Good et. al. 2005, MNHP 2004
grasshopper sparrow *Ammodramus savannarum*	Grassland Habitats	Present; 4 groups of individual birds were observed at station A and a single bird was observed at station C.	Good et. al. 2005, MNHP 2004
Lewis's woodpecker *Melanerpes lewis*	Open Ponderosa Pine Habitats	Present; 87 individuals were seen in 82 groups; spread out through the project area; a single bird was observed in transit during point counts	Good et. al. 2005, MNHP 2004
red-headed woodpecker *Melanerpes erythrocephalus*	Riparian areas, open and burned forests	Present; 89 individuals were seen in 78 groups; spread out through the project area; 4 groups of individual birds were observed in transit during point counts	Good et. al. 2005, MNHP 2004
upland sandpiper *Bartramia longicauda*	Native Prairie Habitats	Present; 5 individuals were seen in 3 groups all in transit during point counts	Good et. al. 2005, MNHP 2004

Table 6. Montana Animal Species of Concern with potential to occur in the project area.

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
MAMMALS			
Eastern red bat *Lasiurus borealis*	Wooded riparian zone in arid areas of eastern MT, roost in trees	Possible around riparian zones in project area	MNHP 2004, BCI 2002
Fringed myotis *Myotis thysanodes*	Found in desert shrub, sagebrush/ grassland, ponderosa pine and Douglas fir woodlands; extent of MT range unknown	Possible due to suitable habitat, mostly reported in western MT, though extent of MT range is unknown	MNHP 2004, BCI 2002
Pallid bat *Antrozous pallidus*	Found in deserts, conifer woodlands, shrub-steppe, and grasslands; typically roost in rock crevices or buildings	Likely; specimen captured in Rosebud Co. west of Colstrip in Ponderosa pine savannah and big sagebrush	MNHP 2004, BCI 2002
Spotted bat *Euderma maculatum*	Usually detected in open arid habitats (Utah juniper, sagebrush), also in ponderosa pine savannah, often near cliffs, rocky outcrops, water, roosts in cliff crevices	Possible; range in MT is in south-central part of state	MNHP 2004, BCI 2002
Townsend's big-eared bat *Corynorhinus townsendii*	Caves and abandoned mines used for roosts and hibernacula; habitat in vicinity of roosts includes Douglas fir, lodgepole, and ponderosa pine woodlands and forests	Possible; project area is within range and habitat is suitable if roosts and hibernacula sites are available	MNHP 2004, BCI 2002
Black-footed ferret *Mustela nigripes*	Dependent on prairie dog towns and therefore limited to open grasslands, steppe, and shrub-steppe	Unlikely; no ferrets other than reintroduced populations are documented in MT	MNHP 2004

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
Black-tailed prairie dog *Cynomys ludovicianus*	Colonies are located on flat, open grassland and shrub/grassland; in MT habitat dominated by western wheatgrass, blue grama, big sagebrush	One prairie dog town is present ¾ mile from project area. No towns are present in the project area. Unlikely to occur in project area in the future due to presence of ponderosa pine forest	MNHP 2004
Dwarf shrew *Sorex nanus*	Generally found in alpine tundra, subalpine coniferous forests, lower-elevation ponderosa pine and aspen forests with mixed shrub, arid sagebrush, shortgrass prairie	Possible; habitat is suitable and project area is in documented range east of Continental Divide	MNHP 2004
Merriam's shrew *Sorex merriami*	Found in sagebrush/steppe, open ponderosa pine stands, forb dominated land, and grassland; in MT captured in sagebrush/grassland	Possible; habitat is suitable, project area is in documented range east of Continental Divide	MNHP 2004
Preble's shrew *Sorex preblei*	Varied habitats include shrub-grassland, sagebrush, oak chaparral, ponderosa pine/Gambel oak stands, alkaline shrubland; in MT captured in sagebrush/grassland	Possible; habitat is suitable, project area is in documented range	MNHP 2004
REPTILES			
Greater short-horned lizard *Phrynosoma hernandesi*	Found east of Continental Divide on ridge crests and in sparse grass and sagebrush with strong sun exposure	Possible; project area is within range and some sun-baked outcrops and ridge crests occur in project area	MNHP 2004
Sagebrush lizard *Sceloporus graciosus*	Found east of Continental Divide in sage-steppe and open conifer stands, often with abundant bare ground	Possible; project area is within range and suitable habitat is present	MNHP 2004

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
Milk snake *Lampropeltis triangulum*	Found east of the Continental Divide in open sagebrush/grassland and ponderosa pine savannah, often near rocky outcrops	Possible; habitat is suitable and project area is within range; has been observed in Rosebud Co.	MNHP 2004
Western hognose snake *Heterodon nasicus*	Found east of the Continental Divide in prairies, sagebrush/grassland, near open pine savannah; prefer arid areas with gravelly or sandy soil	Possible; habitat is suitable and project area is within range	MNHP 2004
Snapping turtle *Chelydra serpentina*	Native east of Continental Divide, especially along Tongue River drainage; found in backwaters of major rivers and in permanent streams and creeks with sandy or muddy bottoms	Unlikely, individuals may occur in nearby Tongue River and have been observed in Rosebud Co., but no habitat exists within project area	MNHP 2004
Spiny softshell *Apalone spinifera*	Found in MT in Missouri and Yellowstone River drainages where there are muddy or sandy banks and soft bottom substrates	Unlikely; individuals have been observed in Rosebud Co., but no suitable habitat exists in project area	MNHP 2004
AMPHIBIANS			
Plains spadefoot *Spea bombifrons*	Found east of Continental Divide in intermountain valleys and prairie with soft sandy/gravelly soils near water; usually observed in sagebrush/grassland	Possible; project area is within range, some suitable habitat may exist in drainages in project area	MNHP 2004
Northern leopard frog *Rana pipiens*	Found in lower elevation wetlands where a mosaic of wetland, wet meadow, and fields with short vegetation is available; more closely associated with water than toads and spadefoots	Unlikely; project area is within range but wetland habitat may be lacking	MNHP 2004

Impacts of the Proposed Action

Birds

The most probable impact to birds resulting from the project is direct mortality or injury due to collisions with the turbines or guy wires of temporary or permanent meteorological towers. Collisions may occur with resident birds foraging and flying within the project area, or with birds migrating through the project area. Other impacts could include displacement effects due to disturbance caused by project construction or operation, mortality or injury due to collisions with construction vehicles or other equipment, and loss of habitat. Impacts are discussed by bird type in the following sections.In Minnesota, researchers have found that breeding songbird density on CRP lands was reduced in the immediate vicinity of turbines (Leddy *et al.* 1999), but changes in density at broader scales was not detectable (Johnson *et al.* 2000a). Construction and operation of the Foote Creek Rim wind plant did not appear to cause reduced use of the wind plant and adjacent areas by most avian groups, including raptors, corvids, or passerines (Johnson *et al.* 2000b). Some reduced use of the areas near turbines was apparent for a local population of mountain plovers during construction (Young et al. 2004). A pair of golden eagles successfully nested 0.5 mile from the wind plant after one phase was operational and another phase was under construction (Johnson et al. 2000a).

Wind plant design has changed significantly since the first large wind plants were developed in California; many of these changes appear to have reduced risk to birds. Turbines are now typically installed on tubular steel towers instead of lattice towers and without open platforms at the top of the tower, eliminating perching opportunities for raptors and other birds. No observations have been made of raptors perched on the new turbine types during studies at Foote Creek Rim (WY) (Johnson *et al.* 2000b), Buffalo Ridge (MN) (Johnson *et al.* 2000a), Vansycle (OR) (Erickson *et al.* 2000a) and Stateline (OR/WA) (J. Jeffrey and K. Kronner 2002, pers. comm.). The nacelle, which houses the generator, drive train and gearbox on top of the tower, is typically completely enclosed. Electrical lines between turbines and from the turbine strings to substations in new-generation wind plants are often buried underground to eliminate perching opportunities, collisions with wires, and electrocutions. Collisions with wires and electrocutions have been a common source of mortality at Altamont Pass (CA) (Orloff and Flannery 1992) and other older wind projects. Overhead lines within new wind plants have often been designed to be raptor safe from electrocution and anti-perching devices are often installed (e.g., Stateline [OR/WA] wind plant [Walla Walla Regional Planning Department 2000]). Turbines are much larger, with blades moving at slower revolutions per minute (rpm) and are therefore presumably more visible than blades on the smaller older turbines. For example, the blades of the 1.5 MW turbines installed at the Klondike (OR) wind plant turn at approximately 20 rpm's, contrasted to greater than 60 rpm's for the Kenetech 56-100 downwind turbine, the most common turbine at the Altamont Pass (CA) wind plant. Studies by Howell (1997) and Hunt (2002) provide some evidence indicating the Kenetech 56-100 turbines (100 kW, 9 m blades) have a higher associated raptor mortality rate than other turbine types, including larger turbines. Hunt (2002) attributes the higher risk in part to the blade proximity to the ground and the low altitude foraging behavior of golden eagles. The 56-100 model is a downwind turbine, with the blades on the downwind side of the nacelle, which some researchers believe may also increase risk of collision of birds that perch on the turbine. Birds perched on this downwind turbine may be blown towards the blades when leaving the perch. Most newer-generation turbines are upwind turbines, including those proposed for this Project.

In addition to changes in technology, significant effort has been devoted to developing standardized methods for locating wind plants (NWCC 2002), monitoring for avian impacts associated with the wind plants (Anderson *et al.* 1999, Erickson *et al.* 2000b), and developing measures to mitigate impacts (Johnson *et al.* in press). Primarily due to the avian collision concerns and through the development of locating and monitoring guidelines, baseline avian use, raptor nesting and operational monitoring data (Erickson *et al.* 2001) have been collected at many of the new wind power developments outside California. These data have been used to predict wind project impacts on wildlife and habitats, and in some cases, for siting individual wind turbines at a particular site. This large and significant source of information has greatly improved the ability to predict impacts for new projects and to aid in wind plant/wind turbine siting. Raptor mortality at these new wind projects has been absent or low in all cases. Intensive monitoring programs in place at newly constructed wind projects such as the Stateline project (OR/WA), the Buffalo Mountain Project (TN), and the Backbone Mountain Project (WV) continue to add to the already available information for other new wind projects (e.g., Buffalo Ridge (MN), Foote Creek Rim (WY), Vansycle, Klondike and Nine Canyon (OR)).

Substantial data on avian mortality at windplants are currently available. Of 841 avian fatalities reported from California studies (>70% from Altamont Pass, CA), 39% were diurnal raptors, 19% were passerines (excluding house sparrows and European starlings), and 12% were owls. Non-protected birds including house sparrows, European starlings, and rock doves comprised 15% of the fatalities. Other avian groups generally made up <10% of the fatalities. Outside of California, diurnal raptor fatalities comprised only 2% of the wind plant-related fatalities. Passerines (excluding house sparrows and European starlings) were the most common collision victims, comprising 82% of the 225 fatalities documented. No other group (e.g., raptors, waterfowl) comprised more than 5% of the fatalities.

For all avian species combined, estimates of the number of bird fatalities per turbine per year from individual studies have ranged from 0 at the Searsburg, Vermont (Kerlinger 1997) and Algona, Iowa sites (Demastes and Trainer 2000) to 4.45 on the Buffalo Ridge (MN) Phase III site (Johnson *et al.* 2000a) to 7.7 per turbine per year at Buffalo Mountain, Tennesse (NWCC 2004). The Phase III Buffalo Ridge (MN) site estimate was based on one field season (1999) and was greatly influenced by a fatality event involving 14 migrant warblers, vireos and flycatchers, observed during a May 17 carcass search of two turbines (Johnson *et al.* 2002). Avian fatality rates were much lower at the Buffalo Ridge (MN) Phase I and II sites, where several years of data were collected (Osborn *et al.* 2000, Johnson *et al.* 2002). Throughout the entire U.S., the average number of avian collision fatalities per turbine is 2.3 per year (NWCC 2004). As new turbines are developed that are larger, spinning blades cover more area. It is not known if predictions of avian mortality at future windpower projects will more closely reflect bird fatality rates on a per turbine or a per area basis. Estimates of bird fatalities on a per MW basis more closely reflect the area covered by spinning blades. On a per MW basis, observed bird fatality rates have ranged from 0.9 – 11.7 / MW / Year with an average of 3.1 (NWCC 2004).

Raptor mortality has been absent to very low at all newer generation wind plants studied in the U.S. This and other information regarding wind turbine design and wind plant/wind turbine siting strongly suggests that the level of raptor mortality observed at Altamont Pass is quite unique (e.g., unique in the number and arrangement of turbines in a small area, turbine types, prey availability, raptor use), and can be avoided at other locations. Raptor use (e.g., golden eagle use) may be a predictor of raptor risk (e.g., likelihood of mortality) when comparing several sites and when comparing different areas within a site. However, low raptor mortality at newer generation wind plants has resulted in low correlation between use and fatality rates at these new projects. It is possible that the new turbine designs and turbine and wind plant siting decisions made based on avian use patterns or patterns observed at other projects have resulted in reduced avian mortality; however, this has not been experimentally tested.

Passerines comprise a large proportion of the fatalities at new wind plants, and involve both resident and migrant species. Studies of nocturnal migration at several wind plants suggest that the mortality compared to the number of birds passing through the area appears low (Johnson *et al.* 2002, Mabee and Cooper 2002, McCrary *et al.* 1984). Since few raptor species targeted during nest surveys (i.e., those visible from helicopter surveys) have been observed as fatalities at newer wind plants, correlations are very low between the number of collision fatalities and raptor nest density within 2 miles of project facilities. Raptors nesting closest to turbines likely have higher probabilities of being impacted from disturbance (construction and operation) or from collision with turbines, but data on nests very close to turbines (e.g., within ½ mile) are currently inadequate to determine the level of these impacts. The existing wind plant with the highest reported nest density is Foote Creek Rim (WY). Most of the nests within 2 miles of the wind plant are red-tailed hawks, but no red-tailed hawk fatalities have been documented at this site (Johnson *et al.* 2000b, Young *et al.* 2003).

Passerines

Passerines (primarily perching birds) have been the most abundant avian fatality at new generation wind plants (Erickson *et al.* 2001, Erickson *et al.* 2002), often comprising more than 80% of the avian fatalities. Both migrant and resident passerine fatalities have been observed at the project area. Given that passerines make up a large proportion of the bird observations in and near the project, we would expect passerines to make up the largest proportion of fatalities.

Many species of songbirds migrate at night and have collided with other tall man-made structures. Large numbers of songbirds have collided with lighted communication towers and buildings when foggy conditions occur during spring or fall migration. Birds appear to become confused by the lights during foggy or low ceiling conditions, flying circles around lighted structures until they become exhausted or collide with the structure. To date, no large mortality events have been documented at wind plants in North America (Erickson *et al.* 2001, NWCC 2004). However, turbines used by many wind developers are getting taller and are therefore required to be lighted by the Federal Aviation Administration, potentially increasing the risk of collision by nocturnal migrants with wind turbines.

McEneaney (1993) presents a very general map of bird migration corridors within the state of Montana. One of the corridors described as a major bird migration corridor appears to follow the Tongue River north through the state, and may include the proposed project area. By examining the topography of southeast Montana at a very small scale, assuming birds are following topography in the project area, birds migrating along the front range of the Rocky Mountains may follow the Tongue River and associated valley when flying north and south. The degree to which migrating songbirds, will utilize ridges within the project area will depend largely on weather conditions and wind direction. The proposed project is located approximately 8 miles west of the Tongue River, and is likely located outside of any potential migratory corridor along the Tongue River.

The magnitude of passerine and other avian mortality due to collisions with human-made structures such as buildings and windows, vehicles, powerlines, communication towers and wind turbines has received quite a bit of attention recently (Erickson *et al.* 2001, Kerlinger 2000). Using the annual avian collision mortality estimate of 200-500 million (a very large portion of which are passerines), it is estimated that at the current level of development, wind turbines constitute 0.01 to 0.02% (1 to 2 out of every 10,000) of the avian collision fatalities. Communication tower fatality estimates make up 1 to 2% (1 to 2 out of every 100) using the conservative estimates of 4 million annual avian fatalities due to collisions with these structures. The low range estimate from buildings/windows of 98 million (Klem 1991) would comprise approximately 25 to 50% of the collision fatalities. The low range estimate of 60 million vehicle collision fatalities comprises 15 to 30% of the total estimated collision fatalities. Powerline collisions are also likely a significant source of collision mortality.

Passerines protected under the Migratory Bird Treaty Act (excluding house sparrows, European starlings and rock doves) have been the most common group of birds killed at new generation wind plants. Forty-two passerine fatalities representing 21 different species were observed at Buffalo Ridge (MN) during the 4-year study. The largest number of fatalities of any one species was seven (common yellowthroat). Seven out of the 10 fatalities at Vansycle (OR) were passerines, including four white-crowned sparrows. Eighty-seven passerine fatalities representing 26 different species were observed at Foote Creek Rim (WY), with horned lark by far the most commonly observed fatality (32%) and most commonly observed bird during point count surveys (Johnson *et al.* 2000b). Horned lark was also the most common observed fatality at Ponnequin (CO; 5 out of 8 passerine fatalities).

Nocturnal migrants are estimated to comprise approximately 50% of the fatalities at new wind projects (estimated range 34 to 59%) based on timing and species (Erickson *et al.* 2001). Some nighttime surveys using radar equipment have been conducted at wind plants and results have been compared to fatalities. Radar studies at Buffalo Ridge (MN; Hawrot and Hanowski 1997) indicate that as many as 3.5 million birds per year may migrate over the wind development area (Johnson *et al.* 2000a). The largest single mortality event reported at a U.S. wind plant was 14 nocturnal migrating passerines at two turbines at Buffalo Ridge (MN) during spring migration. There are no other reported mortality events greater than a few birds at single or adjacent turbines found during a single search at any U.S. wind plant.

Researchers estimated 6,800 birds were killed annually at the San Gorgonio (CA) wind facility based on 38 dead birds found while monitoring nocturnal migrants. The 38 avian fatalities included 15 passerine species. McCrary *et al.* (1983, 1984) estimated that 69 million birds pass through the Coachella Valley annually during migration; 32 million in the spring and 37 million in the fall. Considering the high number of passerines migrating through the area relative to the number of passerine fatalities, the authors concluded that this level of mortality was biologically insignificant (McCrary *et al.* 1986). Three seasons of nocturnal radar surveys at the Stateline (OR/WA) and Vansycle wind plants (OR; Mabee and Cooper 2002) indicate moderate passage rates compared to other studies, with approximately 90% of the radar targets (flocks of birds) estimated flying above the turbine blades. Low passerine mortality was observed at the Vansycle Ridge (OR) wind plant in 1999 (Erickson *et al.* 2000), and at the Stateline wind plant between mid-July 2001 and March 31, 2002 with a few likely nocturnal migrant fatalities observed. The last season of radar data was gathered concurrently with the recent Stateline mortality data, providing some evidence that mortality relative to passage rates is very low. The low avian mortality due to wind turbines compared with communication towers (Erickson *et al.* 2001) can probably be attributed to the fact that the majority of wind turbines currently range from 60-133 m (200-400 ft) in height, whereas television and radio communication towers are generally much taller.

Many of the existing communication towers are guyed structures, whereas nearly all of the newer generation wind turbines are unguyed structures. There are relatively few reports of single mortality events (greater than a few birds) at communication structures less than 150 m (500 ft) in height (Kerlinger 2000) or at wind plants. We are unaware of any studies that directly compare communication tower mortality to wind turbine mortality; although, there is limited information on guyed meteorological (met) tower mortality compared with wind turbine mortality at Foote Creek Rim (WY; Young *et al.* 2003). At this site, searches were conducted both wind turbines (600 kW, approximately 60 m [200 ft] towers) and guyed met towers (60 m [200 ft] in height) once a month during the study. During this period of study, the met towers had estimates of 8.1 bird fatalities per tower per year, whereas the turbines had estimates of 1.8 bird fatalities per turbine per year (Young *et al.* 2003). Estimates of total bird mortality have ranged between 0 to 7.7 birds per turbine per year (0.9 – 11.7 per MW per year, average 3.1) at new wind projects in the U.S (NWCC 2004), with an average of 2.3 per turbine per year. Fatality rates from projects in the Rocky Mountains and the Pacific Northwest have been closer to the national average, with the largest fatality rates occurring in the eastern U.S. Assuming fatality rates are similar to those documented in the Rocky Mountains and Pacific Northwest, from 12 – 60 total avian fatalities per year can be expected using per turbine fatalities rates, and from 27 – 75 total avian fatalities per year using per MW fatality rates. An additional 0 – 16 total avian fatalities per year can be expected from the proposed met towers.

Raptors

Mean raptor use at this site is moderate in the spring, higher in the summer, and low in the fall compared to several other wind plants in the U.S. The mean raptor use estimate (number/20 minutes/800 m radius plot) for 27 wind plants in the U.S. was 0.52 in the spring, 0.42 in the summer and 0.57 the fall (Tables 13-18; updated from Erickson *et al.* 2002), whereas raptor use at the Northern Cheyenne site averaged 0.49 in the spring, 0.72 in the summer, and 0.27 in the fall / 20 minutes. Although summer raptor use was relatively high at the Northern Cheyenne site, similar or higher raptor use in the summer season has been documented at other wind resource areas outside California, including Buffalo Ridge, Minnesota; Foote Creek Rim, Wyoming; and the Columbia Hills in eastern Washington. Additionally, summer months have the lowest wind speeds at the proposed project area. Despite having relatively high raptor use, raptor mortality at other newer generation wind projects outside of California has been very low. The estimate of raptor mortality at the Stateline wind project on the border of Washington and Oregon is the highest observed and is 0.06 raptors per turbine per year (0.09 raptors per MW per year) based on a three-year study of 337 turbines (Erickson *et al.* 2004). No raptor mortality was observed at the Vansycle wind project in Oregon during a one-year study; and 1 raptor was recorded over a four-year study at the Buffalo Ridge wind project (Erickson *et al.* 2001).

Use by buteos and northern harriers was generally lower at the proposed project than at other projects (Table 16). Use by accipiters at the proposed project was higher than observed at other windpower projects, but still low overall. Raptor use at the proposed windpower project is comprised primarily of American kestrels, and it is expected that American kestrels will make up the majority of raptor fatalities. American kestrel use at the proposed project during the summer (0.476 / 20 minutes) is more similar to overall American kestrel use (0.6 – 0.75 / 20 minutes) reported at the High Winds Project in California (Kerlinger et al. 2005), than use reported at other windpower projects (Table 16). Kerlinger et al. (2005) found 33 American kestrel fatalities during one year of scheduled carcass searches at the High Winds Project, which is comprised of 90 1.8 MW turbines. No scavenger or searcher efficiency trials were conducted at the High Winds Project, thus no adjusted estimates are available of fatality rates per turbine or MW. Using only the number of American kestrels found as fatalities at the project, unadjusted fatality rates for American kestrels were approximately 0.36 kestrels / turbine / year or 0.2 / MW / year. It should be noted that data from Kerlinger et al. (2005) are preliminary, and future studies are planned at the High Winds project to estimate searcher and scavenger efficiency rates and studies are planned to identify factors influencing fatality rates. The majority of kestrel fatalities reported by Kerlinger et al. (2005) occurred during the fall season where turbines occurred in wheat fields and other grain crops. Based on the results of Kerlinger et al. (2005), the proposed project may result in approximately 5 – 10 total American kestrel fatalities per year. However, fatality rates of American kestrels may not reach those observed by Kerlinger et al. (2005) for 2 reasons: 1) American kestrel use varied within the project area and 2) high summer use of the project area may be influenced by a few individuals breeding in the project area.

Although relatively high American kestrel use was documented at the proposed project, stations located near rim edges had much higher kestrel use than stations located away from rim edges. At Foote Creek Rim Wyoming the majority of raptor use was documented to occur within 50 m of rim edges (Johnson et al. 2000b). Turbines located within approximately 50 m of the rim edge are expected to have higher American kestrel and raptor use, and higher potential fatality rates. Turbines located away from rim edges are expected to have lower overall raptor use and lower overall raptor and American kestrel fatality rates.

The bulk of kestrel use reported by Kerlinger et al. (2005) occurring during the fall migration season, and was likely comprised of migrant and wintering birds using harvested agricultural fields that may have contained relatively high abundances of prey with relatively little cover. The highest use by kestrels at the proposed project occurred during the breeding season (i.e. summer months). Snags in the project area provided potential kestrel nesting habitat, and the high use estimates may be heavily influenced by frequent use of the project area by a relatively low number of breeding individuals and their offspring. Additionally, wind speeds at the proposed project are lowest during the summer months, further reducing the risk of collision. Thus while use of the proposed project area during the summer was similar to the overall use at the High Winds project, the number of individuals using the proposed project was likely much smaller, and fatality rates of kestrels at the proposed project are expected to be lower than those observed at the High Winds project.

Operation of wind turbines near raptor nests may result in indirect and direct impacts to the nesting birds; however there are little data to indicate such impacts are likely to occur. The only report of avoidance of wind plants by raptors occurred at Buffalo Ridge (MN), where raptor nest density on 261 km^2 of land surrounding a windplant was 5.94/100 km^2, yet no nests were present in the 32 km^2 windplant facility itself, even though habitat was similar (Usgaard *et al.* 1997). The expected number of nests at this facility would have been 2, and this apparent small effect is not statistically significant. Similar numbers of raptor nests were found before and after construction of Phase 1 of the Montezuma Hills, California windplant (Howell and Noone 1992). A pair of golden eagles successfully nested 0.8 km from the Foote Creek Rim, Wyoming wind plant for three different years after it became operational (Johnson *et al.* 2000b), and a Swainson's hawk nested within 0.8 km of a small windplant in Oregon (Johnson *et al.* 2003b). Based on available data, avoidance of the two raptor nests at the Northern Cheyenne site is unlikely due to the proposed wind project.

Construction of turbines during the breeding season may result in nest abandonment due to noise and human activity associated with turbine construction. After construction is complete, regular maintenance activity and the presence of tall turbines may potentially discourage raptors from nesting in close proximity to turbines.

Woodpeckers

Woodpeckers were frequently observed in the summer and most were observed below the rotor sweep area (RSA). Due to the low flight heights of woodpeckers, mortality of these species is expected to be low. Despite some use of existing windpower projects in Wyoming, Oregon and Minnesota, no woodpecker fatalities were recorded at those projects.

Upland Game Birds

The proposed project poses some risk of collision with flying grouse. However, the proposed project has perhaps more potential to negatively impact sharp-tailed grouse within the project area through indirect impacts. The USFWS recommends placing turbines at least five miles from lek sites of all prairie grouse, including greater and lesser prairie chickens, Gunnison and greater sage grouse and sharp-tailed grouse (USFWS 2004). Because prairie grouse generally did not evolve in environments containing tall vertical structures, USFWS officials have expressed concern over the potential impact of wind turbines on prairie grouse populations, especially those occurring within highly fragmented and poor quality habitats. Some research has demonstrated avoidance of areas near human settlements and other structures by prairie grouse species other than sharp-tailed grouse (Pitman 2003, Hagen 2003).

Although the potential exists for negative impacts, no researcher has demonstrated avoidance behaviors to tall structures by sharp-tailed grouse. The level of impact of wind turbines on sharp-tailed grouse most likely depends on quality and availability of habitat and population size and health. The USFWS (2004) describes an unpublished study in which 3 greater prairie chicken leks were active after the construction of 3 wind turbines in Minnesota. Two of the leks were located within 2 miles of the turbines and one lek was located 0.6 mile from the turbines. The report describes one hen and a brood using an area immediately adjacent to a turbine. The study took place in an isolated patch of suitable grassland surrounded by unsuitable cropland. The USFWS concluded that the amount of habitat, rather than the presence of wind turbines, was limiting the population. The USFWS describes the results as "if other factors are not limiting to GPCHs (Greater Prairie Chickens), turbines might not be avoided elsewhere. However, while birds may persist near turbines, survival of those individuals may be compromised, resulting in a population decline."

Clearly, there are a lot of uncertainties and little direct evidence concerning the potential impacts of wind turbines on sharp-tailed grouse. The proposed project area and surrounding areas currently provide a large, relatively unfragmented tract of high quality habitat for sharp-tailed grouse. The project and surrounding areas were once dominated by ponderosa pine forest. Much of the area burned 17 years ago, and many shrub and grass species became dominant. Shrub species such as wild rose (*Rosa arkansana)* and snowberry (*Symphoricarpos occidentalis)* are abundant in burned areas, providing high quality feeding, nesting and winter habitat. The presence of the remaining ponderosa pine forest also provides quality winter habitat. The Northern Cheyenne Reservation is largely undeveloped and unfragmented, unlike many areas occupied by declining populations of other prairie grouse species.

The two leks in the project area are located approximately 1.1 and 1.25 miles from proposed turbine locations. Both leks are located near access roads (Figure X). One lek is located on an existing access road and the second lek is located 100 m from an existing access road. The access roads currently receive relatively low levels of traffic, especially during the spring. A new barbed wire fence was built through one of the leks during the summer of 2004 for range management purposes by the Northern Cheyenne Tribe. The proposed project has the potential to impact sharp-tailed grouse through 1) disturbance to leks and nesting birds, and 2) avoidance of turbines, especially be female sharp-tailed grouse.

Baydack and Hein (1987) examined the impact of disturbances within the actual lek boundary to courting birds. The researchers used human presence, snow fencing, a parked vehicle, propane exploders, scarecrows with and without tape-recorded voices, radio sounds, and a Labrador retriever on a leash. For all but human presence, male sharp-tailed grouse initially flushed from lek locations but returned within 15 minutes and resumed activities. Female sharp-tailed grouse showed strong avoidance of all disturbances, but returned after the disturbances were removed. Thus the presence of a disturbance in a lek may disrupt the breeding activities of female sharp-tailed grouse. Due to location of the two leks on or near access roads, transportation of construction equipment has the potential to disrupt breeding activities of sharp-tailed grouse during the life of construction. After construction is completed, traffic associated with normal maintenance activities will be much less frequent and should have minimal impacts on breeding sharp-tailed grouse. Due to the presence of newly constructed fence in one of the leks, it is likely that female attendance at the lek will decline due to the presence of the fence. This decline may coincide with turbine construction, and it will be difficult to separate the potential impacts of turbine construction versus the new fence.

The potential exists for sharp-tailed grouse to avoid the project area after construction due to the presence of tall vertical structures. As explained earlier, there are many uncertainties regarding the potential impacts of turbines to prairie grouse. Few researchers have examined avoidance of areas by sharp-tailed grouse due to tall vertical structures. Unlike other species of prairie grouse, sharp-tailed grouse will utilize open forested areas, especially during the winter (Connely *et al.* 1998). If sharp-tailed grouse show some level of avoidance to turbines, it is still unclear at what distance that avoidance becomes significant. The leks are located over one mile from proposed turbine locations; however, sharp-tail grouse use the entire project area for feeding and potentially nesting. Due to the location of the lek sites over one mile from the proposed turbine locations, breeding activities on lek sites will likely continue with no disruption, however, sharp-tailed grouse may nest or feed farther away from turbine locations after construction is completed.

The proposed project area currently provides high quality habitat for sharp-tailed grouse due to a burn that occurred in 1988. The project area is currently dominated by shrubs with many small ponderosa pine sapling 1-3’ tall. Over time, the proposed project area will eventually become dominated by ponderosa pine forest, and the habitat quality for sharp-tailed grouse will be reduced. Sharp-tailed grouse populations are likely to utilize more open areas of sagebrush and grassland located north of the project area 1-2 miles.

Other Groups/Species

Other avian groups (e.g., waterbirds, doves) occur in relatively low numbers within the study area and mortality would be expected to be low. Other species only observed during migration may be at risk; however, mortality would be expected to be low given the low use estimates by these species and groups.

Mammals

Mammals that likely or do exist within the project site include, badger, coyote, ground squirrels and other small mammals such as rabbits, voles and mice. Construction of the project may affect these mammals on site through loss of habitat and direct mortality of individuals occurring in construction zones. Excavation for turbine pads, roads, or other wind project facilities could kill individuals in underground burrows. Road and facility construction will result in loss of foraging and breeding habitat for small mammals. Ground-dwelling mammals will lose the use of the permanently impacted areas; however, they are expected to repopulate the temporarily impacted areas. Some small mammal fatalities can be expected from vehicle activity during operations. Impacts are expected to be very low and not significant. Other species that may potentially be impacted by the proposed project include bats and big game.

Bats

Bat casualties have been reported from most windpower facilities where post-construction fatality data are publicly available. Reported estimates of bat mortality at windpower facilities where methods and fatality rates are publicly available have ranged from 0.07 – 20.82 per turbine per year in the U.S. (Table 12). The NWCC (2004) reports a bat fatality rate from the east as high as 47.5 bats per turbine per year, with a national average of 3.4 bats per turbine per year. Because new generation wind turbines are getting larger, the area covered by spinning blades has also increased. Due to the growing size of turbines, it is not known if bat fatality rates will reflect those observed at other windpower projects on a per turbine or area basis. Estimates of bat fatality rates per MW account for the growing area of covered by blades. Current estimates of bat fatality rates per MW in the entire U.S. range from 0.9 – 43.2 bats / MW / year, with an average of 3.4. In the Pacific Northwest and the Rocky Mountains, bats fatalities / MW / year have ranged from 0.8 – 2.2 / MW / Year with an average of 1.8. Most of the bat casualties at windpower facilities to date are migratory species that conduct long migrations between summer roosts and winter hibernacula. Examples of these species commonly found as fatalities at windpower facilities include hoary bats, silver-haired bats and eastern red bats. The causes of the relatively high number of migratory bat deaths at windpower facilities are not well understood. Some have suggested it may be related to the lack or reduction of echolocation during migration (Johnson 2003), while others have suggested wing loading of these species as a potential factor (Fiedler 2004). Furthermore, strong field methods to provide quantitative predictions of migratory bat use are lacking. Due to a lack of information concerning bat migration habits, it is difficult to predict if the proposed project area is located within a bat migration corridor.

The proposed project will likely result in the mortality of some bat species, including red bats, hoary bats and silver-haired bats. The magnitude of these fatalities and the degree to which other bats species will be affected is difficult to determine. A number of large ponderosa pine snags are present in the project area, providing potential roost sites for breeding and non-breeding bats. If patterns of bat casualties follow those observed at other windpower projects, the majority of the bat species killed are likely to be long distance migrants such as hoary bat, silver-haired bat and red bat.

Although potential future mortality of migratory bats is difficult to predict, an estimate can be calculated based on levels of mortality documented at other wind plants. Windpower projects in Oregon and Wyoming have resulted in estimated yearly bat mortality rates ranging from 0.40 per turbine to 3.21 per turbine or 0.8 – 2.2 / MW / Year. Habitats found in other windpower projects in the midwest and east are quite different than in the west, and applying mortality estimates from eastern windpower projects to the proposed project may not be reflect the actual mortality rates at the proposed project. Using the estimates from other wind plants in the west, construction of 20 turbines could result in a total yearly number of bat fatalities of approximately 1 – 65 fatalities on a per turbine basis, assuming the proposed project falls within the observed range of fatalities at other windpower projects on per turbine basis. Using fatality estimates on a per MW basis, from 24 – 66 total bat fatalities per year may be expected. Actual levels of mortality are unknown and could be higher or lower depending on regional migratory patterns of bats, patterns of local movements through the area, and the response of bats to turbines, individually and collectively. The significance of this impact is hard to predict since there is very little information available regarding bat populations. While most bat species documented as fatalities at windpower projects are long distance migrants, Fiedler (2004) found eastern pipistrelles, a resident bat species not known for long distance migrations, to make up 24% of bat carcasses found in Tennessee. Researchers have found that resident species were not found as turbine fatalities in proportion to their use of the project areas (Johnson *et al.* 2002, Gruver 2002, and Fiedler 2004). Based on available data, bat species exhibiting long distance migratory patterns are more at risk to turbine collision; however, some resident species may also be at risk.

The proposed project contains a relatively high density of snags and some mature ponderosa pine forest, providing potential breeding and resting sites for bat species. The potential exists for active breeding roosts to be destroyed as snags are removed during construction. If snags are removed outside of the breeding season, bats will choose other snags for roost sites and no active breeding roost sites will be disturbed.

Big Game

The proposed project is expected to have limited impact to big game species. Due to relatively high and yearlong hunting pressure on the reservation, big game populations are relatively low. Only six mule deer and four pronghorn were observed during surveys.

Two published studies of big game winter use may be relevant to the development of wind turbines and wintering elk (Rost and Bailey 1979, Van Dyke and Klein 1996). Van Dyke and Klein (1996) documented elk movements through the use of radio telemetry before, during, and after the installation of a single oil well within an area used year round by elk. Drilling activities during their study ceased by November 15, however, maintenance activities continued throughout the year. Elk showed no shifts in home range between the pre and post drilling periods, however, elk shifted core use areas out of view from the drill pad during the drilling and post drilling periods. Elk also increased the intensity of use in core areas after drilling and slightly reduced the total amount of range used. It was not clear if the avoidance of the well site during the post-drilling period was related to maintenance activities or to the use of a new road by hunters and recreationalists. The authors concluded that if drilling activities occupy a relatively small amount of elk home ranges, that elk are able to compensate by shifting areas of use within home ranges.

While several authors have documented elk avoiding roads within forested environments during the summer, the effects of roads and associated human activity on wintering elk and mule deer have not been well documented. Rost and Bailey (1979) found that wintering mule deer and elk avoided areas within 200 m of roads in eastern portions of their Colorado study area, where presumably greater amounts of winter habitat were present. Road avoidance was greater where roads were more traveled. Only mule deer showed a clear avoidance of roads in the western portion of their study area, where winter range was assumed to be more limiting. Mule deer also showed greater avoidance of roads in shrub habitats versus more forested areas. The authors concluded that impacts of roads depended on the availability of suitable winter range away from roads, as well as the amount of traffic associated with roads.

There is limited information regarding wind plant effects on big game species. At the Foote Creek Rim wind project in Wyoming, pronghorn observed during raptor use surveys were recorded year round (Johnson *et al.* 2000b). The mean number of pronghorn observed at the six survey points was 1.07 prior to construction of the wind plant and 1.59 and 1.14/ 40 minute point count during the two years immediately following construction, indicating no reduction in use of the immediate area. Mule deer and elk also occurred at Foote Creek Rim, but their numbers were so low that meaningful data on wind plant avoidance could not be collected.

The potential effects of wind plant development on mule deer are even less well known. Rost and Bailey (1979) showed that wintering mule deer in Colorado avoided a well-used road by 200 m. During the construction period, deer would likely be temporarily displaced from the project site due to the influx of humans and heavy construction equipment and associated noise and disturbance. Temporary loss of habitat from project construction is considered a minor impact due the low number of mule deer that use the project area and the vast expanse of suitable habitat for mule deer in the region. There will be intermittent disturbances from vehicle and human traffic during regular operations and maintenance (O&M) of the facility and also from turbine noise output and shadow flicker of moving blades. It is unknown if the level of traffic associated with O&M activities of the wind plant will reach mule deer tolerance thresholds. However, if at times thresholds are surpassed, it is expected that mule deer will be displaced away from roads in the project area. In any event, should the facility result in a redistribution of deer in the area, it is likely that, over time, a portion of the population would become habituated to noise, human disturbance, and shadow flicker associated with the operating wind plant and repopulate areas within the project.

Van Dyke and Klein (1996) report that wintering elk shifted use of core areas out of view of human related activities associated with an oil well and access road. During spring, Wisdom *et al.* (2002) suggest that elk habitat selection may be negatively related to traffic and other human disturbance. However, Van Dyke and Klein (1996) concluded that if drilling activities occupy a relatively small amount of elk home ranges, elk are able to compensate by shifting areas of use within home ranges. If elk occur within the project area, elk may shift use within their home range away from the proposed windpower project.

Reptiles and Amphibians

Construction of the wind project may affect reptiles and amphibians on site through loss of habitat and direct mortality of individuals occurring in construction zones. The level of mortality associated with construction would be based on the abundance of the species on site. Some mortality may be expected as common reptiles such as short-horned lizards often retreat to underground burrows for cover or during periods of winter dormancy. Excavation for turbine pads, roads, or other wind project facilities could kill individuals in underground burrows. While above ground, species such as the terrestrial garter snake and milk snake are generally mobile enough to escape construction equipment, however, short-horned lizards do not move fast over long distances and rely heavily on camouflage for predator avoidance. Some individual lizard fatalities can be expected from vehicle activity. Impacts are expected to be very low and not significant.

Threatened, Endangered and Sensitive Wildlife Species

Threatened, Endangered and Sensitive Species

Due to the lack of prairie dogs in the project area, it is highly unlikely the black-footed ferret will occur and no impacts to this species are expected. No bald eagles were observed during baseline studies. Although the potential exists for bald eagles to occasionally fly through the project area, overall use of the project area is very low based on the lack of observations during baseline studies. Due to the overall lack of use of the project area, the risk of turbine collisions is very low for bald eagles, and no impacts to this species should occur.

Sensitive Species

Of the 25 species of concern potentially occurring in the project, six avian species and a mammal species were observed on site during surveys, including Cassin's kingbird, golden eagle, grasshopper sparrow, Lewis's woodpecker, red-headed woodpecker, upland sandpiper, and black-tailed prairie dog. With the exception of Lewis's woodpecker and red-headed woodpecker, most sensitive bird species were observed in the project area infrequently. Impacts to these species are expected to be minimal due to the low use of the project area.

Both the Lewis's woodpecker and red-headed woodpecker were observed regularly during the summer. Both species utilized snags in the open areas and mature ponderosa pine for nesting and foraging. Due to the relatively low flight heights of these species, there is little risk of the species colliding with turbine blades. However, both species have the potential to be impacted indirectly by the proposed project. Most of the proposed turbine locations are in previously burned areas that contain a relatively high density of snags. If construction takes place during the summer, the potential exists for a few nests to be destroyed during construction as snags are removed for turbines and access roads. However, due to the relatively small acreage that will be physically impacted by the proposed project, no impacts to populations of these species should occur. Some loss of potential nesting habitat will occur, however, previously burned ponderosa pine forest is common throughout the Northern Cheyenne Reservation.

The Project is located within the potential range of the following bat species considered sensitive by the MNHP: eastern red bat, pallid bat, Townsend's big-eared bat, fringed myotis, and spotted bat. Of these species, the red bat is considered highly migratory, and has been documented as fatalities at other windpower projects. The potential exists for red bats migrating through the project area to be at risk of turbine collision. All of the other bat species may migrate locally, but do not conduct the mass, long distance movements of the red bat.

The pallid bat, Townsend's big-eared bat, fringed myotis and spotted bat all form maternity colonies and day or night roosts on caves or rock crevices. No potential maternity colony habitat is present on ridges proposed for turbine development; however, some rock faces are present approximately 1.2 km (¾ mile) north of potential turbine locations; these will not be disturbed by the project. The pallid bat may also form day or night roosts within snags. The proposed project may impact temporary day or night roosts, but no pallid bat maternity colonies will be impacted by the proposed project.

The red bat may form maternity colonies and day or night roosts within snags or forested areas. Some snags in the project area will be removed during construction, and the potential exists for an active maternity colony to be destroyed if tree removal occurs during the breeding season. If a red bat colony is located near proposed turbine locations, bats using the colony may be at greater risk of collision.

Impacts of the Alternatives

No impacts are expected.

Cumulative Impacts

At this time, there is little development planned on the Northern Cheyenne Reservation. The proposed windpower project is the largest potential development project in the near future. Once the project is built, the potential exists for future project expansion on the ridge immediately west of the proposed turbine locations. Our assessment of cumulative impacts to wildlife will be limited to the potential expansion of the proposed windpower project.

Impacts of any expansion of the proposed windpower project will be very similar to impacts predicted for the proposed project, including direct mortality of birds and bats, and indirect displacement impacts to wildlife, especially sharp-tailed grouse. Future expansion would increase the annual fatality rates of birds on the Northern Cheyenne Reservation. Considering the relatively low fatality rates for birds observed at other windpower projects (an average of 2.3 birds per turbine per year), expansion of the proposed project would increase the total number of avian fatalities, however, these rates are not expected to have a significant impact to bird populations on the Reservation. The number of bat fatlities would also increase with any future expansion of the project. Bats impacted by future expansion are expected to be long distance migrants, and breeding populations of local bats are not expected to be greatly impacted. The cumulative impact of future expansion on migratory bats is difficult to predict considering the current lack of knowledge of bat populations in the U.S. The number of migratory bat fatalities will increase with future expansion, however, it is not known if the number of fatalities will result in a significant population decline.

Indirect impacts to wildlife are expected to increase with any future expansion. The species with perhaps the greatest potential for impact is the sharp-tailed grouse. Currently, one active lek is located on the ridge immediately west of the proposed project area. Development of turbines within the boundary of the current lek site has the potential to negatively impact the breeding activities of female sharp-tailed grouse. Additionally, based on current research, it is unclear if sharp-tailed grouse will avoid areas with turbines due to the presence of tall vertical structures. Although not certain, the future expansion of the proposed project has the potential to negatively impact sharp-tailed grouse populations in the area.

Mitigation Measures

Mitigation and monitoring measures that have been implemented at other, newer-generation wind plants, represent possible mitigation measures for the proposed project.

<u>Technical Advisory Committee</u>

A Technical Advisory Committee (TAC) would be formed to implement and evaluate a mitigation and monitoring program and determine the need for further studies or mitigation measures once the project is operational. The TAC would be composed of representatives from The Northern Cheyenne Tribe, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and other affected interests. The role of the TAC would be to determine and coordinate appropriate mitigation measures, monitor impacts to wildlife and vegetation, and address issues that arise regarding wildlife impacts during operation of the wind plant.

<u>Other Mitigation Actions</u>

The primary impacts associated with the project are expected to be loss of habitat, fatalities of birds and bats, and potential displacement effects on sharp-tailed grouse. The following are potential mitigation measures for these impacts:

- The overall design of the wind plant would minimize perching opportunities for raptors and other birds, for example, tubular towers would be used for the turbines and met towers and use of overhead powerlines in the project would be minimized.
- Where possible turbines should be placed away from rim edges in order to reduce potential American kestrel and raptor fatalities.
- During project construction, best management practices could be employed to reduce peripheral impacts to adjacent native vegetation and habitats and to minimize the construction footprint.
- A site management plan could be developed to, at a minimum, identify sensitive wildlife areas (e.g., raptor nests), provide adequate on-site waste disposal, and establish fire management and erosion control procedures.
- Raptor nests within ½ mile of construction areas could be monitored for activity prior to construction to determine the need for construction timing restrictions around active nests.
- All power and communication lines on-site could be buried underground where feasible.
- All overhead power line poles could be equipped with anti perching devices.
- No guy wires should be used on permanent metrological towers in order to reduce bird fatalities.
- Place turbines as far from rim edges as possible to reduce risks to birds utilizing updrafts

<u>Monitoring</u>

A post-construction monitoring study is typically implemented to quantify project impacts to avian and bat species and assess the need for additional mitigation measures. The post-construction monitoring plan should be developed in coordination with the TAC. The monitoring plan for the project should, at a minimum, contain the following components:

- One year of standardized fatality monitoring involving carcass searches, scavenger removal trials, and searcher efficiency trials.
- 2-3 years of monitoring of sharp-tailed grouse leks within the project area
- A standardized procedure for O&M personnel instructing how to report incidental fatalities or injured birds for the life of the project.

The protocol for the fatality monitoring study should be similar to protocols used at other, newer-generation wind plants across the western U.S. In addition, consideration could be given to developing, in cooperation with other industry participants, a focused monitoring study that addresses a specific question regarding impacts from wind plants. For example, investigate the impact of the facility on sharp-tailed grouse.

Such a study would be intended to provide information useful for future wind power planning and permitting, but would not affect mitigation requirements for the Northern Cheyenne project.

Fish

Affected Environment

Fish Habitat and Species Present

The ridges proposed for development do not contain any waterbodies or streams, and no perennial streams are expected to be impacted. A few drainages begin in the project area, and during strong precipitation events, eventually drain in to streams and the Tongue River. The Tounge River is a perennial waterbody that supports fish populations. The closest fish bearing waterbodies occur approximately 3 miles southwest of the proposed project area at the Crazy Head Springs. Approximately five 1/2 to 2 acre fish ponds are present there.

Impacts of the Proposed Action

Due to the lack of waterbodies in the proposed development area, the proposed windpower project is not expected to impact fish populations.

Cumulative Impacts

No cumulative impacts to fish populations are expected to occur.

Mitigation Measures

The project would be designed to use existing roads where possible. Best Management Practices (BMPs) would be initiated to minimize impacts to fisheries resources located downstream from the project area. BMPs would be initiated to retain sediment from disturbed areas and minimize areas of disturbance. Mitigation measures would include replacement of any riparian or wetland areas impacted by the project.

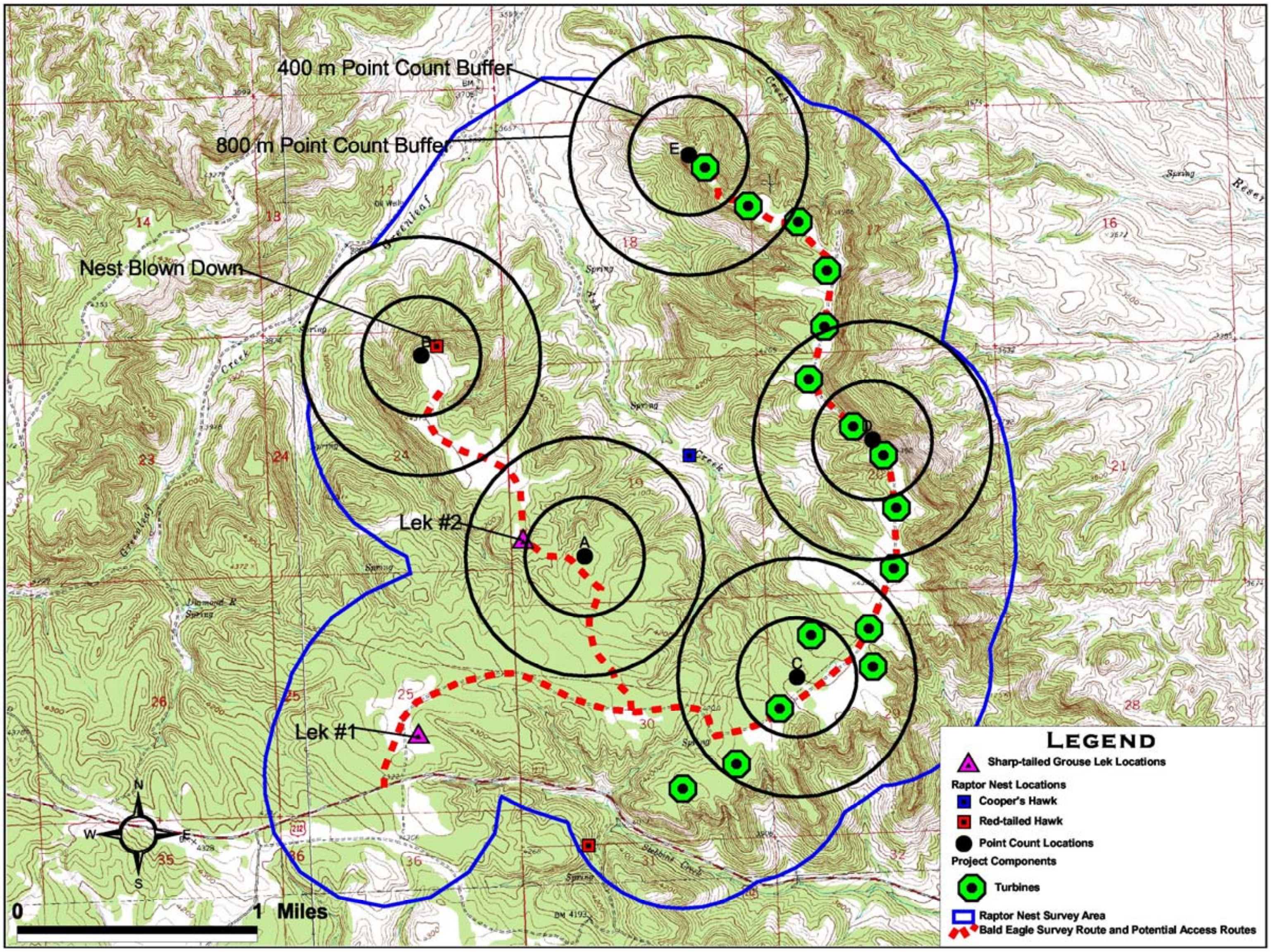

Figure 9. Locations of surveys, raptor nests and sharp-tailed grouse leks in the proposed project area.

Botanical

Affected Environment

General Vegetation Communities

The project area is located within the Missouri Plateau section of the Great Plains Physiographic Province, characterized as an upland plain interrupted by tablelands, drainageways, streams and rivers (Hansen and Hoffman, 1988). The upland plain consists of vast grasslands, while the tablelands and escarpments are commonly covered with Ponderosa pine woodlands with grassland species providing much of the understory vegetation. Riparian forests typically dominate the drainage-ways, streams, and rivers.

They project area is within a Ponderosa pine forest on an upland plateau on the Northern Cheyenne Indian Reservation. Large forest fires swept through the reservation in the late 1980s and early 1990s, including portions of the project area, resulting in the destruction of 60,000 acres of timber (Northern Cheyenne Tribe 2002). Portions of the project area were burned in the 1988 Early Bird fire. As a result, much of the timber in the project area has been salvage cut. Vegetation types were mapped in 2004 for the project area at a scale of approximately 1 inch = 1,800 feet using 1996 black and white aerial photography, followed by field-verification. The "project area" for vegetation mapping purposes consisted of an approximately 1-mile boundary around all project facilities, for a total area of approximately 5,450 acres. Due to the scale of the aerial photos used, fine-scale intermingling in transition areas and small inclusions of one habitat type within another are not shown. The mapped boundaries of each habitat type were digitized using ArcView™. Vegetation types were considered to be the generally recognizable assemblages of plant species that occur in a pattern across the landscape. The following vegetation types were mapped in the project:

- ***Ponderosa Pine***: Ponderosa pine (*Pinus ponderosa*) forest is the predominant vegetation type, accounting for 92 percent of the project area (approximately 5, 020 acres). Most of the ponderosa pine forest (68 percent of the project area) was burned during the fires of the late 1980's and early 1990's and later salvaged-logged. Young ponderosa pines are common in the burn area, along with snags, stumps, downed timber and smaller woody vegetatin. Unburned forest is primarily found on the slopes on the south and east side of the project area and other isolated pockets. Ponderosa pine is the dominant overstory species; a variety of shrubs are scattered in the understory, including wild rose (*Rosa arkansana*), snowberry (*Symphoricarpos occidentalis*), ninebark (*Physocarpus malvaceus*), skunkbrush (*Rhus trilobata*), and sagebrushes (*Artemisia tridentata, A. cana, A. ludoviciana, A. campestris*). Mixed grasses and forbs common to the northern Great Plains are found the understory such as blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), three awn (*Aristata purpurea*), little bluestem (*Schizachyrium scoparium*), thickspike whatgrass (*Elymus lanceolatus*), junegrass (*Koeleria cristata*), green needleandthread (*Stipa viridula*), stiff goldenrod (*Solidago rigida*), yarrow (*Achellia millefolium*), and hairy golden aster (*Chrysopsis villosa*).

- ***Aspen***: Scattered aspen (*Populus tremuloides*) stands are found in the project area, primarily on north-facing slopes in the higher elevations. Aspen dominate the overstory with mixed grasses and forbs in the understory. About 40 acres of aspen forest occur in the project area, or less than one percent.

- ***Riparian***: Riparian forests and shrublands are primarily associated with Ash Creek and a tributary, which bisects much of the project area and flows north out of the project area. Ash Creek is intermittent, with several springs located along the drainage. A small riparian area is also found in the southern end of the project area, associated with a spring that feeds an unnamed tributary to Stebbins Creek adjacent to Highway 212. Common tree species observed in the riparian forests include green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and cottonwood (*Populus deltoides*). The shrub layer includes hawthorn (*Crataegus columbiana*), chokecherry (*Prunus virginiana*), wild rose, snowberry, gooseberry (*Ribes lacustre*), and buffaloberry (*Shepherdia argentea*). Common herbaceous species observed in the understory include catnip (*Nepeta cateria*), tumble mustard (*Sisymbrium altissimum*), brome (*Bromus sp.*), prairie smoke (*Geum triflorum*), field pennycress (*Thlaspi arvense*), meadowrue (*Thalictrum dasycarpum*), morning glory (*Convolvulus arvensis*), and wild bergamot (*Monarda fistulosa*). The tributary to Ash Creek is a riparian shrubland, lacking a tree overstory. The riparian areas appear to receive frequent use by cattle and wildlife based on tracks and droppings observed during a July field visit. The riparian forests and shrublands are linear features in the project area and total 153 acres, or 2.8 percent of the project area.

- ***Sagebrush***: Sagebrush dominates a small portion of the project area at the northern end in the lower elevations. This type consists of approximately 180 acres, or 3.3 percent of the project area. Cattle and horses graze in this area. Big sagebrush (*Artemisia tridentata*) is the dominant species. Other species observed include cudweed sagewort (*Artemisia ludoviciana*), fringed sage (*Artemisia frigida*), snowberry, yarrow, yellow alyssum (*Alyssum alyssoides*), goatsbeard (*Tragopogon dubius*), western wheatgrass (*Agropyron smithii*), and brome.

- ***Grassland***: A small area dominated by grasses is found in the northern end of the project area in the lower elevations at the confluence of Ash Creek and Greenleaf Creek. This type makes up less than one percent of the project area, totaling approximately 26 acres. Cattle and horses graze in this area. Common grasses include western wheatgrass and brome; forbs observed include yarrow, yellow alyssum, field pennycress. Scattered shrubs (wild rose, cudweed sagewort, and fringed sage) also occur.

- ***Rock outcrop***: This type includes rocky areas on side slopes that have little vegetative cover. This type is found in the northern end of the project area and consists of approximately 36 acres, or less than one percent of the project area.

A list of plant species observed during July and October field visits is shown in Table X. This table also lists traditional cultural plant uses by the Northern Cheyenne tribe. This information was obtained from a report prepared by the Northern Cheyenne tribe about the tribe and its reservation (Northern Cheyenne Tribe 2002), and from a list of culturally significant wetland plant species provided by Frank Rollefson, Wetlands Conservation Coordinator, of the Northern Cheyenne Tribe (Rollefson, pers. comm. 2004).

Table 7. Table X. Plant species observed in the project area and their traditional cultural uses.

Scientific Name	Common Name	Uses
Acer negundo	boxelder	ceremonial, ritual
Achellia millifolium	yarrow	medicinal (plant-cough, throat irritation, styptic, colds, nausea)
Agropyron sp.	wheatgrass	food (fruit)
Agropyron smithii	western wheatgrass	food (fruit)
Alyssum alyssoides	yellow alyssum	
Ambrosia artemisifolia	ragweed	medicinal (leaves and stems–bowel cramps, bloody stool, colds, constipation)
Antennaria parvifolia	pussytoes	
Aristita longiseta	threeawn	
Artemisia campestris	green sagewort	
Artemisia cana	silver sagebrush	
Artemisia frigida	fringed sage	medicinal (various–herbage), religious (purify-herbage), industrial (various-herbage), horse medicine (plant), food (leaves)

Scientific Name	Common Name	Uses
Artemisia ludoviciana	cudweed sagewort	Man Sage ceremonial (incense when mixed with *Actea rubra*, purification, favored by Contrary Warriors, drive away bad spirits, fasting beds), Sundance and Standing Against Thunder ceremony, medicinal (leaves-snuff for sinus attacks, nosebleeds, headaches)
Artemisia tridentate	big sagebrush	food (flavoring-leaves), medicinal (respitory-herbage), horse medicine (herbage)
Astragalus sp.	milkvetch	
Balsamorhiza sagittata	balsamroot	food (flower stem, root, seeds), medicinal (various-root, leaves), religious (incense-root)
Bouteloua curtependula	sideoats grama	
Bouteloua gracilis	blue grama	
Bromus ciliatus	fringed brome	
Bromus sp.	brome	
Bromus tectorum	cheatgrass	
Carex rostrata	beaked sedge	ceremonial
Chrysopsis villosa	hairy golden aster	medicinal (tops and stems-soothing tea, tonic), ceremonial (incense to drive evil spirits from people/homes-no special ceremony)
Chrysothamnus nauseosus	rabbitbrush	medicinal (leaves and stems-itch, smallpox, mixed w/ sage-colds, coughs, tuberculosis) ceremonial (leaf and branch-relieve nightmare)
Cirsium undulatum	wavyleaf thistle	food
Convolvulus arvensis	field bindweed	
Crataegus columbiana	hawthorne	food (berry) medicinal (weak heart)
Cynoglossum officanale	houndstongue	
Deschampsia cespitosa	tufted hair grass	
Descuriana pinnata	tansymustard	

Scientific Name	Common Name	Uses
Echinacea angustifolia	coneflower	medicinal (leaves and root-sore mouth and gums, sore neck, toothache, rheumatism, arthritis, mumps, measles; root-mixed w/ *Mentzelia laevicaulis*-smallpox; mixed w/ *Lycoperdon sp.* and skunk oils-boils), ceremonial (root-stimulated salvation for participants in the Sundance)
Eleocharis palustris	spike rush	food; industrial (plant-basket making)
Elymus canadensis	wildrye	
Elymus lanceolatus	thickspike wheatgrass	
Epilobium sp.	willow herb	
Festuca idahoensis	Idaho fescus	
Fraxinus pennsylvanica	green ash	industrial (wood-wood products), ceremonial (wood-Sundance lodge), ritual
Geranium richardsonii	white geranium	medicinal (leaf, root-nosebleed)
Geum triflorum	prairie smoke	
Glyceria grandis		
Glycyrrhiza lepidota	wild licorice	medicinal (root and leaves-diarrhea, upset stomach, various), ceremonial (root-used to cool mouth during Sundance), religious (root-Sundance sweatlodge), food (stem), horse medicine (root)
Grindelia squarrosa	curly cup gumweed	medicinal (flower-skin disease, scabs, sores; gummy residue-eye medicine, snowblindness; plant, flower-various), horse medicine (plant)
Helianthus pauciflorus	stiff sunflower	
Koeleria cristata	June grass	ritual (when plant blooms determines when Sundance starts)
Lemna minor	duckweed	
Linum lewisii	flax	

Scientific Name	Common Name	Uses
Lygodesmia juncea	rush skeletonplant	medicinal (stems-promotes lactation, healthy fetus development, smallpox, measles; plant-respiratory, digestive, various others), food (sap-flavoring), horse medicine (plant), industrial (various)
Mahonia repens	Oregon grape	food (berries), ritual (yellow dye)
Medicago lupulina	black medick	
Mimulus guttatus	monkeyflower	
Monarda fistulosa	wild bergamot	medicinal (herbage, root-various), industrial (leaves-perfume, deodorant, insect repellant; flower-spoon/straw), ritual (puberty)
Nasturtium officinale	water plant	food (entire plant), medicinal (diuretic, skin irritations, liver)
Nepeta cataria	catnip	
Onosmodium molle	false gromwell	medicinal (leaves and stems-restore feeling to numb area, lumbago)
Oryzopsis hymenoxis	Indian rice grass	
Phlox hoodii	Hood's phlox	
Physocarpus malvaceus	ninebark	
Pinus ponderosa	Ponderosa pine	cultural uses; resin used as telepathic chewing gum to transmit thoughts from recipient to giver
Poa secunda	Sandberg's bluegrass	
Poa sp.	blue grass	
Polygonum lapathifolium	pale smartweed	
Populus deltoids	cottonwood	domestic (wood-fire, shelter), industrial (bark-cordage), food (inner bark-human, twigs-horses), ceremonial (Sundance lodge), ritual
Populus tremuloides	aspen	medicinal (bark-ruptures, birth, general), industrial, religious (logs-Sundance lodge), horse medicine (bark), food (cambium), ritual
Potentilla arguta	tall cinquefoil	

Scientific Name	Common Name	Uses
Prunus virginiana	chokecherry	medicinal (bark, berry-various), food (berry), industrial (wood-wood products, sap-glue), ritual
Pseudoroginera spicata	bluebunch wheatgrass	
Ranunculus sp.	buttercup	
Ratibida columnifera	prairie coneflower	medicinal (leaves and stems-snakebite, pain, poison ivy; tops-stomachache), horse medicine (plant)
Rhus trilobata	skunkbush	industrial (leaf-smoking/tobacco)
Ribes lacustre	gooseberry	food (berry)
Rosa arkansana	wild rose	medicinal (vitamin C)
Rumex crispus	curlydock	food, industrial (leaves, stems-yellow dye), medicinal (roots-poultice, lungs)
Schizachyrium scoparium	little blue stem	
Shepherdia argentea	buffaloberry	food (berry), medicinal (bark-ophthalmic, berry-digestive)
Sisymbrium altissimum	tumble mustard	
Sitanion hystrix	squirreltail	
Solidago mollis	soft goldenrod	medicinal
Solidago rigida	stiff goldenrod	
Sorghastrum nutans	Indiangrass	
Stipa viridula	green needleandthread	
Symphoricarpos occidentalis	snowberry	religious (Medicine Lodge alter)
Taraxcum officinale	dandelion	medicinal (liver, digestion, diuretic, diabetes), food (salad green)
Thalictrum dasycarpum	meadowrue	
Thlaspi arvense	field pennycress	
Tragopogon dubius	goatsbeard	
Trifolium sp.	clover	
Verbascum thapsus	mullien	medicinal (ear ache, lungs)
Veronica americana	American speedwell	
Yucca glauca	yucca	industrial (cosmetic), medicinal (roots-anti-inflammatory, hair loss, various), horse medicine (plant)

Noxious Weeds

The Rosebud County Weed District lists ten Category 1 noxious weeds that could occur in the county. Category 1 noxious weeds are weeds that are currently established and generally widespread. These include:

- Leafy spurge
- Russian knapweed
- Field bindweed
- Diffuse knapweed
- Common St. Johnswort
- White top
- Canada thistle
- Spotted knapweed
- Dalmation toadflax
- Sulfur cinquefoil

One of the ten listed noxious weeds was found in the project area, field bindweed. This species was not common and was observed only scattered along the edges of the roads.

In a recent report on the Northern Cheyenne Tribe and Its Reservation, the tribe notes that the three noxious weed species of most concern on the Reservation are Russian knapweed, spotted knapweed, and leafy spurge (Northern Cheyenne Tribe 2002). Canada thistle is also widespread, but not as threatening as the above-mentioned weeds. None of these species were observed in the project area during July and October 2004 field visits.

<u>Sensitive Plant Species</u>
No federally-listed plant species are known to occur in Rosebud County. The Montana Natural Heritage Program lists five plant species of state concern that occur in the county including lead plant (*Amorpha canescens*), narrowleaf milkweed (*Asclepias stenophylla*), Barr's milkvetch (*Astragalus barrii*), pregnant sedge (*Carex gravida*), and Plains phlox (*Phlox andicola*). None of these species were observed during field visits in July and October 2004, however Barr's milkvetch and Plains phlox are only identifiable during their flowering periods, which is late April to mid June for Barr's milkvetch and May to early June for Plains phlox.

Lead plant occurs in dry, well-drained prairie habitats and is considered a Great Plains species. It is listed as a species of concern in Montana because it is at the outer margins of its contiguous range. This species is unlikely to occur in the project area because the project area does not contain prairie habitat.

Narrowleaf milkweed occurs in sandy soils of prairies and open pine woodlands. Like the lead plant it is considered a Great Plains species and is listed as a species of concern in Montana because it is at the outer margins of its contiguous range. This species could occur in the project area because the project area has suitable habitat, but none were observed during July and October field visits. Its flowering period overlaps with the July field visit and would likely have been identifiable during the visit.

Barr's milkvetch occurs on sparsely vegetated knobs and buttes, usually with dry, fine-textured, often calcareous soils. Scattered Ponderosa pine and Rocky Mountain juniper, or a sparse shrub cover of big sagebrush and/or shadscale, often characterize these habitats. The environmental conditions associated with Barr's milkvetch are typical of badland areas, with limited rainfall and high light intensities. This species is a regional endemic, known only from southwestern South Dakota, northeastern Wyoming, Nebraska, and southeastern Montana. This species is unlikely to occur in the project area because the project area does not contain suitable habitat.

In Montana, pregnant sedge is most often found in green ash ravines and wooded draws. In the eastern United States, it is a widespread species in moist prairies and woodlands, but is listed as a species of concern in Montana because it is at the outer margins of its contiguous range. This species could occur in the project area because suitable habitat is available, however the riparian habitats in the project area are not near any proposed project facility.

Plains phlox occupies a wide range of habitats; in Montana it is known mainly from sandy soils in grasslands and Ponderosa pine woodland. Like lead plant and narrowleaf milkweed, Plains phlox is a Great Plains species and is listed as a species of concern in Montana because it is at the outer margins of its contiguous range. This species is unlikely to be found in the project area because it is most often associated with sandy soils, including erosional blowouts and loose sand below sandstone outcrops, which is not typical of the project area.

X.2 Impacts

No Action. No impacts to vegetation (including noxious weeds and sensitive species) are expected under the No Action alternative.

Proposed Action.

General Vegetation Communities

Impacts to vegetation would include both temporary, construction-related impacts and permanent impacts in those areas where project facilities are located. Temporary impacts include:

- temporary removal of the vegetation
- possible erosion of disturbed soils

Permanent project impacts include:

- replacement of vegetative cover with project facilities
- potential for soil erosion

Table XX summarizes the amount of temporary and permanent impacts to vegetation types in the project area. Two of the eight habitat types mapped in the project area would be affected; affected habitat types are ponderosa pine forest and the sub-type ponderosa pine forest that has been burned and salvage logged. The other habitat types would not be impacted by project facilities, either temporarily or permanently. A total of approximately 22.7 acres would be permanently impacted, with the majority (15.6 acres or 69 percent) in the burned area and 7.1 acres (31 percent) in the unburned Ponderosa pine forest. An additional 117.6 acres would be temporarily disturbed; 84.3 acres (72 percent) in the burned area and 33.3 acres (28 percent) in the unburned Ponderosa pine forest. Most of the impact is associated with upgrading the access road and the service roads. A breakdown of permanent and temporary impacts by vegetation type is shown in Table XX. It should be noted that the impact calculations shown are estimates of actual impacts since the final project layout has not yet been finalized. The final layout will be based on the type and size of turbines available at the time of construction, which could be as few as 10 3MW turbines or as many as 30 1 MW turbines, as well as other factors such as topography and setback requirements. An intermediate layout assuming 20 1.5 MW turbines was used for the impacts calculations.

Table 8. Summary of Impacts to Vegetation Types by Project Facility.

		Area Impacted (acres)	
Project Facility	Vegetation Type	Permanent	Temporary
Wind Turbines[1]	Ponderosa pine - burn	0.9	45.0
	Ponderosa pine	0.3	15.0
Permanent Meteorological Towers[2]	Ponderosa pine - burn	0.1	0.1
	Ponderosa pine	0.1	0.1
Access Road[3]	Ponderosa pine - burn	10.7	25.2
	Ponderosa pine	5.0	11.4
Service Roads[4]	Ponderosa pine - burn	2.8	8.5
	Ponderosa pine	1.7	4.6
Electrical Collection and Communication Systems[5]	Ponderosa pine - burn	0	4.4
	Ponderosa pine	0	2.2
Substation[6]	Ponderosa pine - burn	1.0	1.0
Control Building[7]	Ponderosa pine - burn	<0.1	<0.1
TOTAL		22.7	117.6

[1] Assumes 2,600 sq ft permanent disturbance per turbine based on the spread footing design for the turbine foundation (50' x 50') plus 100 sq ft per turbine for pad-mounted transformer. Assumes 3 acres of temporary disturbance per turbine for construction and lay-down staging area. Assumes a 20-turbine layout; however larger turbines may be used if available at the time of construction thus requiring fewer total turbines.

[2] Assumes a 50' x 50' area of permanent and temporary impact per meteorological tower, 2 towers total. Specific siting has not been determined for the permanent meteorological towers but they will generally be located at the northern-most and southern-most ends of the turbine string. Impacts are based on these general localities.

[3] Assumes upgrading the existing Garfield Peak road with gravel or riverbed stone. Assumes a 35-foot road width for temporary impacts, and 15-foot road width for permanent impacts.

[4] Service roads are spur roads from the Garfield Peak road to individual turbines. The number of spur roads is based on the 20-turbine layout; however larger turbines may be used if available at the time of construction thus requiring fewer total turbines and fewer spur roads. Assumes a 35-foot road width for temporary impacts and 12-foot road width for permanent impacts. Spur roads will be maintained as two-track roads.

[5] Both the electrical collection lines and communication lines will be underground and will utilize the same trench; the trench will be located adjacent to the access road. Assumes a 4-foot wide trench for temporary impacts and no permanent impacts due to reclamation of the trench.

[6] Assumes 1 acre of impact (both temporary and permanent) for the substation. Actual siting of the substation has not been determined, but it will be located in the NW1/4 Section 29 T2N R43E adjacent to the existing 69kV line.

[7] Assumes 300 sq ft for permanent impacts. The control building will be located adjacent to the substation.

NOTE: Several facilities have not yet been sited, therefore the vegetation impacts cannot be determined. These facilities include the permanent meteorological towers, the O&M facility, and the construction staging areas.

The proposed project includes reclamation of disturbed areas immediately after construction. Topsoil would be salvaged during construction and replaced on disturbed areas once construction is complete. Steep slopes and erodible soils would be stabilized using the NCT Water Quality and EPA recommended Best Management Practices (BMPs). Ruts and vehicle tracks would be scarified to the original topography. All disturbed area would be reseeded using native vegetation. Decommissioning would follow the same reclamation practices.

Impacts to vegetation are not considered significant because they would not result in any of the following:

- The elimination of an entire vegetation type in the project area;
- Impacts to sensitive species or habitats; or
- A decrease in species richness resulting from the loss of a plant population in the project area.

Noxious Weeds
Most noxious weeds are aggressive pioneer species that have a strong competitive advantage over other species on disturbed sites. Therefore, all areas disturbed by the project are potential habitat for noxious and invasive species, particularly for Russian knapweed, spotted knapweed, and leafy spurge, which are of concern on the Reservation, and field bindweed, which was observed in the project area. Vehicles entering the project area during construction can transport new weed seeds that can readily invade disturbed areas.

Once established in an area, negative impacts from noxious weeds can include the following, depending on the species, degree of invasion, and control measures:

- loss of wildlife habitat;
- alteration of wetland and riparian functions;
- reduction in livestock forage and crop production;
- displacement of native plant species;
- reduction in plant diversity;
- changes plant community functions;
- increased soil erosion and sedimentation;
- reduction in recreational value and use;
- control and eradication costs to local communities;
- reduction in land value (Sheley et al. 1998).

The degree of impact from noxious species largely depends on the implementation of control measures during and after construction.

According to a recent report on the Northern Cheyenne Tribe and Its Reservation, the Tribe has adopted a Noxious Weed Management Plan, which is now somewhat dated

(Northern Cheyenne Tribe 2002). It suggests general control of noxious weeds through biological, chemical, and integrated management techniques. As of 2002, the Tribe was in the process of inventorying weed species on the Reservation and selecting high value areas for rehabilitation.

The Montana Weed Control Association (MWCA) has additional information on the impacts and control of each listed noxious weed in Montana (www.mtweed.org). Field bindweed, the only listed noxious weed observed in the project area, is primarily problematic in cropland. The recommended control measures in non-cropland are chemical control methods.

Other noxious weeds of concern on the Reservation include Russian knapweed, spotted knapweed, and leafy spurge. According to the MWCA website, Russian knapweed is one of the most difficult perennial weeds to control, while spotted knapweed is generally easy to control. Both are best controlled through herbicide use. Biological control of various knapweed species has not been found to be successful in reducing established knapweed stands. Leafy spurge, a highly competitive plant, overruns and destroys grazing lands for cattle and horses, degrades wildlife habitat and wildlife-associated recreation, decreases rangeland plant diversity, threatens native plants, and reduces land values. Intensive, long-term, integrated management is necessary to reduce leafy spurge infestations. Five methods are used to mange leafy spurge: prevention, plant competition, physical control, biological control, and chemical control. The only effective management programs incorporate several or all of these methods. Leafy spurge control must be considered a long-term management program.

Sensitive Plant Species

Since no sensitive plant species have been found in the project area, impacts to these species are unlikely. Furthermore, the potential for impacts is lessened since the habitat that would be disturbed by the project is not suitable for most of the species of state concern. The only species of state concern that occurs in the habitat that would be disturbed by the project (Ponderosa pine forest) is the narrowleaf milkweed, and this species was not found during field visits to the project area. However, impacts could occur if undocumented individuals are present in the areas that are disturbed. If undocumented individuals are lost or disturbed, impacts to the species are not considered significant since the species is apparently secure range-wide, though it may be quite rare in parts of its range, and/or suspected to be declining. This plant is listed as a species of concern in Montana because it is at the outer margins of its contiguous range.

Mitigation Measures

The proposed project includes several measures to mitigate impacts to vegetation, such as immediate reclamation of disturbed areas, salvage of topsoil, and reseeding using native species. Additional recommended mitigation includes the following measures to be implemented during project construction to minimize impacts to vegetation:

- Require all equipment brought into the project area be washed prior to entry to minimize the potential for transporting weed seeds into the project area.
- All seed, straw, and hay used on the project should be free of noxious weeds.

Cumulative Impacts
At this time, there is little development planned on the Northern Cheyenne Reservation. The proposed windpower project is the largest potential development project in the near future. Once the project is built, the potential exists for future project expansion on the ridge immediately west of the proposed turbine locations. Our assessment of cumulative impacts to vegetation will be limited to the potential expansion of the proposed windpower project.

Cumulative impacts are defined as impacts that "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) undertakes such actions" (40 CFR 1508.7). The livestock grazing and logging practices that currently occur in the project area are likely to continue in the foreseeable future, and these activities will likely result in similar conditions as currently exist at the site. The areas of ponderosa pine forest that previously burned are likely to return to a forested condition over time. The potential expansion of the proposed project will occur within previously burned ponderosa pine forest, and there will be some additional loss of this habitat type. However, this habitat type is common on the Northern Cheyenne Reservation, and no significant cumulative impacts to vegetation should occur.

Cultural Resources

Michael Burney, consulting NCT Archaeologist, conducted a cultural resource investigation for the proposed site in December 2003. Baseline data was gathered for roughly half of the project area to accompany existing cultural resource studies conducted after the Early Bird Fire in 1988. The results of the cultural resource inventory are in appendix #. The investigation included a Class I file and literature search, a Class III (field) inventory, and an Ethnographic Overview.

Archaeological
The Area of Potential Affect (APE) of the project area as determined by the BIA, was approximately 650 acres. The Class III conducted by Burney inventoried 250 acres, and the remaining 300-acre area having been previously surveyed by the BIA in 1989 after the Early Bird Fire.

Two stacked circular rock features known as cairns were identified. These sites represent potential burial locations, fasting, vision questing, markers, or other functions (Burney 2003). The first site, Smithsonian number: 24RB1292, is an approximate $9m^2$ area of circular scoria stones ranging from less than 40cm to greater than 1 meter in length stacked to form a hollow structure about 3m in diameter with walls approximately 17cm thick and 40cm in height. At the time of the 1988 survey the feature was in relatively good and condition and intact although several scoria stones appeared to have fallen off of the walls (Keller 1989). Figure # identifies the location of this site in the SE1/4 of the SW1/4 of Sec 20 T2S R43E.

The second site 24RB2099 identified by Burney in 2003 was an oval-like rock formation approximately 5 meters E/W and 1.2 meters N/S. The cairn is composed of 45-50 small to medium size rocks ranging from 18-38-cm in height. The feature appeared to be intact and in very good condition at the time of the 2003 survey (Burney 2003). Figure # identifies this site in the SW1/4 of the NW1/4 of Sec 29 T2S R43E.

No subsurface testing was conducted for either site. However, both of these sites were recommended in Burney 2003 to be eligible for the National Register of Historic Places (NRHP) under criteria "d" in CFR 800 60.4, where historic and scientific significance could be identified to "have yielded, or may be likely to yield, information important to understanding history or prehistory". It is the final decision of the NCT and BIA whether to formally register these sites in NRHP. Neither site has been recorded.

Ethnographic

In addition to the physical archaeological surveys, several tribal elders were interviewed during the Burney survey for information regarding the past and present uses of the project area. The details of the interviews can be found in cultural report in appendix #. The interviews reviewed the primary use of this area to for good hunting. The Greenleaf Creek area northwest of the project area was known for piercing, and Native American Church activities and burials. The north-northeast area near Garfield Peak was once used as part of an organized native communication system where the Northern Cheyenne received word of the Battle of Little Big Horn in June of 1876 (Burney 2003).

Much of the sensitive cultural locations in the Greenleaf Creek area to the north north west of the project were severely impacted by the Early Bird Fire (Burney, 2003). The post fire survey reports indicated that past and present uses were for piercing, fasting, vision questing, Native American Church Lodges, burials, and ceremonial use e.g.: peyote site with a hearth and a tipi circle (Keller 1989 sited in Burney 2003).

Figure 10. Prayer cloth in an aspen stand in project area

At the time of the Burney survey several multi-colored prayer cloths were placed in the headwater spring of Stebbins Creek in the southwest corner of the project area (Figure #). Prayer cloths are considered to be ceremonial offerings with spiritual attributes or Important Spiritual Areas (ISA) and Contemporary Use Areas (CUA) figure#. Hot and cold springs are significant to native peoples and are considered potential spiritual locations (Burney 2003).

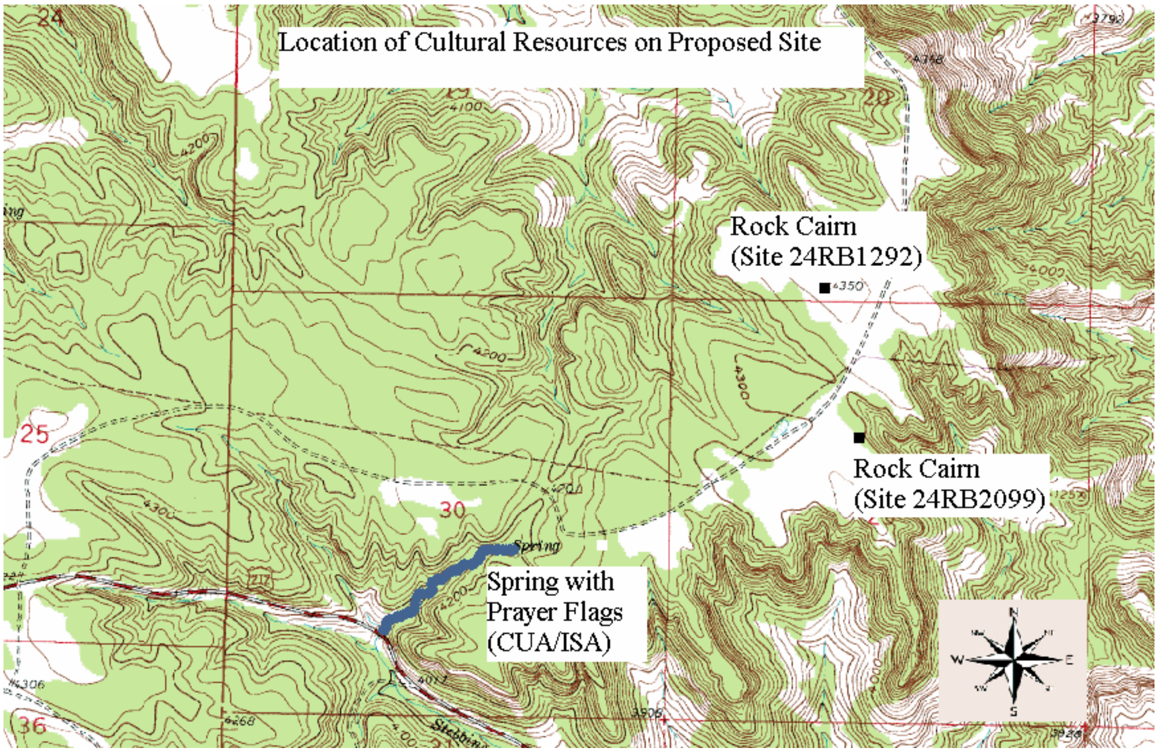

Figure 11. Approximate location of cultural resources identified in the cultural resource inventory

Traditional Cultural Plants

Surveys of traditional cultural plant species located on the project area were conducted in Late June and Mid October 2004. Table_insert table from botanical section indicates the species observed in the project area by Western EcoSystem Technology, Inc. The species list was compiled from a 2002 NCT report to the BLM (NCT 2002), as well as a list from Fran Rellefson NCT Wetlands Conservation Coordinator (Rollefson, Pers. Comm. 2004).

No Action Alternative

No ground disturbing activities would occur under the no action alternative, requiring no further action regarding the existing cultural resources at the proposed site related to the proposed wind project.

Cumulative Impacts

No cumulative impacts would occur as no project related ground-disturbing activities would occur under the no action alternative.

Proposed Action
Significant impact could occur if on of the historic sites or the prayer cloth area were disturbed by construction activities. The 30MW wind facility would be sited in a manner so as to avoid impacts to the sites identified in the cultural resource inventory. The Greenleaf Creek area that the cultural resource report identified to have the most recent historic cultural activities will be completely avoided because of the minimal wind resources associated with the low topographic characteristics of drainage areas.

Cumulative Impacts
In the event that the project is expanded a cultural resource investigation in compliance with Sec. 106 of NHPA would be conducted on any additional proposed lands. A successful project may generate more interest in wind power development within and among

Mitigations
To avoid adverse impacts to both the archaeological and ethnographic resources the THPO officer at the time of the cultural resource inventory (2003), Gilbert Brady, indicated that a minimum 50-foot non-disturbance buffer must be implemented around the three identified sites.

In addition, during construction a NCT member qualified in NCT cultural resources shall be onsite during all ground disturbing activities. In the event that human remains are exposed, construction shall cease within 100 feet of the area and the NCT THPO, BIA regional archaeologist, and the Rosebud County coroner shall be notified. First the coroner shall determine whether or not the find indicates a crime scene. If a crime scene is not found the NCT THPO and Culture Commission shall provide direction on how to proceed. In the event that new culturally sensitive items or locations are uncovered, it the decision on how to proceed is at the discretion of the NCT THPO and Cultural Commission. Depending on the nature of the find a buffer zone between 100 and 200 feet may be appropriate to all construction to continue (Burney 2003).

Energy Resources

The Tongue River Electric Cooperative (TRECO) operates the electrical distribution system that supplies the Northern Cheyenne Reservation. The peak electrical usage comes in the winter at about 7.5 MW, whereas the lowest usage falls in the summer at around 3.6MW. The nearest city to the project area, Lame Deer, accounts for approximately half of the total usage of the reservation (Alan See. Pers. Comm.). For perspective the proposed wind power plant would produce a peak of 30MW. The remaining electricity would supply off-reservation demands. All of TRECO's energy is supplied from the Colstrip coal-fired power plant approximately 16 miles northwest of the project area. The project would interconnect to a 69kV TRECO power line that traverses southern third of the project area.

No Action Alternative
The TRECO system would remain in its current condition. TRECO's energy mix would be primarily from coal burned generation imported from off the Reservation.

Cumulative Impacts
No cumulative impacts would occur under the No Action Alternative

Proposed Action
The proposed project would introduce 30MW of rated power onto the TRECO grid at a 25-30% capacity factor depending on the selected turbine. The 'capacity factor' is the expected annual energy output for the project divided by the maximum potential power output of the turbines or their 'rated output'. The expected annual energy output is different (lower) than the rated power of the turbine because the natural intermittency of the wind resource does not allow a turbine to operate at full capacity 100% of the time.

Potential impacts are related to introducing an intermittent energy resource onto the existing TRECO grid. 30MWs of new wind energy would add voltage and reactive power support to the existing grid and potentially bolster the system by reducing short-term power outages and flickering lights. The existing grid should be robust enough to handle the power fluctuations created by the intermittent wind resource. To ensure compatible interconnection and operations of the proposed facility an Interconnection Agreement (IA) would be negotiated between TRECO or its cooperative Southern Montana Generation and Transmission and the project owner/operator prior to construction. The IA specifies technical and contractual obligations necessary for conditional system upgrades, ancillary services, electrical specifications, metering requirements, access, emergency override, potential wheeling charges, and dispute resolution procedures.

Utility Bills
Interconnection of the proposed wind power facility would not increase the utility bills of tribal members. Utility rates are set by the state Public Utilities Commission

Power Purchase Agreement
The price of the power generated by the project would be negotiated between the project owner and the Southern Montana Generation and Transmission or similar utility. The Renewable Energy Credits (RECs) produced by the project will either be included in the PPA with the purchasing utility or sold to a separate buyer in their own PPA. Both agreements determine a purchasing price at a non-fluctuating rate for a specified period of time, typically 25 years, and outline contractual obligations and dispute resolution procedures.

Cumulative Impacts
The non-fluctuating energy price of the wind energy generation enables the utility to accurately forecast energy prices for 25 years. It also diversifies the energy generation mix of the utility, and provides a hedge against fluctuating fuel prices from other generation sources.

Fire

The wildland fire season typically runs from June to September. However, as a result of an on going drought the 2004 season ran from April to October. The fire season has run as late as November (Ron Burns, Pers. Comm.).

The BIA Wildlands Fire Protection Program typically responds to range and forest fire related issues. Their estimated dispatch time to Garfield Peak is 15-20 minutes. Outside of the fire season the organization runs with three to four employees, with three responders available. Outside contractors are brought in during the fire season, which raises available fire protection personnel to 25-30 people. The program is equipped with 8 engines capable of responding to wildland fires. Of those eight, four are Type 6 engines, with a 300 gallon capacity; three are Type 5 engines, with a 750 gallon capacity, and there is one Type 4 engine with a 1000 gallon capacity. Two bulldozers are available on lowboy transports trailers. In addition, during the peak fire season (mid July-1st week in September), a Type 3 helicopter is available. The helicopter response time is approximately seven minutes (Ron Burns, Pers. Comm).

After electrical storms the BIA mans Garfield Peak to oversee Ashland Flats to the east of the project area. Badger Peak, which overlooks the project area four miles to the west, is also manned, as well as Fisher Butte seven miles south of the project area.

The Tribal Fire Protection Program in Lame Deer is also available for response to the project area. Located approximately nine miles from the project area, the estimated would be sixteen minutes. The program has limited resources in funding, manpower and equipment. The number of personnel available for an average fire call is approximately nine individuals. Volunteers are not paid while on duty fighting fires, as would be the case if they worked for a state funded department off the reservation. The department is composed of one paid staff member, the fire marshal, and fourteen volunteer fire fighters. The fire marshal is the only individual within the program certified as an Emergency Medical Technician (EMT), with the rest of the staff at various levels of medical training below EMT status. Most of the personnel have undergone survival training in coordination with the St. Labre fire department in Ashland. One singe fire truck, capable of responding to structure fires, is available for emergency response. To supplement deficiencies, the NCT program has cooperative agreements with the St. Labre and Ashland departments approximately 13 miles east of the project area (Merlin Sioux pers. comm. 2005).

The Tribal Fire Protection program would be responsible for responding to incidents involving hazardous materials and electrical fires. The program has a trained hazardous materials team, but lacks the necessary equipment to adequately respond to hazard material emergencies on its own. In addition there are individuals with Level A and Haz-wapper training, as well as training to respond to Weapons of Mass Destruction (Merlin Sioux pers. comm. 2005). Nonetheless, the program scores low on national standardized rating scales. The Insurance Service Office rated the program a one out of ten in 2000 (NCT 2002), although this score may have improved to about a six recently (Merlin

Sioux pers. comm. 2005). The primary reason is due to lack of funding due to lack of a tribal tax base.

No Action Alternative
No impacts on fire protection would result form the No Action Alternative.

Cumulative Impacts
No cumulative impacts would result from the No Action Alternative.

Proposed Action
The proposed project could have a positive impact on the tribal fire department as the revenue from the constructed and operating project could be used to improve the current economic deficiencies faced by the Tribal Fire Protection Program.

The proposed project increases the risk of fire on the Garfield Peak ridgeline both during and after construction. During construction increased vehicle use and the presence of operating machinery increases the likelihood of human induced range fires. In addition, hazardous materials associated with construction activities and installed electrical equipment.

Cumulative Impacts
The proposed site is slowly recovering from past wild lands fires, specifically the Early Bird Fire of 1988. Evidence of tribal reclamation efforts is apparent in the form of re-plantings and salvage logging. Any construction or project related fires would further exacerbate the recovering Ponderosa Pine forest that is characteristic of the proposed site on the Garfield Peak ridgeline. Potential fire disaster would reduce the limited and valuable natural resources on the NCT reservation.

Mitigation Measures
Both the Tribal Fire Protection Program and the BIA Wild Lands Fire Protection Program would be given specifics on the equipment used during construction and a timetable of construction activities. A comprehensive list of potential hazardous materials present during construction and installed at the site would be given to the Tribal Fire Protection Program prior to transport to the site, use at the site, and/or installation. If needed the project would augment any manpower or HAZMAT needs both during and after construction to make sure the qualified skills are present on the reservation to deal with any associated incidents.

During construction, per recommendation of the BIA Wild Lands Fire Protection Program, watering trucks or appropriate equipment will be present onsite. In addition a fire watch would be required to remain on the site for a specified period of time after the final construction vehicle has left the site.

Forestry

The forest resource on the NCT reservation is managed in a manner that supports both commercial and non-commercial objectives. Timber sales are an important economic benefit to tribal members, but the forest management practices must also reflect the other uses such as grazing, cultural, watershed management, recreation, and wildlife management. (NCT 2002).

The Early Bird Fire in 1988 and subsequent salvage logging affected approximately 62 percent of the project area. What remains are sparse stands of mature ponderosa pine forest surrounded by the burned areas that consist of snags, downed timber, and grassland.

Figure 12. One of the remaining mature stands of Ponderosa Pine in the project area after the Early Bird Fire

Much of the burned area west of Garfield Peak road was replanted with pine saplings. The replantings occurred primarily to the west of Garfield Peak road. Despite the replanting efforts, recovery of the area has been slow with varying success. The general character of the previously burned land still appears to be degraded and scarred. (Figure x.).

Figure 13. Dead fall, snags, and re-plantings, among grassland in a Ponderosa Pine habitat in the project area affected by the Early Bird Fire

The majority of the remaining mature tracks of ponderosa pine with commercial timber value are located on the western side of Garfield Peak Road. Figure X indicates the timber stands that would be impacted using the 1.5 MW turbine layout. Using this layout seven turbines appear to lie in virgin timber stands. Of the seven turbines three of these turbines appear to be in dense stands of virgin forest. The remaining sites are within less dense areas that appear to have been managed using forest thinning practices.

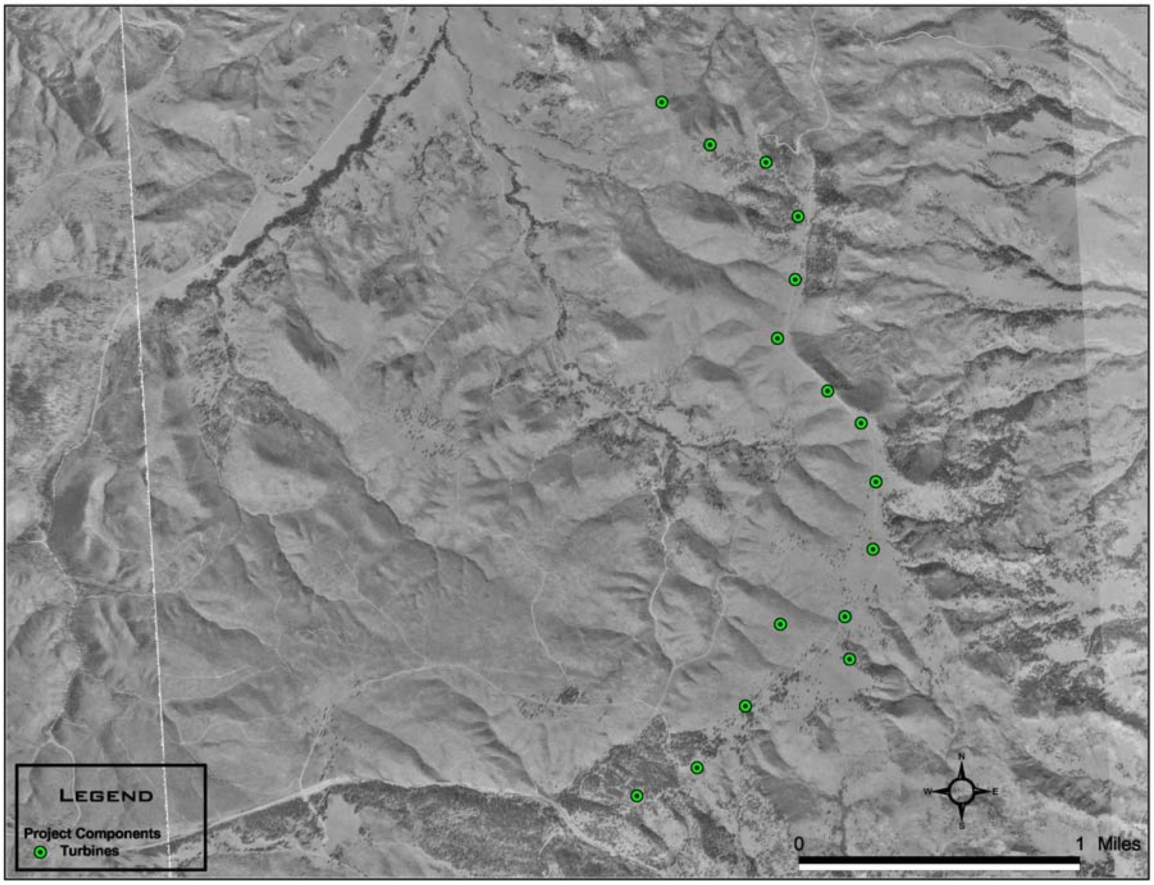

Figure 14. Arial Photo showing the 1.5 MW turbine site plan affect on mature stands of Ponderosa Pine

No Action Alternative
No impacts to forest resources would occur under the No Action Alternative.

Cumulative Impacts
No Cumulative Impacts would occur under the No Action Alternative.

Proposed Action
The proposed 30 MW wind project would impact both virgin and replanted timber stands. Most of the project area is placed within previously burned area meaning most of the impacts would be on replanted areas. Figure X indicates that the 1.5 MW turbine site layout shows approximately seven turbines potentially impacting forested areas. Of the seven turbine sites, three turbines lie within mature forested areas. Including construction and staging areas and roads, a conservative estimate of approximately three acres per turbine would be impacted, making a the total physical impact on the forest resources approximately nine acres. If turbines larger than 1.5 MW are used at the site, fewer turbines would be needed to reach 30 Megawatts, so fewer turbine sites would be located within mature timber stands.

Both the Tribal and BIA forestry departments were consulted regarding the potential impacts to forestry. In the event the removal of mature timber sources is required, both departments would be involved. A final site plan would be submitted to each entity prior to construction. The construction contractor will be required to coordinate the timber removal through the BIA and tribal forestry departments.

Mitigations
Forested areas disturbed during construction, but not impacting the functions of the project after construction, would be reclaimed and replanted per specification from the BIA and Tribal forestry departments.

Cumulative Impacts
No significant cumulative impacts on forest resources are expected to occur under the current proposal.

Range

Almost the entire project area is utilized for livestock grazing (A. Lafranier pers. comm. 2005). Rangeland grazing is the primary land use within the reservation (NCT 2002). Roughly 200 head of cattle are grazed within the project area from April through October. Tribal members lease the rangelands on tribal trust land on a monthly basis. Several cattle guards approximately 15 feet wide are installed throughout the project area on Garfield Peak Road. Recent cattle fences were installed in project area in 2003-2004. A wooden corral exists to the west of Garfield Peak road in the west half of Sec 30 west of Garfield Peak Road.

The condition of the vegetation in the project area indicates heavy grazing use of the project area.

No Action Alternative
No range impacts would occur under the No Action Alternative.

Cumulative Impacts
No cumulative range impacts would occur under the No Action Alternative

Proposed Action
Cattle grazing would not be allowed in the immediate construction areas during the construction period. The grazing lease owners would be notified of the Tribe's intent to construct on the grazing allotments prior to initiating a lease for the proposed construction period. During that period grazing would be limited in duration and location to avoid potential conflict between livestock and construction equipment. The BIA rangeland department would determine the terms of the lease based on the proposed construction schedule.

Areas beneath new access roads, turbines, and associate electrical equipment would permanently lost. Approximately 22.7 acres would be permanently removed, and 117.6 acres would be temporarily disturbed, thus requiring reclamation. Grazing would resume in the project area after construction is complete and once the vegetative reclamation stabilizes. Existing cattle guards located within the project would be bypassed by construction roads, or temporarily removed.

Cumulative Impacts
No cumulative impacts to range lands are expected to occur.

Geology, Soils, and Mining

Affected Environment

The reservation lies on part of unglaciated portion of the Missouri Plateau, part of the Northern Great Plains physiographic province (NCT 2002). Topography on the reservation is characterized by rolling uplands, sandstone ridges, and shale valleys (Ceeds, 2001). The Project area is located on rolling upland plateau that was dissected by tributaries of Greenleaf and Stebbins Creeks in the Tongue River watershed.

The project area is underlain by relatively flat-lying beds of the Fort Union Formation of the Paleocene Age. Surface soils are reddish clinker, and scoria stones that formed after exposure to intense heat that once rose from burning underground coal beds. Clinker is often used as road material on the reservation (NCT 2002).

A preliminary geotechnical engineering exploration was conducted on December 22, 2004 in order to provide recommendations relative to subsurface soil and bedrock conditions, groundwater conditions, and foundation design. A single test boring at 30.5 feet in depth was drilled at a representative location in the middle of Section 30 on the western edge of the Garfield Peak ridgeline. The soil profile consisted of a thin (four inch) layer of topsoil overlying approximately four feet of silty sand. The sand is underlain by interbedded siltstone and sandstone bedrock. The bedrock continued for the remainder or the 30.5-foot depth (Terracon 2005).

The mining resources on the reservation consist of coal and its derivatives. The NCT controls an estimated 450,000 acres of coal rights in Bighorn and Rosebud Counties (Stagg 1994 sited in NCT 2002). The coal is classified as subbituminous in type. Several estimates have been made by several different entities on the total amount minable coal on the reservation. As a general rule it is assumed that at least five billion tons of minable coal is under the control of the NCT (NCT 2002). In addition to coal, coalbed methane could be mined. Approximately three billion cubic feet of methane was initially estimated to exist on the reservation, however recent feasibility studies suggest that the coal beds contain characteristics unsuitable for economical exploration and development of the resource (Ceeds 2001 and NCT 2002).

No coalmines or gas wells exist within the project area (Little Coyote pers. comm. 2005). No coal or related minerals were found during the December 2004 Geotechincal test boring of a 30.5-foot depth (Terracon 2005). The NCT controls exclusive mining rights and claims on and beneath the tribal trust land within the project area (Little Coyote pers. Comm. 2005).

No Action Alternative
No Geology, Soils, or Mining impacts would occur under the No Action Alternative.

Cumulative Impacts
No cumulative impacts are expected to occur under the No Action Alternative.

Proposed Action
Potential impacts to the geology of the project area would be topographic changes related to construction activities. A total of 22.7 acres would be permanently impacted by the project[1]. An additional 117.6 acres would be temporarily impacted by construction activities. Figure X indicates areas along Garfield Peak road that may require cut and fill road modification to reduce slopes to support certain construction equipment. The use of the existing maintained Garfield Peak Road reduces the footprint of the project area considerably. The siltstone/sandstone bedrock would easily degrade when exposed to the elements (Terracon 2005). Adherence to the dust management plan (Appendix X) would control wind weathering. Also adherence to the stormwater Best Management Practices (BMPs) and use of Best Available Control Technologies (BACTs) per specification of the NPDES stormwater discharge permit and recommendations from the tribal water quality department is expected to control stormwater erosion. Disturbed areas would be reclaimed immediately after construction and topsoil would be stockpiled and covered onsite, and reapplied to areas that received significant soil modification. Vegetation below shrub size would be brushbeat or crushed to keep the rootstock and stabilize the soil. Given the dust control measures, the required stormwater controls, and the relatively small areas of permanent disturbance, no significant impact is expected to occur as a result road construction, trenching, and related construction activities.

The preliminary geotechnical study concluded that the turbine be supported by either a drilled pier or mat foundation. Individual foundations would extend 30-45 feet into the hard siltsone and sandstone bedrock. No groundwater was observed in the test boring, and the lab test indicates that there low to moderate potential for the soil to shrink or swell (Terracon 2005). During construction individual test bores would be drilled at each respective turbine location to determine site-specific geological characteristics. Given the relative stability of the soil conditions no significant impact should result from turbine foundation installation.

In addition no coal seams or valuable minerals were uncovered by the initial geotechnical feasibility study. In the event that such a discovery is made, the tribe controls the mineral rights underneath the project area, and would control further activity of the project. Given the absence of valuable minerals in the preliminary geotechnical study, no significant impact is expected for mining resources.

[1] Assumes 20 1.5 MW Turbines. See site plan on figure X.

<u>Cumulative Impacts</u>
During decommissioning, re-powering, or expansion soil impacts similar to construction could be expected. Specific turbine access roads would be re-widened. Any earth moving activities would adhere to the most recent stormwater and dust management practices. Re-powering and expansion could involve pouring new foundations for new turbine sites, new roads and trenches, but this cannot be quantified at this time. Significant road modification, including cut and fill, is not likely as the primary infrastructure would already be in place. Geotechnical test borings would be drilled at each new turbine site. No change in mineral rights status is expected in the future, so the Northern Cheyenne would remain in control of such decisions.

Hydrological

Affected Environment

The NTC reservation is in the Powder River Basin, and is part of the Yellowstone River Subbasin, which turns into the Missouri River Basin. Drainage in the project area is generally north and east from Greenleaf and Stebbins creeks and their tributaries into the Tongue River east of the project area.

Wetlands
A survey for wetlands in the project area was conducted July 1, 2004. The area surveyed included all areas where project facilities would be located and a 50 m buffer (Figure X). Wetlands were delineated using the 1987 U.S. Army Corps of Engineers (ACOE) wetland delineation manual (Environmental Laboratory 1987). A functional assessment using the MDT Montana Wetland Assessment Method (Berglund 1999) was also conducted.

One wetland was found and delineated in the survey area (Figure X2). This wetland, approximately 0.1 acre in size, is associated with a spring located approximately 100 feet east of a two-track road that was originally identified as a potential access road, but is not included in the current project description as an access road. The wetland is classified as a palustrine, emergent wetland (Cowardin et al. 1979). It is located within a drainage that is a tributary to Stebbins Creek. Water was flowing in the tributary at the time of the field visit and the U.S.G.S. topographic map indicates it is a perennial stream. The spring that supports the wetland is located on a slope adjacent to the stream and has been modified with a pipe and tank for livestock watering. Overflow from the tank flows into the wetland. The wetland is dominated by hydrophytic vegetation (primarily tufted hairgrass – *Deschampsia cespitosa*). Hydric soils were also present, based on the indicator of a low chroma color (10YR 2/1).

Based on the MDT Montana Wetland Assessment method, the wetland was classified as a Category III wetland. A Category III rating indicates the wetland is relatively common with low to moderate diversity, and is relatively small and isolated. Categories I and II are the highest quality wetlands and Category IV is the lowest rating. This wetland had high ratings for sediment/nutrient/toxicant removal due to the potential to receive low to moderate inputs from livestock and the nearby two-track road, but the vegetative cover at approximately 70 percent helps to retain and remove these sediment and nutrient inputs. It also received a high rating for groundwater discharge/recharge due to the spring. The wetland was rated as moderate for the following functions and values: general wildlife habitat, short and long term surface water storage, sediment/shoreline stabilization, and production export/food chain support. The wetland was rated as low for the following functions and values: listed/proposed T&E species habitat, Natural Diversity Database species habitat, flood attenuation, uniqueness, and recreation/education potential.

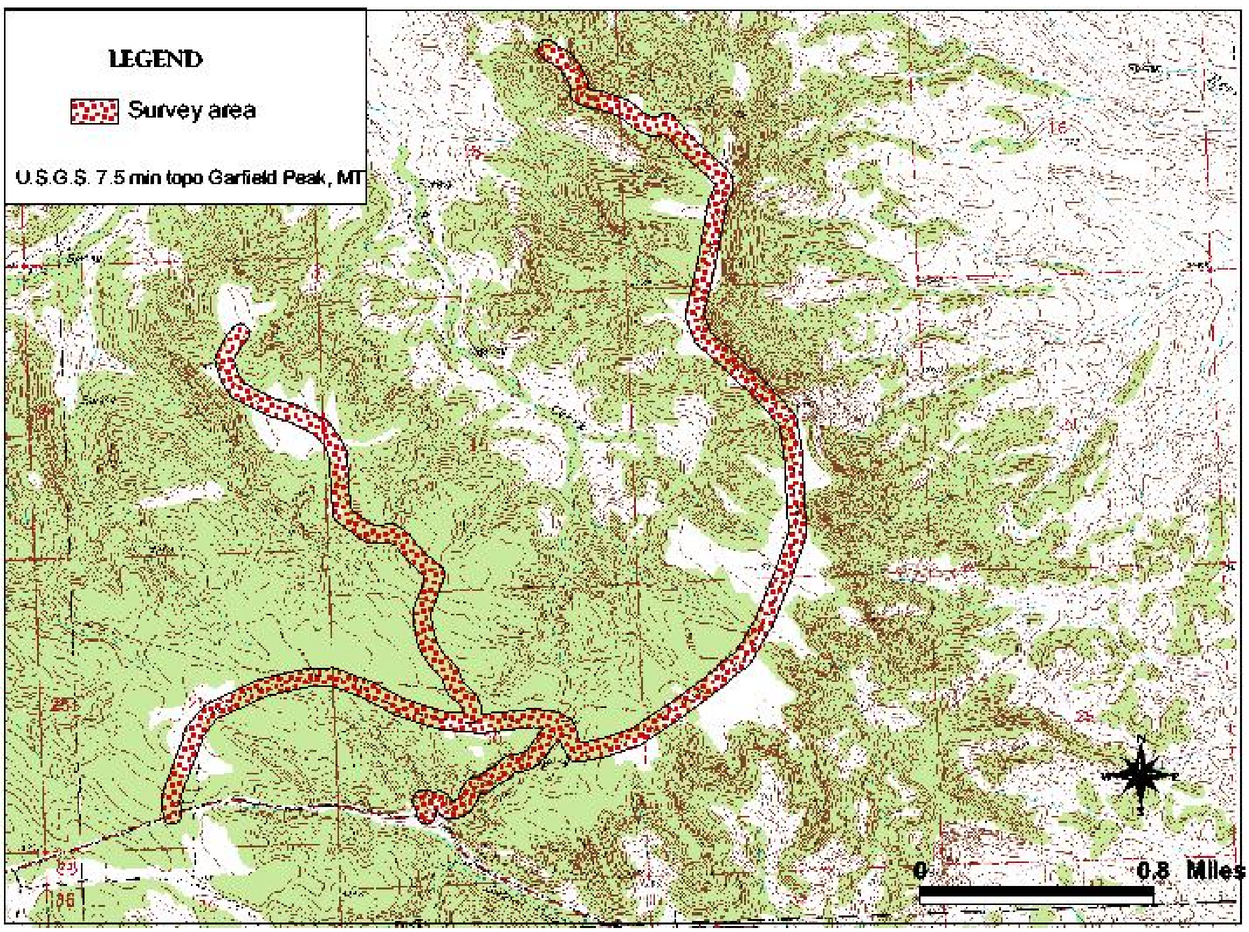

Figure 15. Wetland survey area

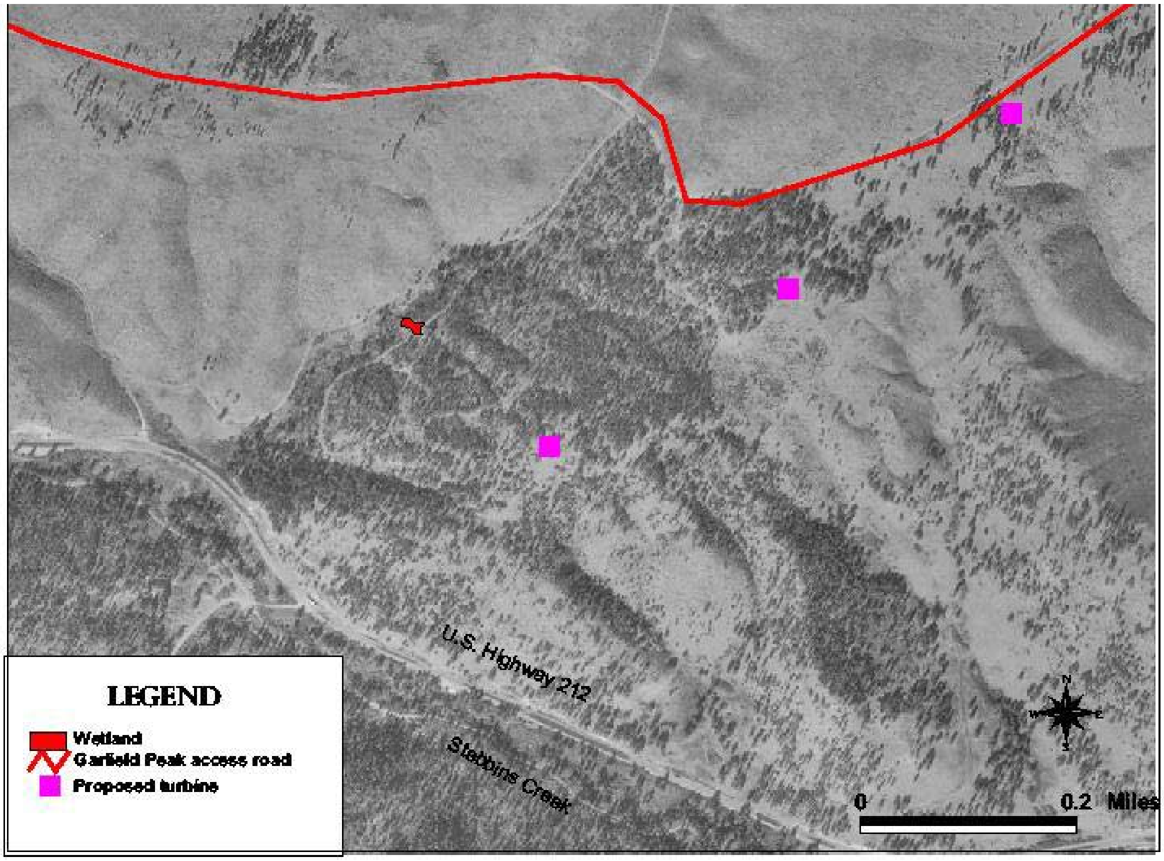

Figure 16. Project area wetland

Groundwater
Groundwater was not observed in the boring during the December 2004 boring for the Geotechnical Engineering Report. A location representative of the turbine locations in the project area was chosen for a single geotechnical test bore of 30.5 feet. A siltstone/sandstone bedrock lies beneath four inches of topsoil and four feet of silty sand. This bedrock has a low to moderate water content and should have a relatively low potential for volume change (swelling or shrinkage) with water fluctuations (Terracon 2005). While no groundwater was found at the initial boring site, variations based on seasons, weather, and location within the site could influence the presence of groundwater at various turbine locations.

Springs
Springs are spiritually significant to the Northern Cheyenne. A 2002 survey on the NCT traditional economy and subsistence patterns on the reservation stated that 97% of the representative sample of 112 interviewees from all districts on the reservation said that springs have spiritual value. A single spring is identified on the Garfield Peak USGS 7.5 minute quad map, however surface water has not been present since the inception of this project in October 2002. The July 1, 2004 survey located a separate spring approximately 100 feet east of a two-track road, also not indicated on the Garfield Peak

quad. The spring was modified with a pipe and water tank for livestock, and feeds the 0.1-acre wetland identified in Figure X.

Burney in the October 2003 cultural field survey observed a multi-colored prayer cloth associated with this spring. The prayer cloths are considered ceremonial offerings that honor spirits believed to reside in these springs (Burney 2003). Further discussion can be found the cultural resource report in Appendix __.

No Action Alternative
No impacts are expected to occur under the No Action Alternative.

Cumulative Impacts
No cumulative impacts are expected to occur under the No Action Alternative.

Proposed Action
No impacts to wetlands are anticipated as a result of the proposed project. Only one wetland occurs in the project area and it is over 200 feet from the nearest turbine and over 350 feet from the Garfield Peak access road. This wetland will not be filled as a result of the project, and other indirect impacts are not anticipated.

Cumulative Impacts
At this time, there is little development planned on the Northern Cheyenne Reservation. Once the project is built, the potential exists for future project expansion on the ridge immediately west of the proposed turbine locations. The assessment of cumulative impacts to vegetation will be limited to the potential expansion of the proposed windpower project.

There are no known future projects planned for the vicinity of the proposed project that are likely to result in cumulative impacts to wetlands in the project area. The livestock grazing and logging practices that currently occur in the project area are likely to continue in the foreseeable future, but these activities along with the proposed project are not expected to cumulatively impact wetlands. The one wetland in the project area is currently used for livestock watering and this use is expected to continue in the future. Wetlands on the reservation are overseen by the tribal wetland conservation coordinator.

Land Use

Affected Environment

The land considered for the project area is a contiguous tract of tribal trust land on the Garfield Peak ridgeline comprising of approximately 5.5 sections (5.5 square miles or 3520 acres) (EDA 2003). The primary land use of this area is livestock grazing. The area is also used for hunting, primarily for deer and elk (Lafranier pers. comm.). The area is also managed for timber production, with large tracks of project lying within replantings following the burning and salvage logging associated with the Early Bird Fire (Terry Spang pers. comm. 2005). Several locations within the project area are used for culturally sensitive activities. Details of the cultural resource investigation can be found in the cultural resource inventory in Appendix __ (Burney 2003).

No Action Alternative
No impacts are expected to occur under the No Action Alternative.

Cumulative Impacts
No cumulative impacts are expected to occur under the No Action Alternative.

Proposed Action

Significant impact could occur if the project irreversibly changed the existing land use practices at the site. A land use lease would be granted by the Bureau of Indian Affairs for tribal or project owner use of the Trust land for the proposed project. All previously existing land use activities including but not limited to grazing, hunting, forestry, and ceremonial activities would be allowed under the proposed action. A minimal amount of land would be taken out of use as a result the proposed action. Assuming the land use project area of 5320 acres (table x). Approximately 22.7 (0.64%) acres would be permanently disturbed by the proposed action, with an additional 117.6 acres (3.34%) of temporary disturbance. Grazing and forestry activities would be restricted during construction and until soils are fully stabilized by reclamation efforts. Public access would be allowed on Garfield Peak Road throughout the entire phase of the project. Given the minimal disturbance to existing land use activities, and compatible nature of the project with previously existing land uses, no significant impacts to the existing land use are expected.

Cumulative Impacts

All existing land uses would be allowed to continue in the event that the project is expanded. A similar disturbance could be expected for repowering or expansion. Similarly grazing and forestry practices would be temporarily suspended during future construction or decommissioning activities. All future activities would be reclaimed in accordance to the latest construction BPMs. Decommissioning would reclaim lands once used by the project increasing the available land for other land uses. Compliance with the BIA land use permit would ensure that the project does not contribute to cumulative negative impacts on land use.

Noise

Affected Environment

Sound can be defined as any pressure variation that the human ear can detect. Noise is defined as “unwanted sound” (BLM PEIS 2005). Unwanted sounds are often tonal, broadband, and impulsive. The unit used to describe sound is the decibel (dB). Units used to describe sounds heard by humans and what is commonly referenced in noise ordinances are dB(A). dB(A) is a weighted scale that approximates the range of human hearing by filtering out lower frequency noises, which are considered less noticeable and damaging to human than high frequency noise. For reference rustling leaves have a decibel level of 10db(A), a conversational speech is approximately 60db(A), and an aircraft takeoff is near 120dB(A). The threshold of pain for the human ear is considered to be at 150dB(A) (BLM PEIS, 2005).

The project area is proposed within a rural undeveloped hilly terrain relatively remote from any human population densities. Ambient noise at the site at the site is rather low, with the primary noise sources being from wind, animal, and the occasional vehicle on Garfield Peak Road. Some road noise from HW 212 can be heard from the southern most part of the project area approximately ¼ mile from the highway, especially the sound of large trucks ascending up the pass from Ashland flats to the east (Bergen pers. com., 2005). The background noise within the majority of project area would be similar to standard estimate for a rural environment of 40dB(A) during the day and 30 dB(A) at night, or roughly 35dB(A) (Harris 1979, and Miller 2002 sited in BLM DEIS 2004).

Two types of noise would be distinguishable from a commercial turbine: the broadband noise of rotor blades creating turbulence often referred to as "whoosh", and a potential tonal sound often referred to as a "hum" from mechanical actions within the gearbox and generator within the nacelle (gearbox housing).

Increasing wind speeds at the site often masks the whooshing sound, and modern wind turbines have virtually eliminated the tonal noises. Noise levels would also be influenced by an individual's topographic location, as well as the intensity of the winds at a given time. Nonetheless, as a general rule commercial wind turbines omit noise ranging from 30-45 dB(A) at approximately 350 meters (1148 feet) from the project area (AWEA.org).

Neither the BIA nor the NCT have any noise standards that would apply to the proposed project. However the Environmental Protection Agency (EPA) guidelines through the Noise Control Act of 1972 sets broadband noise levels at 55dB(A) at a distance of 500 m from the source.

<u>No Action Alternative</u>
Noise conditions would remain at their current levels at the site under the No Action Alternative.

<u>Cumulative Impacts</u>
Noise related cumulative impacts are not expected to occur under the No Action Alternative.

<u>Proposed Action</u>
During construction noise levels from construction equipment could generate noise at variable intervals at levels between 80 and 90dB(A) at 50 feet (15 meters) (BLM PEIS 2005). The construction period is anticipated be 90-120 days. During this period temporary impacts to wildlife could be expected. The nearest occupied dwelling or populated area is approximately four miles to the north of the project area outside of the reservation boundary. Temporary impacts to the existing human environment from construction related noise would be minimal.

Turbines for the proposed project are expected to emit broadband noise in the range of 30-45dB(A) at 350 meters (AWEA.org). Similarly the modern turbines ultimately selected for the project would all be designed to eliminate tonal noises. Any noise from operating turbines and associated equipment would be absorbed into rural background levels at approximately 2000 feet (BLM 2005). Given the remoteness of the project from human populations, impacts from noise related to the project would be negligible.

Cumulative Impacts
Noise from construction would be temporary, lasting no more than 120 days. Broadband noise from operating turbines would be absorbed into typical rural background levels at 2000 feet. Because of the temporary nature of construction activities, and the remote location of the project area, no significant noise related impacts are expected for the human and natural environment.

Decommissioning, repowering, and expansion could cause the same temporary construction related noise impacts. Decommissioning would eliminate any broadband noises from once operating turbines.

Paleontological Resources

Affected Environment

The Fort Union Formation underneath the project area has plant and animal fossils, but no dinosaur fossils. This suggests that the formation dates to the Paleocene Era (Ceeds 2001). No fossils were discovered during the Class III inventory conducted in December 2003 (Burney 2003), or during the December 2004 Geotechnical study (Terracon 2005).

<u>No Action Alternative</u>
No impacts are expected to occur under the No Action Alternative.

<u>Cumulative Impacts</u>
No cumulative impacts are expected to occur under the No Action Alternative.

<u>Proposed Action</u>
Earth moving activities during construction could irreversibly impact plant and animal fossils. The following construction BMPs are designed to minimize potential impacts. The cultural resource monitor contracted to monitor potential impacts to cultural resources would also be qualified to identify paleontological resources. Construction crews would be instructed to halt construction and notify the monitor if a potential fossil is uncovered. In the event there is a positive discovery, it would the THPO officer, and BIA regional archaeologist would be notified. The decision to proceed would lie with the tribal authorities.

<u>Cumulative Impacts</u>
Earthmoving activities from repowering, expansion, or decommissioning would be similar to construction. The latest BMPs would be used to avoid impacts to paleontological resources.

Public Health and Safety

Affected Environment

Emergency Medical Response

The tribal Emergency Response Service (EMS) would be responsible for emergency calls within the project area. The service is comprised of approximately eleven on-staff employees and five subcontractors. The department has four ambulances, and one truck available for a given emergency call. Their estimated response time to the entrance of the project area is six minutes, and twenty minutes to the outermost boundary of the project area. Medical facilities in Lame Deer vary in characterization from either "Urgent Care" to "Emergency Room" status based on available X-Ray and Laboratory resources and personnel. The facility is open until 6:00 pm. A heli-pad is also available in Lame Deer, and a fixed-wing landing strip can be utilized in Colstrip for access to full-service medical facilities in Billings (E. Spang pers. comm. 2005).

Public Safety Response

The police department in Lame Deer is under the direct control and supervision of the BIA. The police department is composed of eleven employees and eleven vehicles (J. Whitefoot pers. comm. 2005). The reservation has a disproportionately high crime for its population. On a whole the department is underfunded and understaffed. Public safety concerns related to the project would be vandalism of equipment, and safety risks from electrical substation equipment. Upon request the department would be willing to patrol the area twice a week under its current staffing and resource structure.

<u>No Action Alternative</u>

No impacts to Public Safety Response would occur under the No Action Alternative.

<u>Cumulative Impacts</u>

No cumulative impacts would occur under the No Action Alternative.

<u>Proposed Action</u>

The project area would be open to the public during construction and operations. Construction equipment would be secured from vandalism and theft once the construction day is over. Hazardous construction area i.e. pits, trenches, electrical equipment would be secured from the public with fencing and readily visible warning signs. Regular patrols of the construction area would be needed to control potential vandalism and theft of equipment, and to minimize public safety risk. The construction managers may request a daily security patrol of the area from the BIA. Additional resources to support such a project would likely come from the construction budget or from the tribe. The BIA division of public safety would be notified several months prior to the planned construction period so that the necessary resources can be planned prior to the construction date. Given the construction safety precautions, potential risks to public safety during construction would be negligible.

An operating wind plant is a relatively benign risk to public safety. The cylindrical turbine towers cannot be climbed when locked. The rotor swept area lies well above the ground at a minimum of 30 meters (98.4 feet)[2], which would eliminate most practical human hazards. As a precaution for aviation turbine and met towers would be installed

[2] Assumes the Mitsubishi (1) MW turbine—the smallest considered turbine for Garfield Peak.

with lighting per FAA requirements. Substations would be fenced and visibly marked with high voltage warning signs, and a gravel firebreak would surround the substation within the fence line to reduce fire hazards. During operations and maintenance the BIA would patrol the project area at a minimum of twice a week.

Cumulative Impacts
Expansion, repowering, or decommissioning would involve the same construction risks detailed during construction. Public safety resources would be considered prior to any activities and addressed where appropriate. In the event the project is expanded or repowered, more FAA lighting would be required for the new structures in addition to the standard site construction safety practices. Decommissioning practices would require standard site safety practices, and when complete would remove any public safety hazards associated with the wind plant.

Socioeconomics

Affected Environment

The socio-economic condition on the Northern Cheyenne Reservation is shaped by a unique culture and a difficult history that followed their establishment onto their reservation in Southeastern Montana in 1884. Today persistent economic poverty and social instability are a common socioeconomic condition within the NCT. Years of federal policies of cultural assimilation, their consequential resistance, and the inputs from the surrounding Euro-American economy all factors into the causes of their current socioeconomic condition. Demographics, social geography, population density, employment and poverty levels, labor characteristics, and the NCT's historic experience with energy development were analyzed in the socioeconomic analysis of the existing conditions on the reservation.

Demographics
Officially published demographic data for the NCT reservation is not available after the 2000 census. However, an unpublished BIA worksheet titled "Labor Market Information on the Indian Labor Force" acquired from the NCT enrollment office for year 2003 provides the most updated enrolment information.

Table 9. Enrollment and age distribution

Enrollment and Age Distribution				
As of Year End 2003				
Extracted from BIA Labor Market Worksheet for year 2003				
	Male	**Female**	**Total**	
Official Tribal Member Enrollment:	4,067	4,115	8,182	
Total Resident/Service Area Population:[1]	2,553	2,515	5,068	61.9%[2]
Residents under age 16:	826	768	1,594	31.5%[3]
Residents age 16-64:	1,641	1,640	3,281	64.7%[3]
Residents over age 64:	86	107	193	3.8%[3]

[1]Individuals eligible for on-reservation services for Indian People through the Secretary of Interior.
[2]Calculated as a percentage of enrollment population.
[3]Calculated as a percentage of resident population.

The official tribal membership role lists the total NCT enrollment at 8182 as of the end of 2003. Of the total enrolled members 5068 we/re resident and service area individuals eligible for on-reservation services.

A more detailed analysis can be taken from official 2000 census, although it should be noted that official census figures regularly undercount actual populations in low-income and Indian areas (NCT 2002). As of the 2000 census the resident population of the Northern Cheyenne Reservation was 4,470. Of this population 4,029 people or 90% of the population is Native American. The next largest population group was white at 350 people, or 7.8% of the population. The population was roughly evenly divided between male and female (Census 2000). The influx of non-tribal members on the reservation as a result of the proposed development was expressed as a concern during the public scoping meeting in November 21, 2003.

The median age on the reservation in 2000 was 22.7, which is relatively young compared to the State of Montana with a median age of 37.5, and the entire United States of 35.3. Moreover 44.3% of the population was under the age of 18, whereas in Montana the percentage was 26.5% in Montana, and in the United States the percentage was 25.7% (Census 2000). The relative fewer numbers of elders among the NCT population can be attributed to prolonged warfare and difficult history prior to the establishment of the reservation, as well as chronic prolonged semi-starvation in the early years of the reservation in the early 1900s prior to the Indian Reorganization Act on 1934 (NCT 2002).

Social Geography and Population Density

A look at the reservation population in relation to its region establishes a demographic context of the reservation. The Northern Cheyenne Reservation is situated inside Bighorn and Rosebud Counties in southeastern Montana. It shares its western border with the Crow Reservation, and is adjacent to Powder River County to the East. Northern Cheyenne people represent approximately 12% of Bighorn County, and 67% of Rosebud County. The population density on the reservation is roughly 6.3 persons per square mile, compared to roughly 1.4 persons per square mile in Bighorn, Rosebud, and Powder River Counties (NCT 2002).

Employment and Poverty

The strong rooted cultural homeland identity of the NCT keeps many individuals within the reservation despite the economic and social hardships. The reservation struggles with unemployment and poverty. The latest employment records were extrapolated from the 2003 BIA Labor Market Worksheet. As of 2003 the NCT has an unemployment rate of 74% (Figure X).

Table 10. Northern Cheyenne Employment Breakdown

Year 2003	
Extracted from BIA Labor Market Information Survey Form Worksheet	
[redacted]	
Total Resident Indian Population:	**5,068**
Residents Not Available for Work:[1]	**290**
Residents Available for Work:[2]	**3,184**
Number Employed:[3]	**830**
Number Not Employed:[4]	**2,354**
Unemployment Rate:[5]	**74%**

[1] Reflects the Number of Individuals disabled or incarcerated
[2] The number of enrolled members on the reservation between ages of 16-64 minus Residents Not Available for Work
[3] Those individuals working for money
[4] Residents Available for Work minus Number Employed
[5] Number Not Employed divided by Residents Available for Work

A majority (88.7%) of the reported employment jobs are within the public sector. Of the 830 employed members 736 of those jobs lie within the public sector, while only 94 (11.3%) are private sector positions. In addition the BIA must report the number of employed individuals falling below the federal poverty guidelines established by the federal Department of Health and Human Services. Of the reported 830 employed individuals, 57 (6.9%) fell below the poverty criteria (BIA Survey 2003 and Montana Dept of Labor website: dli.state.mt.us)

Historical Impact of Energy Developments Near the Reservation

A look historical impact of energy development surrounding the reservation provides context on the potential impact of proposed developments within the reservation. The Northern Cheyenne have experienced various forms of non-renewable energy developments near their reservation since the early 1970s. The effect of such developments has been historically negative in terms of economic conditions on the NCT reservation (NCT 2002). As a result the NCT is known for it's strong opposition to large-scale coal and oil and gas developments in their area (Mifflin 2005). A report for a recent BLM Powder River Basin Oil and Gas EIS (NCT 2002) recognizes four explanations as to why economic conditions deteriorated as a result of surrounding energy developments:

1. *The lack of tribal access to higher-paid energy jobs*
2. *The reservation's limited local commercial infrastructure*
3. *The reservation's lack of access to mineral revenue to support public services and infrastructure*
4. *The Northern Cheyenne's commitment to place*

The Northern Cheyenne provided nearly a quarter to a third of the working age population in Rosebud County during the energy boom of the 1970s and 1980s. Assuming the population of the workforce should reflect the workforce population of the area, an equitable energy workforce population should have been around 25-33 percent. Instead the NCT workforce percentage was around three to eight percent. The expectation of potential energy jobs also created socioeconomic difficulties within the reservation. During the development of the Colstrip coal fired power plant in the 1980s the possibility of jobs brought Cheyenne people back to the reservation with the expectations of potential high paying job opportunities associated with the energy developments. To their detriment, very few Cheyenne people were actually employed during Colstrip's development, and unemployment and demands on social services increased within the reservation (NCT 2002).

The NCT reservation currently and historically has a limited local commercial infrastructure. As a result their local economy was not able to capture and hold the revenue from regional energy developments within their local economy. Meanwhile surrounding urban economies like that of Colstrip expanded, as they were able to offer more goods and services do their increased income base. As these neighboring economies expanded, more dollars left the reservation for the new or more competitive goods and services to the detriment of the economy on the reservation.

Rosebud County, the City of Colstrip, the State of Montana, and the Federal Government all gained significant amounts of energy-related revenues through mineral taxation and sharing of royalty revenues, which were used to expand public services and support the local economy. During this time the NCT did not have access to these revenues, as the tribal governments were unable to fund initiatives to increase the likelihood benefiting from the regional energy developments. Therefore the regional economies improved while the reservation slipped out of competition with the rest of its region.

The Northern Cheyenne are highly committed to the preservation of their homeland, their identity, and their sense of place. The provincial nature of Cheyenne members contracted sharply with the large, mobile workforce that typically characterized the boom and bust cycles of energy exploration and power plant construction. The Northern Cheyenne were less likely to leave the reservation to exploit new energy resources in new region than their non-tribal iterant worker counterparts. Instead the NCT is more committed to creating and maintaining a viable, economically sustainable, culturally and environmentally rich homeland.

Related Labor Experience
In April 2005 the Tribal Employments Rights Office (TERO) database included 50 Northern Cheyenne owned and certified contractors. Only ten of the contractors appear to have contracting and labor experience to construction activities potentially associated with a wind farm. Seventeen contractors had experience with forestry and timber related management activities that could be related to site preparation (Disgen 2005). In addition, TERO manages a list of approximately __ tribal laborers who would be available for site preparation and construction related activities. Laborers make up the majority of the workforce utilizing TERO services (Jennie Lafranier pers. comm. 2005). To date no tribally owned enterprises have been identified with specific wind farm construction and operations experience. Colstrip Electric out of Colstrip MT, immediately north of the reservation, is currently involved with the Judith Gap wind project in central Montana, and is a licensed contractor on the Northern Cheyenne Reservation.

Currently there are no academic programs related to the technical needs associated with a wind farm. Associates of Arts and Applied Science degrees, along with certificates are offered in the tribally owned and controlled college of Chief Dull Knife College in Lame Deer. Currently no engineering or electrical technology degree programs are offered at Chief Dull Knife College, though it offers a certificate program tailored to ready individuals for immediate entry into employment. Several employees of the college have expressed interest facilitating technical training in operations and maintenance through their certificate program (C. Bear Tusk, Pers. comm. 2005).

No Action Alternative
The current economic condition of the NCT would continue without the realization of the economic development benefits of renewable energy resource development.

Cumulative Impacts
No cumulative Impacts would result from the No Action Alternative.

Proposed Action
The proposed wind project could create significant socioeconomic benefits for the NCT. Potential economic and sociological impacts from the proposal are discussed separately.

Economic Impact: The economic development benefits would accrue to the NCT in six categories: (i) employment salaries and wages, (ii) landowner royalty payments, (iii) administration personnel training and fees, (iv) sales tax equivalency, (v) property tax equivalency and (vi) ownership income distributions.

Employment Salaries and Wages
This project would include tribal employment preference for training for full time permanent employment in the area of operations and maintenance of the wind facility. The estimated annual budget for operations and maintenance is approximately $540,000 per year, with 40% of that amount being labor. Approximately $210,000 per year of this

amount is expected to be labor, which would be comprised of qualified tribal members. The project life is assumed to be 30 years, so the total direct economic benefit is estimated to be $6,300,000. For the purpose of this document, the indirect benefits are not specifically calculated, but in customary analyses, the indirect benefit would be approximately 1.2 times the direct benefit, so an additional indirect benefit of $7,560,000 would seem reasonable (Osborn 2005).

Landowner Royalty Payments
It is customary for the owners of the property to be paid an annual royalty when hosting wind projects. While only about two acres per turbine are actually disturbed, the overall site will host about 10 to 30 turbines based on size of turbine. The undisturbed land continues its current use, which is primarily agricultural. Consequently, the royalties received from the wind project are incremental income to the property owner. Because this project is located on Tribal Trust Land, the annual royalty of approximately $100,000 per year accrues directly to the Northern Cheyenne Tribe. For a thirty-year period, this equates to approximately $3,000,000 (Osborn 2005).

Administration Personnel Training and Fees
It is the objective of the Northern Cheyenne Tribe to assume control and ownership of the project sometime during its life. In order to prepare the tribe and its employees to achieve this objective, a budget line of $150,000 per year has been incorporated into the economics. These funds are the sole purview of the tribe and can be used for personnel or any other activity. The funds available for this account over the life of the project equate to $4,500,000 (Osborn 2005).

Property Tax Equivalency
Wind projects are capital intensive in nature and require no water, sewer or other services from the communities. They customarily pay significant property taxes to county governments in non-Indian developments. The models created for this project assumes an equivalent payment in lieu of property taxes is made to the NCT government. These taxes decrease over time and the wind facility asset depreciates in value. The model assumes the taxes to NCT exceed over $1 million during the project's life. This value, and whether it will be available to the tribe, will depend on the economics of the project and cannot adversely affect the ability to finance the project (Osborn 2005).

Ownership Income Distribution
The financing structure created by Disgen includes a federal low cost, long-term loan (debt) combined with a taxable equity investor such that the federal Production Tax Credit (PTC) can be fully utilized. This structure allows the NCT to participate as a project owner without incurring any financial risks or making any capital investment in the project. The financing will be non-recourse project financing. The federal loan will support about 70% of the total project cost and a tax investor will provide the remaining equity and be able to fully utilize the Production Tax Credit for wind. The NCT and the Tax Investor will be members of a Limited Liability Company and over time, the economic benefits will transfer to the tribe. The timing of the transfer and the amount the tribe will receive in ownership benefits will be heavily negotiated and cannot be

appropriately estimated at this time. However, the amounts will be uncertain until after negotiations with the tax investor are completed (Osborn 2005).

Summary of Economic Benefits: The following table represents a conservative estimate of the economic benefits the Northern Cheyenne Tribe can expect from the development and lifetime operation of the subject wind facility:

Table 11. Summary of projected economic benefits

Summary of Projected Economic Benefits	
[redacted]	
Employment Salaries and Wages:	$6,300,000
Landowner Royalty:	$3,000,000
Administration Personnel Training and Fees:	$4,500,000
Sales Tax Equivalency:	$1,000,000
Property Tax Equivalency:	$1,000,000
Total:	$15,800,000
[redacted]	

Sociological Impacts:
The Northern Cheyenne Tribe is located in an area that provides little opportunity for manufacturing quality jobs and the associated wage potential. The quality jobs are primarily located within tribal government with heavy support from the federal government through its Trust Responsibilities. The unemployment rate is very high and is attendant with all the other issues, such as health care, education and family violence, on remote reservations.

The wind energy facility would be consistent with the traditional values of the NCT in the areas of self-sufficiency and environmental sustainability. In addition, the development of sustainable natural resources is consistent with the NCT's Comprehensive Economic Development Strategy (CEEDS 2005).

The project's development is under the guidance of the Economic Development Committee and the newly elected Tribal Administration. The NCT has decided to focus on value creation through ownership. The NCT believe that the Tribal Membership will achieve great and justified pride with the construction of the project. The NCT also believe that the project would convey a sorely needed message to the Tribal Members that self-sufficiency and self-determination can be achieved. The project will establish an expectation for more appropriate development as the tribe's natural resources are quantified and as such development occurs, the NCT can achieve its objectives.

Employment and Education
Related employment positions in the short term during construction would be private sectors jobs, employed and contracted by the BOP contractor and the entity responsible for operations and maintenance. During construction the 74% unemployment rate and would be reduced employment of tribal laborers and contractors. In addition, this type of private sector employment would reduce the ratio of public to private sector jobs currently heavily skewed towards public sector. During the operations and maintenance phase two to four qualified tribal members would be employed to operate and maintain the facility.

Demographics
The potential influx of non-tribal members onto the Northern Cheyenne Reservation was expressed during the public scoping meeting. Any population influx would occur in the short-term during construction in the form of professional contractors and laborers that are not filled by tribal members. These individuals would be housed in the nearest commercial lodging facilities during the construction duration. The NCT wish to own and operate the project, meaning the Operations and Maintenance staff of two to four people would be comprised of tribal members. It is unlikely that the project would directly contribute to non-tribal population increases on the Northern Cheyenne Reservation.

Cumulative Impacts

The successful completion of a tribally owned wind power project would deliver confidence to the Northern Cheyenne Tribe on the success of tribal economic development endeavors. This success would likely lead to other successful projects as the tribal personnel develop successful project management skills. The potential exists for expansion of the project over 30MW on adjacent land areas west of the project area. Successful expansion would bring incremental increases in revenue. In a successful project may trigger success in similar developments of tribal natural resources in further pursuit of self-sufficiency and self-determination. Social and Economic benefits would accrue from each successive development.

Mitigations

The BOP contractor in charge of construction of the facility would obtain all TERO licenses and certifications prior to the beginning of construction.

The BOP contractor would be required to include a tribal contractor and laborer preference in their construction contract for the 30 MW wind facility.

To ensure the necessary Operations and Maintenance knowledge is acquired and remains on the reservation, Chief Dull Knife College would be involved in the technical training of full and part-time Operations and Maintenance staff. The NCT and the entity in charge of the Operations and Maintenance would coordinate with the turbine manufacture to set up the necessary certificate programs at the college.

Visual Resources

Affected Environment

Visual impact is defined as the unwelcome visual intrusions or the creation of unwelcome visual contrasts that affect the quality of the landscape.

The view of and within the project area is one of a natural setting impacted by human uses i.e.: grazing, salvage logging, and roads, transmission lines, and natural disasters including fire and tornadoes. The Early Bird fire impacted approximately 68 % of the project area, and the entire project area is grazed. While the general character of the landscape is that of disturbance, it retains a natural and uninhabited appearance. The nearest occupied dwelling off of the reservation approximately 4 miles north of the project area. Impacts to scenic resources were submitted during the public scoping process. Appendix X shows two photosimulations of the project area.

The existing project area is primarily visible by most of the public from HW 212 adjacent to the project and to the east from an area known as Ashland Flats. None of these areas are designated as tribal, county, regional, state, or federal significant scenic overlooks. The subjective nature of the perception of visual impacts makes visual impacts difficult to quantify. Photo simulations of the proposed project were created form Ashland Flats approximately __ miles east of the project area and from Fisher Butte approximately _ miles south of the project area and can be viewed in appendix __. The turbines simulated in the photo-simulations were 1.5 MW turbines and assumed a 65-meter tower (213 feet) and 70-meter rotor (227 feet), making the total height from base to vertical blade tip 100 meters (328 feet).

Shadow Flicker
Shadow flicker is caused by shadows cast from the sun shining through moving blades. A comparable experience would be the effect of driving in a car adjacent to a forest with the sun shining through it. Shadow flicker would be disturbing if the flicker was cast into the windows of occupied dwellings adjacent the project area. Most wind power ordinances require project setbacks from the nearest occupied dwellings to be at a minimum of a 1000 feet. The nearest occupied dwelling is approximately 4 miles north of the project area outside of the reservation boundary.

Staging Areas
Staging area may be needed during and after construction for miscellaneous repair equipment, spare parts, vehicles etc. The area would be approximately three acres in size. If left visible to regular traffic, the area could take on an unfavorable industrial appearance inconsistent with the natural landscape.

No Action Alternative
Under the No Action Alternative the project area would retain its disturbed but natural character.

Cumulative Impacts
The site would be left in its current degraded condition to slowly recover from the previous fires.

Proposed Action
The proposed project would be composed of 20 turbines assuming the representative 1.5 MW turbines. Towers for the 1.5 MW turbines vary in height from 65 to 80 meters, and rotors vary in width from 70 to 77 meters. The photo simulations in figures x and y assume a 65-meter tower and a 70 meter rotor, which makes the total tip height of the turbine 100 meters (328 feet). Smaller turbines could be used for the project, with the smallest proposed turbine being one megawatt. In this case 30 turbines would be used to reach the 30 MW project size. The maximum tip height of a one-megawatt turbine would be 91 meters (297 feet) assuming a 60-meter tower and 61-meter rotor. As of the writing of this document the largest turbines in production are 3 MW in size, though turbines are still increasing in size, height, and capacity. Because of this a hypothetical turbine was chosen to represent the maximum size turbine possible for the proposed site. Assuming this turbine is rated at 3 MW, only 10 turbines would be required to reach the 30 MW project size. The hypothetical tip height would be 100 meters (492 feet), assuming a 100-meter rotor and 100-meter tower. So while fewer turbines would be needed for the site, they would be larger in size.

Regardless of the final chosen turbine size, all of the prospective turbines would extend well above the tree line and would be readily visible on the skyline. Topographic orientation prohibits the project from being seen from Lame Deer and most of Ashland. The project would be readily visible from HW 212 particularly coming from the east through Ashland flats and immediately adjacent to the project area on top of the pass of the Garfield Peak ridgeline. None of these areas are designated as tribal, county, regional, state, or federal significant scenic overlooks. The visual impact of the turbines would be subjective and dependent on the perceptions of the viewer. For example some may believe that the turbines represent tribal self-sufficiency. Still others may believe that turbines mar the scenic beauty of the natural landscape. Because of the subjective nature of visual perception, significant positive or negative impacts from an operating wind project cannot be concluded.

Shadow Flicker
Significant impact would occur if rotating shadows disturbed local residents and the passing frequency of the blades were above 2.5 Hz, which is the threshold known to cause epileptic seizures. The project area is located in a rural and sparsely forested area with the nearest dwelling being four miles north of the project are off the reservation. Also the rotation of modern turbine rotors is below 1.75 Hz. No significant impacts are expected in regards to Shadow Flicker.

Staging Area
Staging areas during construction would be temporary and located within the project area. The project area is setback enough from HW212 enough that visual impacts from commonly used areas would be negligible. During operations and maintenance the project area would be void of any unused equipment not planned for immediate maintenance. A permanent equipment staging area for temporary equipment would be sited in a low visible area using topography or vegetation as cover in order to avoid an unsightly industrial appearance.

Cumulative Impacts
No cumulative visual resource impacts are expected as a result of normal operations of the wind plant. Expansion would increase the number of installed turbines, though none of the adjacent land areas are designates as tribal, county, regional, state, or federal scenic areas. Repowering and expansions could introduce different turbine sizes to the project, and impact the visual uniformity from the use of the same model turbine. The incremental impacts of expansion or repowering would be considered negligible compared to development on a pristine area. Decomissioning would remove the visual impact from the existing project, and the subsequent reclamation would return the project area to its original state.

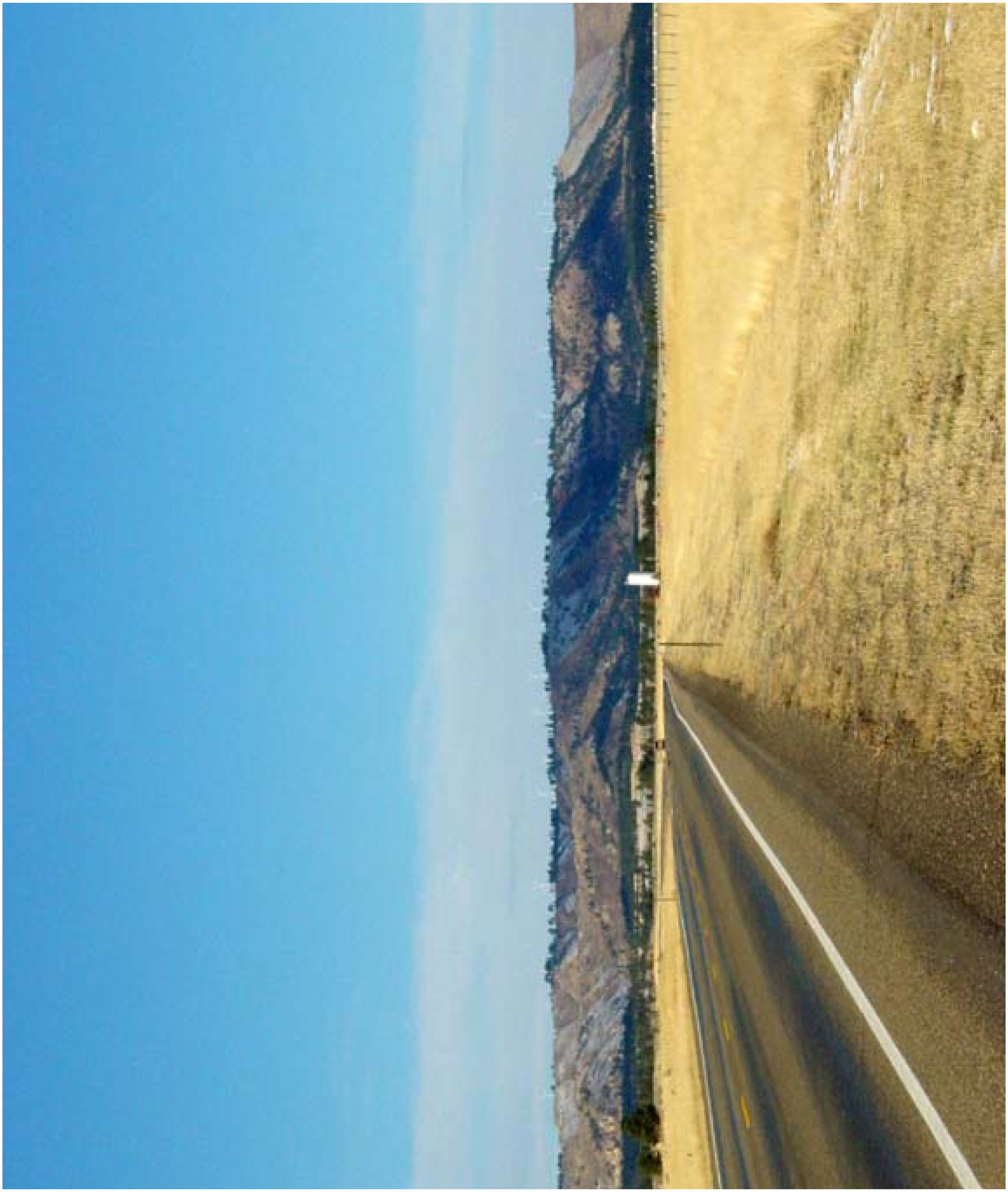

Figure 17. Photo Simulation from Ashland Flats at mile marker 53 facing west approximately 5 miles from project site.

Figure 18. View of project area from road west of Fisher Butte approximately 6 miles from project

Appendix D

Interconnection Study

Northern Cheyenne Tribe
North Cheyenne Reservation

Northern Cheyenne Wind Project Impact Study

Prepared for
Tongue River Electric Cooperative, Inc.
&
Distributed Generation Systems

Prepared by:

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May 2004

INDEX

1.0 INTRODUCTION & PURPOSE

Distributed Generation Systems (DisGen) has requested an interconnection to Tongue River Electric Cooperative, Inc.'s (TRECO) 69 kV transmission system. The Northern Cheyenne Wind Project, referred to throughout this report as the "Project" consists of approximately 30 MW of wind generation delivered to TRECO's system. The Project is located in southeastern Montana, near Ashland, on the Northern Cheyenne Reservation. The 30 MW of generation is proposed to be directly interconnected to TRECO's 69 kV system at a tap point on the 69 kV line between Lame Deer and Ashland Substations. Geographically, the 69 kV line parallels U.S. Highway 212 between the towns of Ashland and Lame Deer.

The purpose of this report is to identify impacts to TRECO's system, as well as any regional impacts, such as to the NorthWestern Energy (NWE) system occurring from the interconnection of the generators. Other objectives of this study consists of the following items:

- Identify the most appropriate transmission scenarios to support the proposed 30 MW interconnection; including transmission taps, costs and load flow analysis.
- Provide input on optimal plant sizing and configuration (e.g., constraints that may exist in the 69 kV system, as well as required interconnect facilities).
- Provide information that may ultimately be submitted to NorthWestern Energy (NWE) or Western Area Power Administration (WAPA), for interconnection queue purposes.

Analysis was completed for several different load flow scenarios associated with interconnection of the Project. The load flows included both TRECO's 69 kV system, as well as the regional transmission system. The results of the studies performed, in addition to general requirements in order for DisGen to interconnect and associated cost estimates, are provided in the following sections of the report. A TRECO transmission operating diagram is shown on the following page, indicating with the proposed interconnection location.

2.0 MODELING

Power flow analysis was performed using Western Electricity Coordinating Council (WECC) base cases, supplied by NorthWestern Energy (NWE). The 2003 Heavy Summer Base Case **(03hs2)** and the projected 2004 Light Autumn Case **(04la1)** had been previously modified by NWE to include additional system detail in the Montana Area (particularly at the sub-transmission voltage level) and provide more accurate loading for the 2003 Peak Summer and 2004 Autumn time frames. The cases were supplied in GE PSLF format and all analysis was performed using the PSLF program.

The summer peak case was chosen as a critical case for evaluation because it represents a condition where the Montana to Northwest backbone transmission system is at peak loading. With peak transmission system loading, any additional generation added on TRECO's system will demonstrate the worst-case transmission system constraints. The Light Autumn Case was chosen to represent light loading conditions in which over-voltage issues could be evaluated.

2.1 Base Case Modifications

The **03hs2** and **04la1** Base Cases were modified to include additional transmission system detail for the TRECO system and to update TRECO system loads. Specifically, the base case modifications that were made are as follows:

a. A detailed 69 kV TRECO system model was added to NWE's Colstrip 69 kV bus, and the simplified representation of the TRECO system originally in the model, was taken out of service.

b. Individual TRECO loads were modeled at their non-coincident, 12-month, historical peaks, to represent the highest anticipated load level.

c. The 69 kV system was modeled in the "normal" condition; with all disconnect switches in their normal state for operation.

d. The DisGen Northern Cheyenne Wind Project was modeled at its approximate location on the TRECO system. For simplicity, the Project was modeled as a single generator on the 34.5 kV bus.

Generation was modeled at 100% of combined nameplate rating (30 MW). The generators were modeled at a running power factor of 0.97 lagging.

e. The Project generation was scheduled to the NWE control area.

For the final base case configuration, the flows at the Colstrip 69 kV bus were compared with data supplied by NWE and TRECO to validate the detailed base case model including the TRECO system. These cases were designated **03hsf0** and **04laf0** for the Peak Summer and Light Autumn cases, respectively.

The output of the Project is large when compared with the total TRECO system load. In order to evaluate the impact of maximum Project generation during times when native system load is at minimum levels, a Light Load Case was developed representing the lowest anticipated TRECO system load. Delivery point information between 1999 and 2003 was analyzed to determine a "worst case" light load level on TRECO's system. For the light load cases, all TRECO loads were scaled to 25% of their peak load value. The Light Load Cases were designated **03hsl0** and **04la10**.

2.2 Alternatives Studies

The TRECO system is currently operated as two separate radially fed sections. Disconnect switches between the Mission Tap and Lame Deer are normally open to isolate the two 69 kV feeds. Two primary alternatives were considered to provide transmission service for the Project, radially fed from Lame Deer Tap, and radially fed from Mission Tap. Tying the two TRECO sections together in a loop-fed arrangement at the Project was briefly considered, but later dismissed due to the complexity of relay modifications that would be required at Colstrip 69 kV. Due to the high losses associated with the Project, additional analysis was completed with a 115 kV option.

The final alternative cases that were studied are as follows:

Heavy Summer Regional Model:

- **03hsf2** – full load case with Project fed from Lame Deer Tap

- **03hsf3** – full load case with Project fed from Mission Tap
- **03hsl2** – light load case with Project fed from Lame Deer Tap
- **03hsl3** – light load case with Project fed from Mission Tap
- **03hsf4** – full load case with 115 kV option
- **03hsl4** – light load case with 115 kV option

Light Autumn Regional Model:

- **04laf2** – full load case with Project fed from Lame Deer Tap
- **04laf3** – full load case with Project fed from Mission Tap
- **04lal2** – light load case with Project fed from Lame Deer Tap
- **04lal3** – light load case with Project fed from Mission Tap
- **04laf4** – full load case with 115 kV option
- **04lal4** – light load case with 115 kV option

3.0 RESULTS

Addition of the Project generation results in a net power flow into the Colstrip 69 kV bus and 115/69 kV transformer when generation is at or near maximum levels. For the off-peak condition, when TRECO native load is light, this flow approaches the normal thermal rating of the Colstrip 115/69 kV transformer (24 MVA).

Voltage regulation on the TRECO transmission system results in high transmission system voltages for some of the cases studied. Specifically, when one Colstrip breaker is out of service and the entire TRECO system is fed via the remaining Colstrip breaker and the Project, voltages above 1.05p.u. occur at some of the busses within TRECO's system. Voltages also exceed 1.05 p.u. during these same conditions without the Project; however, the magnitude is reduced by approximately 0.03 p.u. This condition may be somewhat improved by adjustment of taps at the Colstrip transformer, adjustment of voltage compensation equipment at the Project or opening the line between Lame Deer and Mission Tap. The addition of the Project also results in increased line losses on the TRECO system.

The potential impacts to the regional system (NWE) as a result of the Project occur during light loading conditions and maximum generation. Under this scenario, the Colstrip 115/69 kV transformers (three (3) single-phase units) are loaded to 98% of nameplate rating (24 MVA). Considering that no system conditions evaluated result in actual bank overload, as well as the fact that the extreme light load conditions are very infrequent, no mitigation measures such as Remedial Action Schemes or load shedding schemes are recommended at this time. Such schemes could be required in the future as a result of change of system characteristics. Should generation be increased beyond 30 MW, additional system improvements would be required.

Addition of the project will require replacement of non-directional overcurrent relays on the Colstrip breakers 69/52, 69/55 and 69/63 with directional type. Directional relays are required to prevent these breakers from operating on currents over the minimum pickup value that flow from the TRECO system toward the Colstrip bus.

3.1 Load flow Analysis

Power flow plots for the cases studied are included in the Appendix to this report. *Table 3-1* and *3-2* summarize the flow conditions of the cases studied. *Table 3-1* shows all of the cases with TRECO's entire system operated at 69 kV and *Table 3-2* shows the cases associated with the 115 kV option.

Case	Project Generation	69 kV Breaker #63 Flow	69 kV Breaker #52 Flow	Colstrip Transformer Flow
03hsf0	0 MW	3.0 MW	3.1 MW	16.0 MW
03hsf2	30 MW	-24.5 MW	3.1 MW	-11.5 MW
03hsf3	30 MW	3.0 MW	-24.6 MW	-11.7 MW
03hsl0	0 MW	0.7 MW	0.8 MW	4.0 MW
03hsl2	30 MW	-26.6 MW	0.8 MW	-23.3 MW
03hsl3	30 MW	0.7 MW	-26.8 MW	-23.6 MW
04laf0	0 MW	3.0 MW	3.1 MW	12.4 MW
04laf2	30 MW	-24.5 MW	3.1 MW	-15.1 MW
04laf3	30 MW	3.0 MW	-24.6 MW	-15.3 MW
04lal0	0 MW	0.7 MW	0.8 MW	7.8 MW
04lal2	30 MW	-26.6 MW	0.8 MW	-19.5 MW
04lal3	30 MW	0.7 MW	-26.8 MW	-19.8 MW

Table 3-1
Power Flow Results – 69 kV

Case	Project Generation	69 kV Breaker #63 Flow	69 kV Breaker #52 Flow	Colstrip Transformer Flow
03hsf4	30 MW	3.0 MW	-25.2 MW	12.9 MW
03hsl4	30 MW	0.7 MW	-27.4 MW	3.2 MW
04laf4	30 MW	3.0 MW	-25.2 MW	9.3 MW
04lal4	30 MW	0.7 MW	-27.5MW	7.1 MW

Table 3-2
Power Flow Results – 115 kV Option

None of the cases resulted in overloads of transmission line conductors. The light load cases with the Project at full rated output result in flows that are 74% of the normal thermal rating for some line sections in the TRECO transmission system (line sections with #4/0 ACSR conductor). This ampacity level is very high for transmission and is therefore indicative of a correspondingly high level of losses.

3.2 System Voltage Analysis

Addition of the Project at full nameplate rated output results in increased nominal bus operating voltage at various locations on the TRECO transmission system. The worst case system voltages during normal system operating conditions with the Project on-line is approximately 1.064 per unit, slightly above the recommended WECC criteria of 1.05 p.u. maximum during normal system conditions. During outage conditions, the worst-case is increased to approximately 1.108 per unit. Without the Project, the worst case voltage is 1.094 per unit during outage conditions.

The recommended configuration for connecting the generators to TRECO's system result in no overvoltage criteria violations during normal system operation. During outage conditions, it is recommended that TRECO keep either the WA-1 or WA-2 switch between Ashland and Mission Tap open to avoid overvoltages, regardless if the Project is connected or not. Additional investigation will be required once the actual wind turbine has been selected for the project. Machines operating at power factors higher than the assumed 0.97 lag will exacerbate high voltage conditions. If final facilities studies show bus voltages of over 1.05 per unit during normal system conditions, some form of reactive compensation may be required.

3.3 Contingency Analysis

Contingency analysis for radially fed systems is limited to analysis of alternate feed arrangements which might be used during system interruptions or equipment maintenance situations.

Power flow plots of the various alternate feed arrangements considered are included in the Appendix of the report. The optimum arrangement for delivery of the generation is connection to the Mission Substation tap. This could be achieved by reconfiguring the WA-2 switch to normally closed, as shown in the Transmission Operating Diagram in Section 1 of this report.

3.4 System Loss Analysis

System losses were tabulated for the TRECO system (Zone 26) and for the Montana area (Area 62) for the base case and each of the Project Cases. *Table 3-3* summarizes the results of this analysis.

Case	Project Generation	TRECO Load	Project Connection	TRECO Losses	Montana Losses
Heavy Summer Cases					
03hsf0	0 MW	16 MW	OFF	0.4 MW	101.3 MW
03hsf2	30 MW	16 MW	WA-1	2.5 MW	105.7 MW
03hsf3	30 MW	16 MW	WA-2	2.2 MW	105.5 MW
03hsf4	30 MW	16 MW	WA-2 / 115	1.5 MW	104.9 MW
03hsl0	0 MW	4 MW	OFF	0.1 MW	101.8 MW
03hsl2	30 MW	4 MW	WA-1	2.6 MW	106.4 MW
03hsl3	30 MW	4 MW	WA-2	2.3 MW	106.2 MW
03hsl4	30 MW	4 MW	WA-2 / 115	1.5 MW	105.7 MW
Light Autumn Cases					
04laf0	0 MW	16 MW	OFF	0.1 MW	90.9 MW
04laf2	30 MW	16 MW	WA-1	2.5 MW	95.3 MW
04laf3	30 MW	16 MW	WA-2	2.2 MW	95.1 MW
04laf4	30 MW	16 MW	WA-2 / 115	1.5 MW	94.5 MW
04lal0	0 MW	4 MW	OFF	0.1 MW	91.1 MW
04lal2	30 MW	4 MW	WA-1	2.6 MW	95.7 MW
04lal3	30 MW	4 MW	WA-2	2.3 MW	95.5 MW
04lal4	30 MW	4 MW	WA-2 / 115	1.4 MW	94.9 MW

Table 3-3
System Losses

The addition of the Project increases the TRECO system losses between 1.8 and 2.6 MW, or between 6% and 8.7%. Correspondingly, DisGen and the project developers should be careful to prepare economic models based upon a project net delivery of 28 MW (30 MW output less 2 MW average increased losses). The total losses in the Montana area increase by approximately 4 MW due to the Project (this figure includes the TRECO losses). The losses are less when the generation is delivered to the Mission bus (**03hs3** and **03hs13** cases) opposed to the delivery of generation to Lame Deer.

3.5 115 kV Conversion Option

As a result of the very high losses associated with the project, additional analysis was performed to evaluate alternatives to reduce losses. The existing transmission line between Colstrip Substation and Switch CS-2 near Ashland was designed for 115 kV but is currently operated at 69 kV. Losses can be significantly reduced by operating this 30.3 mile section of line at 115 kV instead of 69 kV. Operating the line at 115 kV would require a new breaker position off the Colstrip 115 kV bus and a new 115 kV/69 kV autotransformer near Ashland. The 115 kV option would also alleviate thermal overloading concerns on the Colstrip transformers should DisGen prefer to add generation beyond the 30 MW analyzed in this study. The only negative impact to TRECO would be the loss of switching capability at CS-3 (outside Colstrip); however, all TRECO loads could still be fed from either breaker at Colstrip.

Based on the 115 kV option load flow results, an improvement of approximately 0.7 MW in losses in TRECO's system is achieved with the 115 kV option compared with the optimal 69 kV option. Based on $0.05 per kWH for the additional sale energy and a 70% load factor, operation at 115 kV could result in annual increase in revenue of $210,000. The capital cost for facility upgrades associated with the 115 kV option could potentially be recovered over a 6 to 8 year period. The diagram on the following page illustrates the 115 kV option.

4.0 General Requirements

In addition to system impacts associated with load flows as outlined in Section 3, other safety and operational requirements for the interconnection of the Project also exist. These requirements consist of relaying and safety disconnect equipment. Section 4.0 outlines these general requirements.

At the point of interconnection to TRECO's 69 kV system, an isolating device, typically an air disconnect switch and/or an interrupting device, shall be provided that physically and visibly isolates TRECO's system from DisGen. Safety and operating procedures for the isolating device shall be in compliance with the following stipulations:

4.1 Isolating Devices

- Must simultaneously open all phases (gang-operated)
- Must be accessible by TRECO operations personnel at all times
- Must be lockable in the open position by TRECO operations personnel
- Would not be operated without advanced notice to either party, unless an emergency condition requires that the device be opened to isolate the generation
- Must be suitable for safe operation under the conditions of use

TRECO operations personnel may lock the device in the open position and install safety grounds under the following circumstances:

- If it is necessary for the protection of maintenance personnel when working on a de-energized circuit
- If DisGen's equipment presents a hazardous condition
- If DisGen's equipment interferes with the operation of TRECO's system
- If TRECO's system interferes with the operation of the Project

4.2 Relaying Requirements

New relaying must be installed at the interconnection location in order to operate the generation in parallel with TRECO's system. The purpose of these relays is to promptly detect system abnormalities and disconnect the Project from the rest of the grid. Specifically, the relaying system shall be capable of detecting and clearing the generators from short circuits or grounds on TRECO's facilities serving the project. The relaying system should also be capable of detecting voltage and frequency changes, which can occur if TRECO's system is disconnected from the project. This is especially important in this application since the generators are induction type and self-excitation may present a concern for overvoltages. Self-excitation occurs when an isolated generator is connected to a system having capacitance equal to, or greater than, the magnetizing reactance requirements. Depending on the value of the capacitance and the kW loading on the machine, voltages in the island of 1.5 to 2.0 per unit can be produced. The third relaying requirement is that the project shall not reconnect to TRECO's system until the TRECO service voltage is of normal magnitude and phase sequence.

Typical protection devices, which are required to satisfy the relaying requirements, are discussed below:

- Residual overcurrent or overvoltage relays to trip for ground faults on TRECO's system (devices 51N or 59N).
- Under/over voltage relays (devices 27 and 59).
- Directional line over current relays (67L)
- Under/over frequency relays (device 81).
- Synchronism checking relays (device 25).

All of the relay settings shall be reviewed by a TRECO appointed representative to assure that settings are in compliance with their interconnection requirements. A one-line diagram is shown at the end of Section 5.0, summarizing these relay requirements.

Non-directional overcurrent relays are currently utilized at the Colstrip 69 kV delivery point for protection of the radial lines that serve TRECO's system. Ideally, during fault conditions, the corresponding line breaker should trip and clear the fault while the other breaker remains in service and feeds a portion of TRECO's system. Settings on the line relays will need to be confirmed to prevent tripping of the non-faulted line during outage conditions on the adjacent 69 kV line. Directional overcurrent relaying will be required on all three (3) 69 kV breakers at Colstrip.

4.3 Metering

Metering shall be located at a mutually agreed upon locations. These locations will accommodate requirements for metering load and generation, as well as provide a means to monitor system losses. DisGen shall be responsible for all transmission and transformer losses related to delivery of generation to the Colstrip bus.

The contract between TRECO and DisGen and/or other project owner(s) will stipulate that energy metered at the point of interconnection for the project will be reduced to account for losses in the 69 kV system. For planning purposes, DisGen should assume that the net kWH delivered to TRECO's system will be reduced by 6.6% for delivery over the existing network and 4.3% for delivery over an improved 69/115 kV TRECO transmission system. Loss adjustments to deliver energy through the NWE (or other) transmission system to a customer would be in addition to the TRECO loss levels.

At full generation, some energy will be exported into NWE's system through the Colstrip transformer. As a result, NWE may also require additional metering at the Colstrip Substation to monitor this power flow. It is also noted that if exported power is sold to third parties, some additional considerations may be required. Some of these considerations include FERC power marketer status and NERC and WECC scheduling requirements must be adhered to.

5.0 FACILITY COST ESTIMATES

Shown on the following page is a proposed one-line diagram for DisGen's interconnection to TRECO's system. DisGen's requirements would include a 69 kV circuit breaker, associated relaying, a 69-34.5 kV transformer with a 20/26/33.3 MVA or larger rating, metering disconnect switches and other miscellaneous items associated with the interconnection. Also included are *Tables 5-1* and *5-2* that provide detailed cost estimates associated with these facilities. These cost estimates include all of the items shown in the One-Line Diagram, as well as engineering fees, construction costs, relay upgrades at Colstrip, an NWE Facilities Study and other miscellaneous expenses associated with the construction of the substation facilities. The cost is divided between the 69-34.5 kV delivery facilities and the 69 kV transmission facilities. The total cost is the combination of these two and is estimated at $1,620,245. This estimate does not include the distribution (or collector) facilities to be installed at the generation location. Additional distribution facilities would consists of the actual generators, 575 V to 34.5 kV step-up transformers, all relaying and disconnect switches associated with the collector system and the wind farm communications.

This cost estimate does not include additional NWE metering or communications requirements internal to the NWE system. However, optional costs for SCADA and communications from the project to Colstrip are included. The cost also assumes that the Project will not require a significant extension of the 69 kV line to tie into TRECO's system. Should extension of a 69 kV line be required, estimated costs are $90,000 per mile.

The approximate cost for upgrade of the 115 kV system to reduce losses is estimated at $1,379,487. This estimate includes two (2) 115 kV breakers (one at Colstrip and one at the autotransformer location), associated relaying, a 115-69 kV autotransformer with a 30/40/50 MVA rating and other miscellaneous equipment. In addition, the 115 kV system cost estimate includes engineering fees and construction costs associated with a new 115-69 kV facility, as well as upgrade at Colstrip required for a 115 kV breaker addition. The 115 kV cost would be in addition to all of the 69 and 34.5 kV facility cost estimates outlined in the preceding paragraphs. *Table 5-3* provides detailed cost estimates associated with the 115 kV facilities.

69 - 34.5 kV Substation
Prepared by Electrical Consultants, Inc.

Item	Description	Unit	Quantity	Cost Per Unit		Total Cost		Combined Cost
				Material	Labor	Material	Labor	
A1	Structural Steel - 2 Feeders, 1 Transfer and Metering/Switch Bays	Lb.	12,800	$1.25	$0.85	$16,000.00	$10,880.00	$26,880.00
A2	Static Mast	Lb.	4,250	$1.25	$0.75	$5,312.50	$3,187.50	$8,500.00
A3	Electrical Bus - Complete Bay 34.5 kV	Lot	3	$4,900.00	$5,100.00	$14,700.00	$15,300.00	$30,000.00
A5	Insulators - 34.5 kV Station Post	Ea.	58	$80.00	$40.00	$4,640.00	$2,320.00	$6,960.00
B2	Group Operated Switch - 34.5 kV	Ea.	3	$3,900.00	$1,200.00	$11,700.00	$3,600.00	$15,300.00
C2	Surge Arresters - Station Class, 22 kV MCOV	Ea.	3	$500.00	$100.00	$1,500.00	$300.00	$1,800.00
D1	Hook Operated Switch - 34.5 kV	Ea.	18	$300.00	$150.00	$5,400.00	$2,700.00	$8,100.00
D2	Fused Disconnect Switch - 34.5 kV	Ea.	1	$800.00	$300.00	$800.00	$300.00	$1,100.00
E2	Power Circuit Breaker - 34.5 kV, 1200 Amp	Ea.	3	$29,500.00	$1,750.00	$88,500.00	$5,250.00	$93,750.00
G1	Current Transformer - 34.5 kV	Ea.	3	$850.00	$350.00	$2,550.00	$1,050.00	$3,600.00
G3	Voltage Transformer - 34.5 kV	Ea.	5	$850.00	$350.00	$4,250.00	$1,750.00	$6,000.00
G4	Feeder Relaying	Ea.	3	$8,000.00	$1,800.00	$24,000.00	$5,400.00	$29,400.00
G5	Transformer Relaying and Metering	Ea.	1	$25,000.00	$5,000.00	$25,000.00	$5,000.00	$30,000.00
G6	SCADA and Communications (DisGen Control of Gen Facilities-Optional)	Lot	1	$34,000.00	$14,000.00	$34,000.00	$14,000.00	$48,000.00
H1	Power Transfomer - 20/26.6/33.3 MVA	Ea.	1	$300,000.00	$25,000.00	$300,000.00	$25,000.00	$325,000.00
H2	Station Service Transfomer - 37.5 kVA	Ea.	1	$2,400.00	$500.00	$2,400.00	$500.00	$2,900.00
K1	Conduit System	Lot	1	$3,000.00	$6,000.00	$3,000.00	$6,000.00	$9,000.00
K2	Control Wire and Cable	Ft.	6,800	$2.00	$2.00	$13,600.00	$13,600.00	$27,200.00
L1	Concrete Foundations	Cu. Yds.	64	$250.00	$600.00	$16,000.00	$38,400.00	$54,400.00
M1	Site Preparation	Lot	1	$6,500.00	$10,000.00	$6,500.00	$10,000.00	$16,500.00
M2	Station Gravel	Cu. Yds.	181	$25.00	$20.00	$4,525.00	$3,620.00	$8,145.00
N1	Station Chainlink Fence	Ft.	280	$8.00	$12.00	$2,240.00	$3,360.00	$5,600.00
O1	Station Grounding	Sq. Ft.	9,800	$0.80	$1.00	$7,840.00	$9,800.00	$17,640.00
P1	Control Building - Prefabricated	Sq. Ft.	440	$60.00	$20.00	$26,400.00	$8,800.00	$35,200.00
P2	Battery & Dual Chargers - 125 Volt	Ea.	1	$16,000.00	$3,500.00	$16,000.00	$3,500.00	$19,500.00
P3	Control Building Accessories	Lot	1	$12,000.00	$15,000.00	$12,000.00	$15,000.00	$27,000.00
	Miscellaneous Items & Contingency	Lot	1					$100,000.00
	Engineering, Construction & Project Management, Start-Up	Lot	1					$140,000.00
	Total							$1,097,475.00

Table 5-1
69 - 34.5 kV Delivery; Facility Cost Estimate

69 kV Substation Facilities & Misc. NWE Requirements
Prepared by Electrical Consultants, Inc.

Item	Description	Unit	Quantity	Cost Per Unit		Total Cost		Combined Cost
				Material	Labor	Material	Labor	
A1	Structural Steel	Lb.	24,000	$1.25	$0.85	$30,000.00	$20,400.00	$50,400.00
A2	Electrical Bus - Complete	Lot	1	$8,500.00	$12,000.00	$8,500.00	$12,000.00	$20,500.00
A3	Insulators - 69 kV Station Post	Ea.	9	$350.00	$150.00	$3,150.00	$1,350.00	$4,500.00
A4	Insulators - 69 kV Suspension	Ea.	12	$150.00	$200.00	$1,800.00	$2,400.00	$4,200.00
B1	Group Operated Switch - 69 kV	Ea.	2	$5,000.00	$2,000.00	$10,000.00	$4,000.00	$14,000.00
C1	Surge Arresters - Station Class, 48 kV MCOV	Ea.	6	$1,200.00	$200.00	$7,200.00	$1,200.00	$8,400.00
E1	Power Circuit Breaker - 69 kV, 1200 Amp	Ea.	1	$50,000.00	$2,500.00	$50,000.00	$2,500.00	$52,500.00
G1	Current Transformer - 69 kV (Metering Accuracy)	Ea.	3	$4,000.00	$800.00	$12,000.00	$2,400.00	$14,400.00
G2	Voltage Transformer - 69 kV	Ea.	3	$3,000.00	$800.00	$9,000.00	$2,400.00	$11,400.00
G4	Substation Metering & Relaying	Lot	1	$44,000.00	$8,400.00	$44,000.00	$8,400.00	$52,400.00
G5	SCADA & Communications (TRECO/NWE/DisGen Control -Optional)	Lot	1	$30,000.00	$10,000.00	$30,000.00	$10,000.00	$40,000.00
K1	Conduit System	Lot	1	$2,000.00	$4,000.00	$2,000.00	$4,000.00	$6,000.00
K2	Control Wire & Cable	Ft.	1,880	$2.00	$2.00	$3,760.00	$3,760.00	$7,520.00
L1	Contcrete Foundations	Cu. Yds.	51	$250.00	$600.00	$12,750.00	$30,600.00	$43,350.00
M1	Site Preparation	Lot	1	$6,500.00	$8,000.00	$6,500.00	$8,000.00	$14,500.00
M2	Station Gravel	Cu. Yds.	260	$25.00	$20.00	$6,500.00	$5,200.00	$11,700.00
N1	Station Chainlink Fence	Ft.	340	$8.00	$12.00	$2,720.00	$4,080.00	$6,800.00
O1	Station Grounding	Sq. Ft.	14,000	$0.80	$1.00	$11,200.00	$14,000.00	$25,200.00
	Miscellaneous Items & Contingency	Lot	1					$40,000.00
	Engineering, Construction & Project Management, Start-Up	Lot	1					$95,000.00
	Misc. NWE Requirements							
	Replacement of Relays at Colstrip	Ea	3	$15,000.00	$10,000.00	$45,000.00	$30,000.00	$75,000.00
	NWE Facilities Study	Lot	1		$25,000.00	$0.00	$25,000.00	$25,000.00
	Total							$522,770.00

Table 5-2

69 kV Transmission Facilities Cost Estimate & Misc. NWE Requirements

115-69 kV Substation & 115kV Breaker Addition at Colstrip
Prepared by Electrical Consultants, Inc.

Item	Description	Unit	Quantity	Cost per Unit		Total Cost		Combined Cost
				Material	Labor	Material	Labor	
A1	Structural Steel	Lb.	35,000	$1.25	$0.85	$43,750.00	$29,750.00	$73,500.00
A2	Electrical Bus - 69 kV	Lot	1	$8,500.00	$12,000.00	$8,500.00	$12,000.00	$20,500.00
A3	Electrical Bus -115 kV	Lot.	1	$15,000.00	$20,000.00	$15,000.00	$20,000.00	$35,000.00
A4	Insulators - 69 kV Suspension	Ea.	3	$150.00	$200.00	$450.00	$600.00	$1,050.00
A5	Insulators - 69 kV Station Post	Ea.	12	$350.00	$150.00	$4,200.00	$1,800.00	$6,000.00
B1	Group Operated Switch - 69 kV	Ea.	1	$5,000.00	$2,000.00	$5,000.00	$2,000.00	$7,000.00
B2	Group Operated Switch - 115 kV	Ea.	3	$6,000.00	$2,000.00	$18,000.00	$6,000.00	$24,000.00
C1	Surge Arrester - 60 kV, 48 MCOV Dist. Class	Ea.	6	$1,200.00	$200.00	$7,200.00	$1,200.00	$8,400.00
D1	Fused Disconnect Switch - 25 kV	Ea.	3	$650.00	$180.00	$1,950.00	$540.00	$2,490.00
E1	Power Circuit Breaker - 115 kV	Ea.	2	$60,000.00	$2,500.00	$120,000.00	$5,000.00	$125,000.00
E2	Power Circuit Breaker - 69 kV	Ea.	0	$50,000.00	$2,500.00	$0.00	$0.00	$0.00
G1	Voltage Transformer - 69 kV, Single phase	Ea.	3	$3,000.00	$800.00	$9,000.00	$2,400.00	$11,400.00
G3	Substation Metering and Relaying	Lot	1	$44,000.00	$8,400.00	$44,000.00	$8,400.00	$52,400.00
G4	SCADA & Communications (Optional)	Lot	1	$30,000.00	$10,000.00	$30,000.00	$10,000.00	$40,000.00
H1	Auto Transformer 30/40/50 MVA	Ea.	1	$510,000.00	$31,000.00	$510,000.00	$31,000.00	$541,000.00
H2	Auxiliary Transformer - 25 kVA	Ea.	1	$1,050.00	$200.00	$1,050.00	$200.00	$1,250.00
K1	Conduit System	Lot	1	$5,000.00	$10,000.00	$5,000.00	$10,000.00	$15,000.00
K3	Control Wire and Cable	Ft.	5,000	$2.00	$2.00	$10,000.00	$10,000.00	$20,000.00
L1	Concrete Foundations	Cu Yds.	55	$250.00	$600.00	$13,750.00	$33,000.00	$46,750.00
M1	Site Preparation	Lot	1	$6,500.00	$10,000.00	$6,500.00	$10,000.00	$16,500.00
M2	Station Gravel	Cu Yds.	200	$15.00	$20.00	$3,000.00	$4,000.00	$7,000.00
N1	Station Fence - Chainlink	Ft.	400	$8.00	$12.00	$3,200.00	$4,800.00	$8,000.00
O1	Station Grounding	Sq Ft.	15,000	$0.80	$1.00	$12,000.00	$15,000.00	$27,000.00
P1	Control Building Pre-Fabricated	Sq Ft.	440	$60.00	$20.00	$26,400.00	$8,800.00	$35,200.00
P2	125 VDC Battery and Charger	Lot	1	$16,000.00	$3,500.00	$16,000.00	$3,500.00	$19,500.00
P3	Control Building Accessories	Lot	1	$12,000.00	$15,000.00	$12,000.00	$15,000.00	$27,000.00
	Contingency - Construction	Lot	1			$46,297.50	$12,249.50	$58,547.00
	Construction Management and Engineering	Lot	1				$150,000.00	$150,000.00
								$1,379,487.00

Table 5-3

115 kV Option; Transmission Facilities Cost Estimate

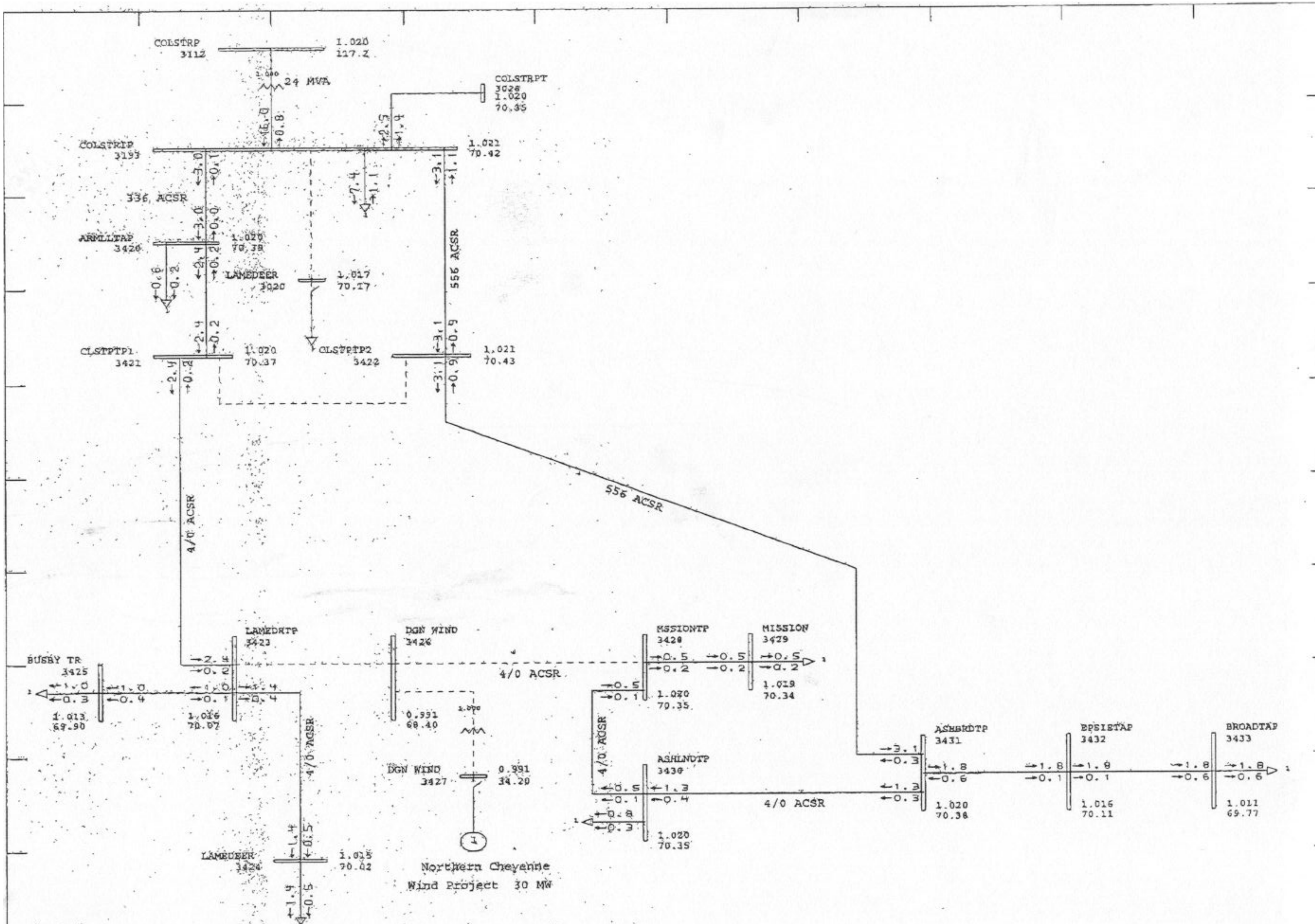
6.0 CONCLUSIONS

The Project was studied at full nameplate rated output (30 MW). Reduction in the total amount of generation, due to reduced machine availability, unfavorable wind conditions, etc. would reduce the impact of the Project on the TRECO system. These impacts primarily consist of increased losses and possible violation of maximum operating voltage in the TRECO system. These losses do not directly affect TRECO; however, they significantly reduce the amount of power that DisGen can export to the grid at the Colstrip delivery point. All of the other impacts to TRECO's system can be resolved with proper relaying through system operations.

Generation additions would be limited to approximately 30 MW with the optimal configuration for delivery of generation through the Mission Tap with the Lame Deer WA-1 switch open. It is ECI's opinion that conversion of a portion of the system to 115 kV should be given serious consideration. Such conversion would reduce losses on both TRECO and NWE systems to more acceptable levels.

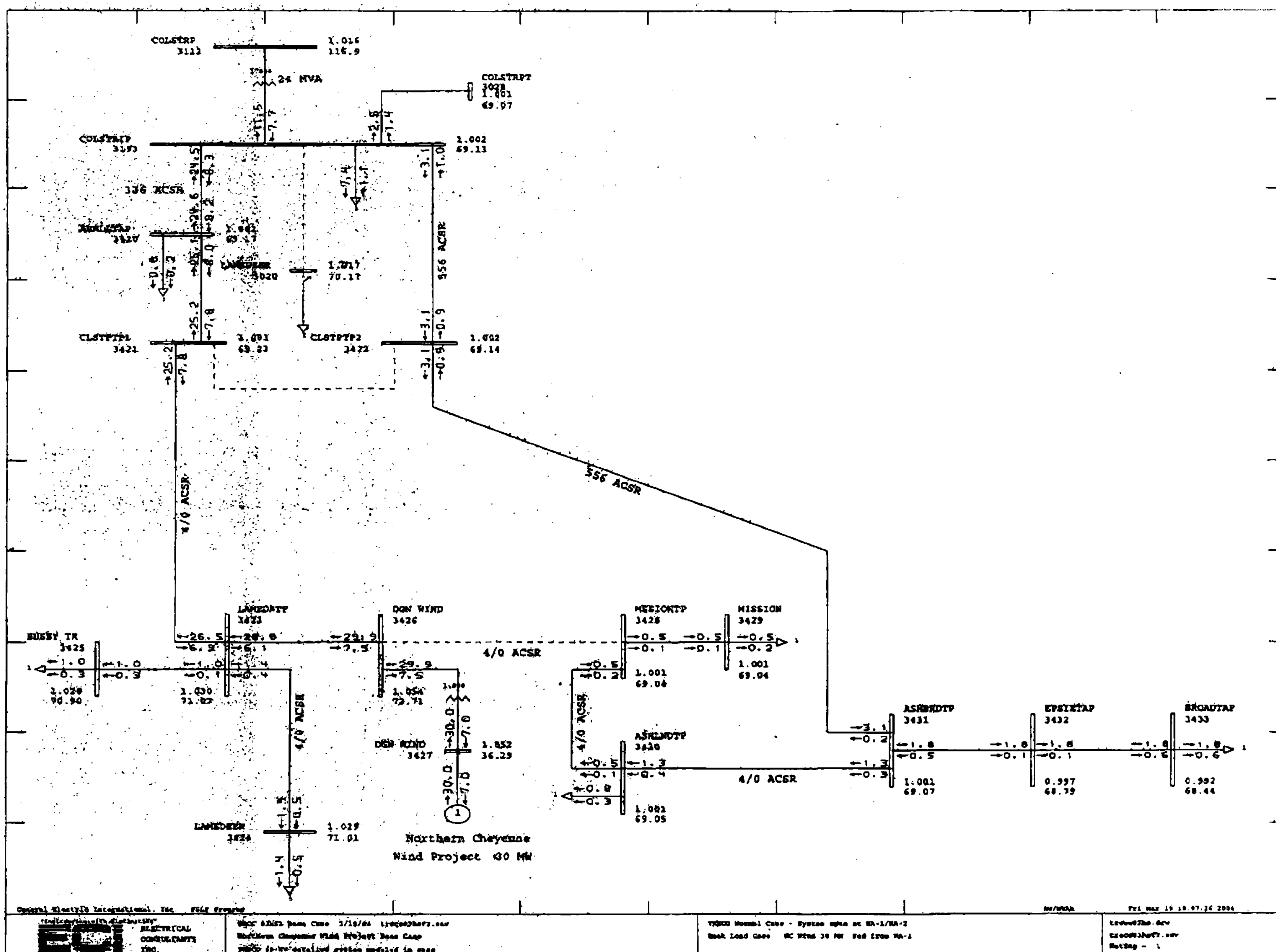
Interconnection with TRECO's system will require DisGen to comply with IEEE Standard 1547. This standard addresses items such as voltage flicker, grounding, electro/magnetic interference and surges that have not been discussed in this report. IEEE 1547 also provides uniform criteria and requirements relative to the performance, operation, testing, safety considerations and maintenance of the interconnection. In addition to the IEEE 1547 standard, DisGen shall follow all other applicable industry standards and construction practices. Other contractual issues shall be negotiated between TRECO and DisGen as the project develops.

Costs stated in this report are believed to be conservative, but should not be considered to be "firm" or "maximum". Additional facilities studies required by NWE, as well as potential reactive compensation for control of high voltages, may identify other costs related to integration of this resource.

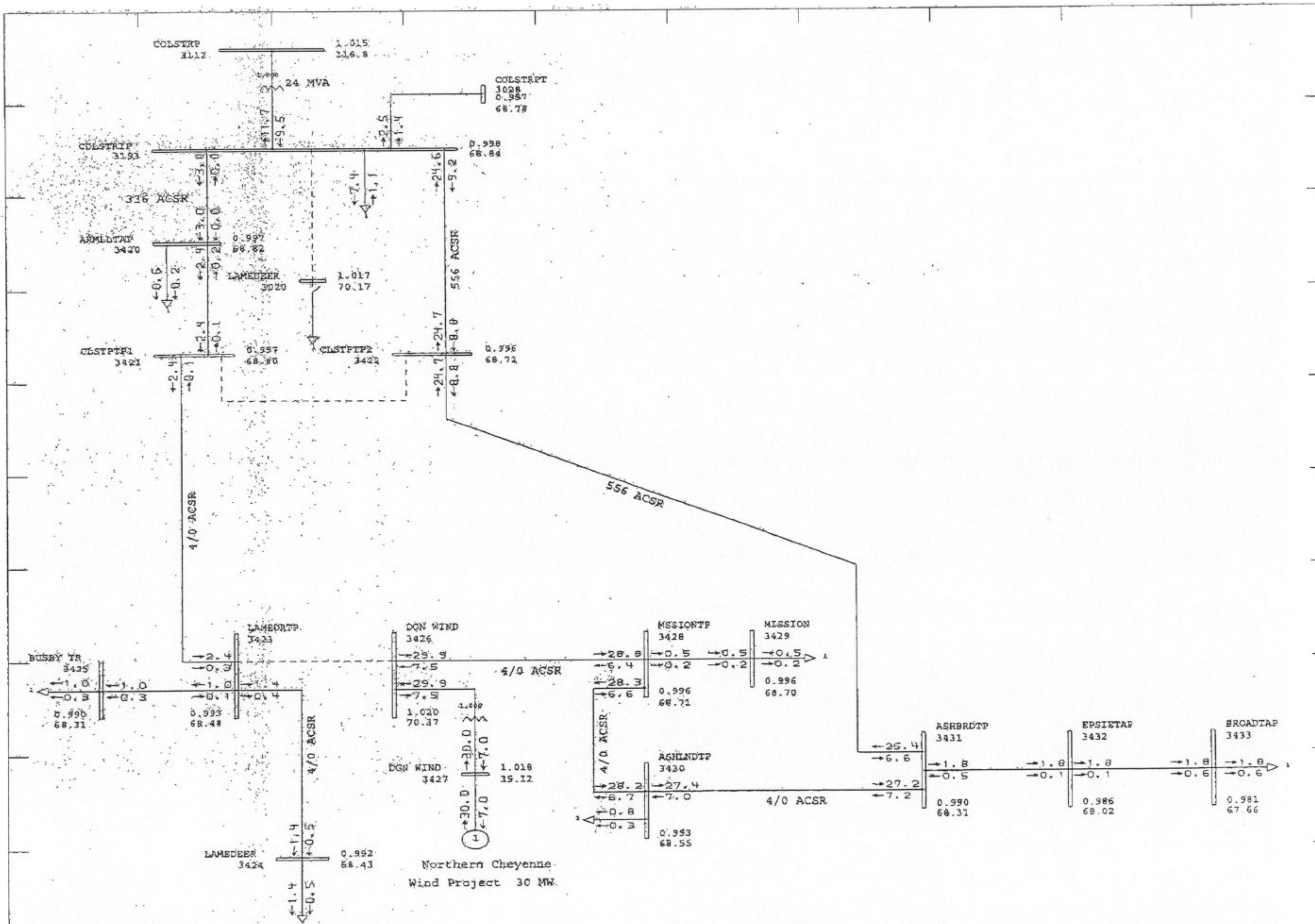


General Electric International, Inc. PSLF Program — MW/MVAR — Fri Mar 19 19:06:33 2004

"Engineering with Distinction" ECI ELECTRICAL CONSULTANTS INC.	WECC 03HS2 Base Case 3/19/04 treco03hsf0.sav Northern Cheyenne Wind Project Base Case TRECO 69-kV detailed system modeled in case.	TRECO Normal Case - System open at WA-1/WA-2 Peak Load Case NC Wind Not in Service	treco03hw.drw treco03hsf0.sav Rating = 1



COLSTRP 3111
1.016 116.9
24 MVA
COLSTRPT 3028
1.001 69.07
COLSTRIP 3193
1.002 69.11
336 ACSR
556 ACSR
1.017 70.17
CLSTPTP1 3421
1.001 69.33
CLSTPTP2 3422
1.002 69.14
4/0 ACSR
556 ACSR
BUSBY TR 3425
1.026 70.90
LAMEDRTP 3423
1.030 71.07
DGN WIND 3426
DGN WIND 3427
1.052 36.29
LAMEDEER 3424
1.029 71.01
MISSIONTP 3428
1.001 69.06
MISSION 3429
1.001 69.04
1.001 69.05
ASHLNDTP 3431
1.001 69.07
EPSIETAP 3432
0.997 68.79
BROADTAP 3433
0.992 68.44
Northern Cheyenne
Wind Project 30 MW
ELECTRICAL CONSULTANTS INC.



MW/MVAR

Fri Mar 19 15:08:06 2004

General Electric International, Inc. — PSLF Program

ELECTRICAL CONSULTANTS INC.

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Northern Cheyenne Wind Project Base Case
TRECO 69-kV detailed system modeled in case

TRECO Normal Case - System open at WA-1/WA-2
Peak Load Case NC Wind 30 MW Fed from WA-2

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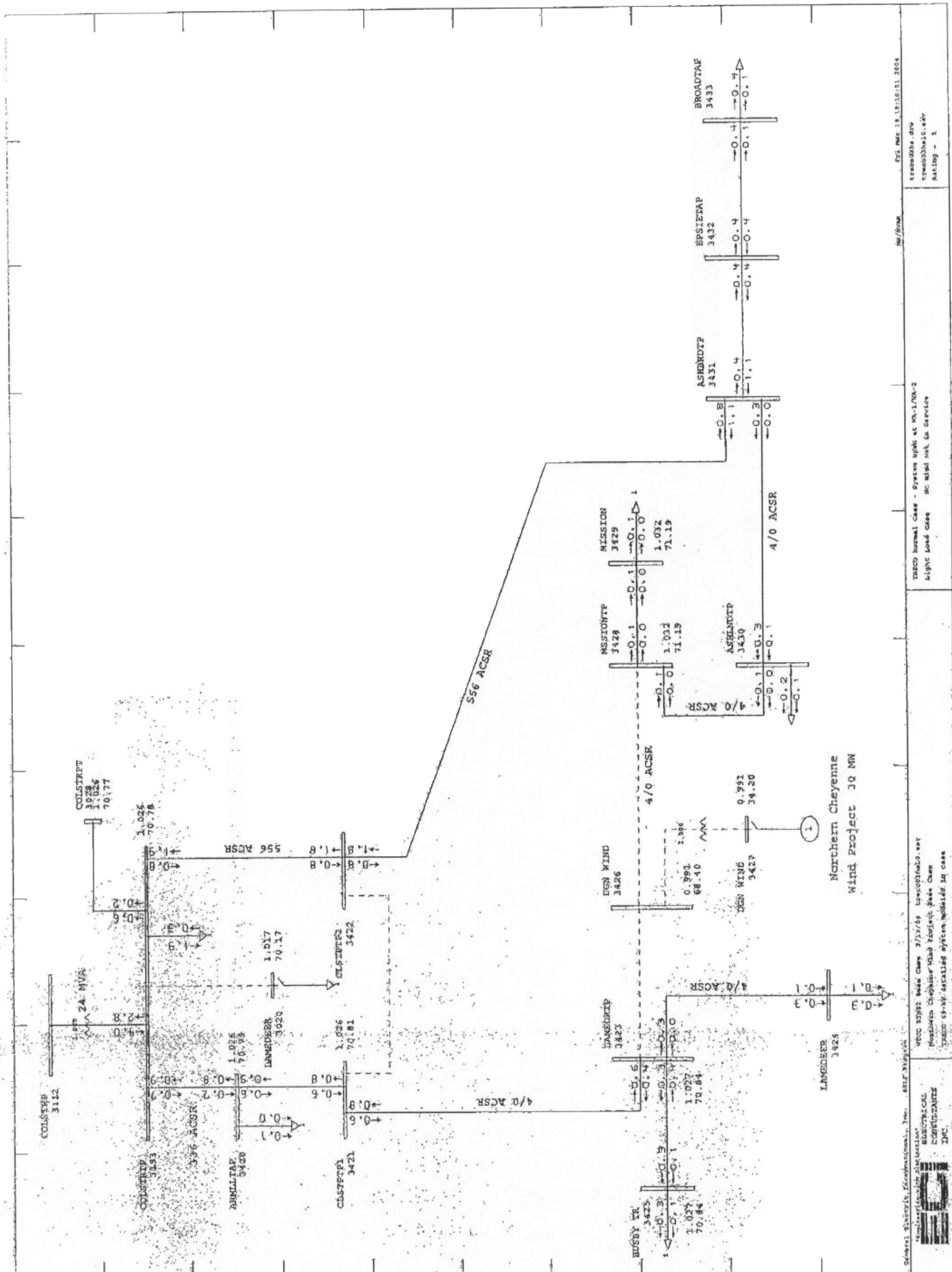
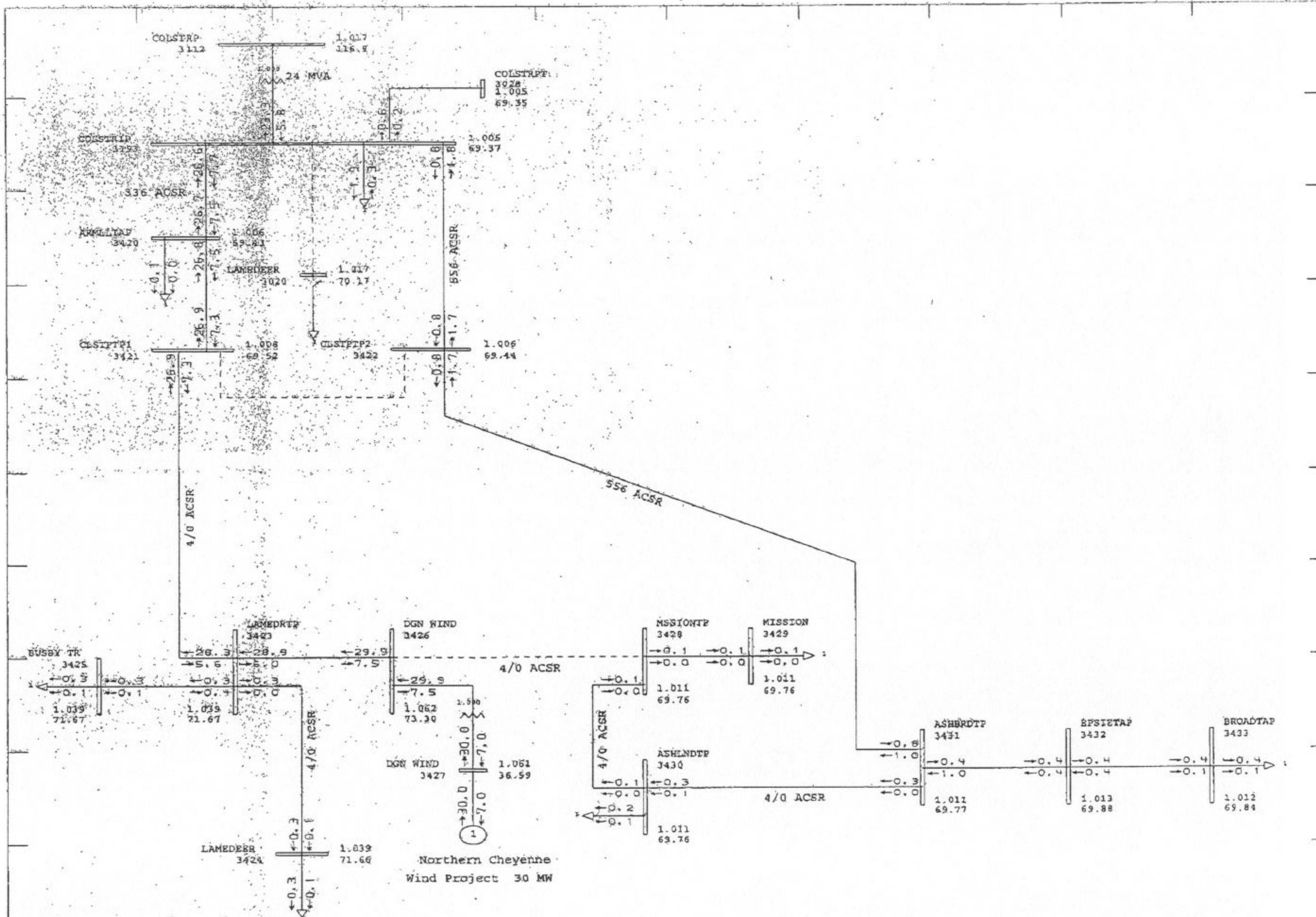

Northern Cheyenne
Wind Project 30 MW
556 ACSR
4/0 ACSR
336 ACSR
24 MVA
COLSTRP
COLSTRIP
ARMLLTAP
CLSTPTP1
CLSTPTP2
LAMEDEER
BUSBY TR
DGN WIND
MSSIONTP
MISSION
ASHLNDTP
ASHBRDTP
EPSIETAP
BROADTAP
ELECTRICAL
CONSULTANTS
INC.



General Electric International, Inc. PSLF Program | MW/MVAR | Fri Mar 19 13:11:19 2004

ELECTRICAL CONSULTANTS INC.

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Northern Cheyenne Wind Project Base Case
TRECO 69-kV detailed system modeled in case

TRECO Normal Case - System open at WA-1/WA-2
Light Load Case NC Wind 30 MW Fed from WA-1

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treco03hsl2.sav
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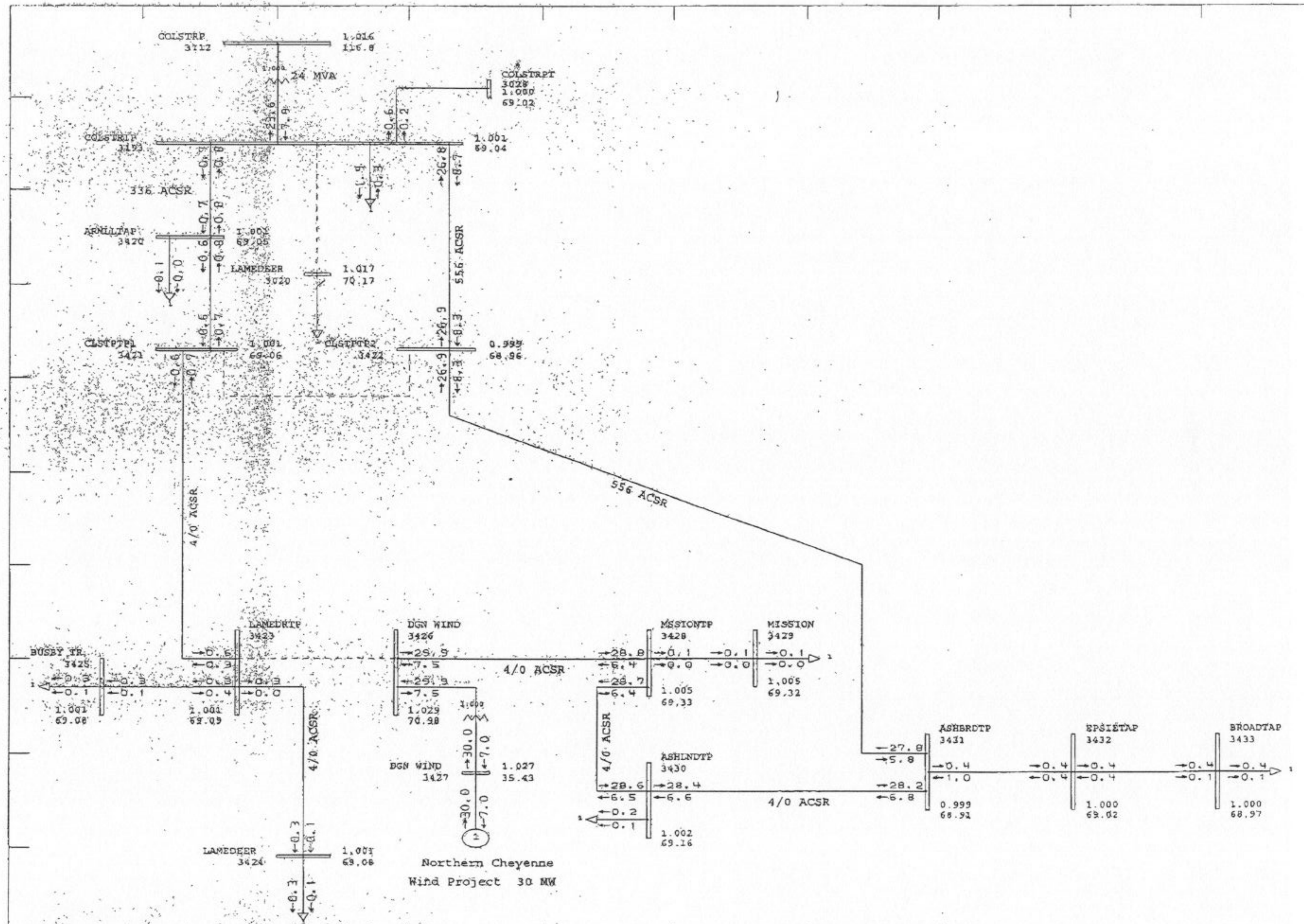

General Electric International, Inc. PSLF Program

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Northern Cheyenne Wind Project Base Case
TRECO 69-kV detailed system modeled in case

TRECO Normal Case - System open at WA-1/WA-2
Light Load Case . NC Wind 30 MW Fed from WA-2

MW/MVAR

Fri Mar 19 19:13:13 2004

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treco03hsl3.sav
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Appendix E

Wind Turbine Selection And Wind Resource Report

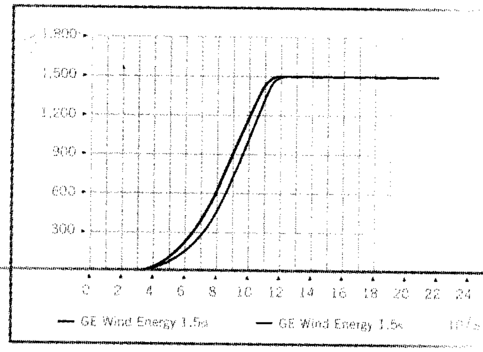
Northern Cheyenne Tribe North Cheyenne Reservation

1.5sl/1.5s wind turbine

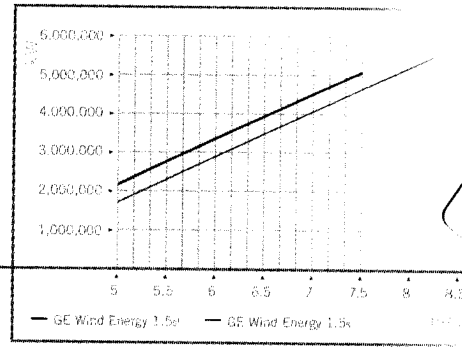
English

imagination at work

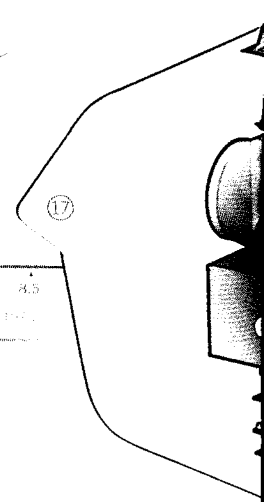
Wind speed at hub height / Standard atmosphere acc. to DIN ISO 2533, M.S.L. Standard Rayleigh distribution and unobstructed air flow

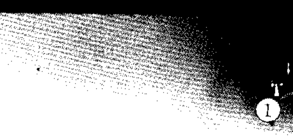


Power curve



Annual energy yield



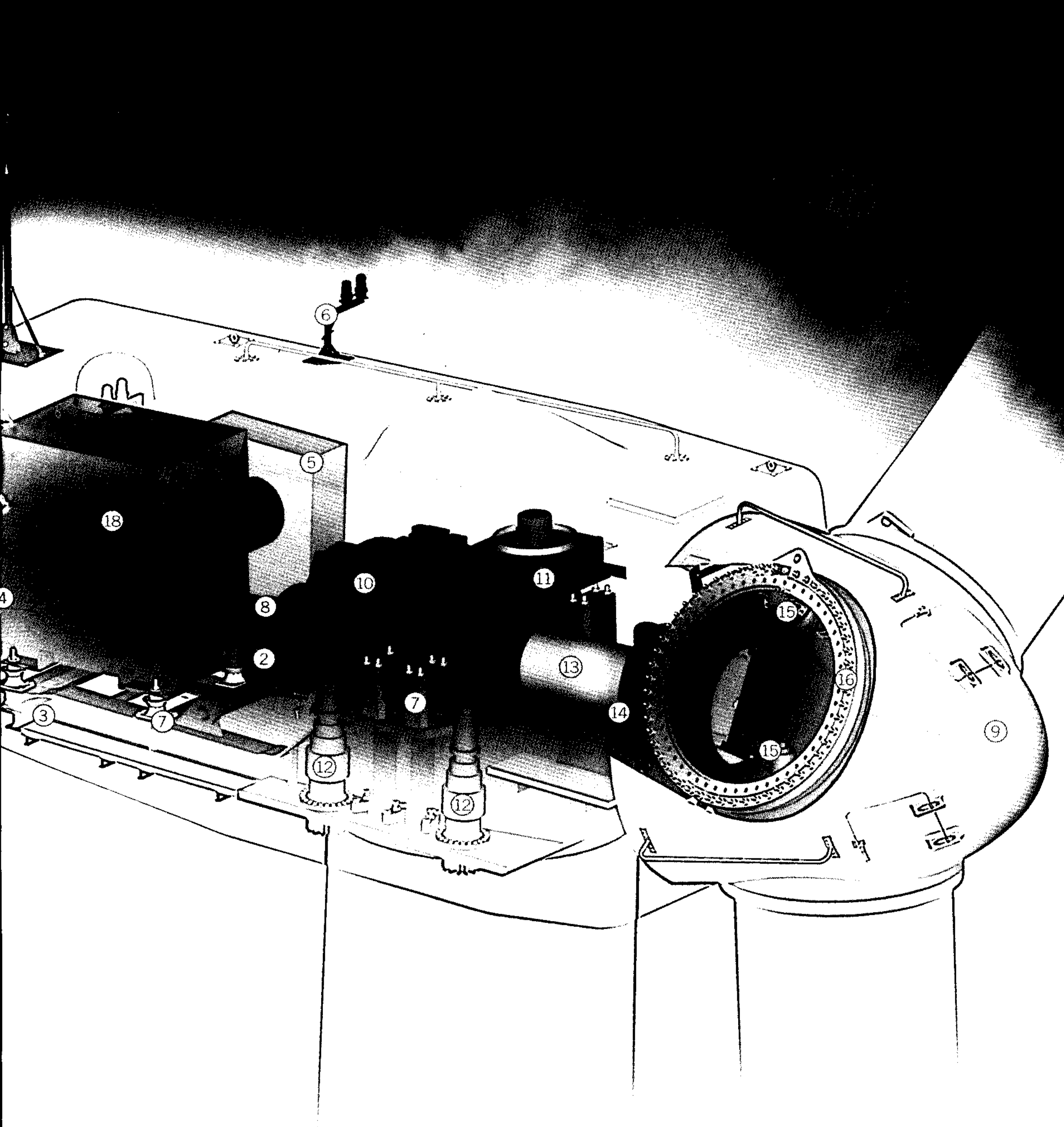


Support services that keep your goals and expectations at the forefront.

Trent Mesa, USA
100 x 1.5s,
total capacity: 150 MW

With a wide range of capabilities and proven wind project success, we can provide you with your desired level of assistance. From operation and maintenance to project development assistance – we can put our experienced, worldwide resources to work for you.

Once online, your unique project needs are our priority. We will work with you to determine your individual needs and preferred level of assistance – then, we'll be there for you whenever you need us. Our customers are our highest priority and our goal is to deliver the absolute highest customer value – when you're pleased, we are successful.



1. Wind measurement equipment
2. Hydraulic parking brake
3. Main frame
4. Generator
5. Control panel
6. Aviation light
7. Impact noise insulation
8. Coupling
9. Nose cone
10. Gearbox
11. Oil cooler
12. Yaw drive
13. Rotor shaft
14. Bearing housing
15. Pitch drive
16. Rotor hub
17. Ventilation
18. Heat exchanger

Technical specifications

	1.5sl	1.5s
Operating data		
• Rated capacity:	1,500 kW	1,500 kW
• Cut-in wind speed:	3 m/s	4 m/s
• Cut-out wind speed		
300 s average:	25 m/s	25 m/s
30 s average:	WZ II: 23 m/s, IEC s: 28 m/s	WZ II: 25 m/s, WZ III, IEC II: 28 m/s
3 s average:	WZ II: 25 m/s, IEC s: 30 m/s	WZ II: 27 m/s, WZ III, IEC II: 30 m/s
• Cut-back-in wind speed 300 s average:	WZ II: 17 m/s IEC s: 22 m/s	WZ II: 19 m/s, WZ III, IEC II: 22 m/s
• Rated wind speed:	11.8 m/s	12 m/s
Rotor		
• Number of rotor blades:	3	3
• Rotor diameter:	77 m	70.5 m
• Swept area:	4,657 m²	3,904 m²
• Rotor speed (variable):	10.1 – 20.4 rpm	11.1 – 22.2 rpm
Tower		
• Hub heights for WZ II:	61.4 / 80 / 85 / 100 m	64.7 / 80 / 85 / 100 m
• Hub heights for WZ III/IEC s:	64.7 / 80 / 85 m	64.7 / 80 / 85 m
Power control:	Active blade pitch control	Active blade pitch control

Operating limits (outside temperature)
- cold weather light: -20° C to +45° C
- cold weather extreme: -30° C to +45° C / -40° C survival without operation

Control system

Gearbox
- Three step planetary spur gear system

Generator
- Doubly fed three-phase asynchronous generator

Braking system (fail-safe)
- Electromechanical pitch control for each blade (3 self-contained systems)
- Hydraulic parking brake

Yaw system
- Electromechanical driven with wind direction sensor and automatic cable unwind

Converter
- Pulse-width modulated IGBT frequency converter

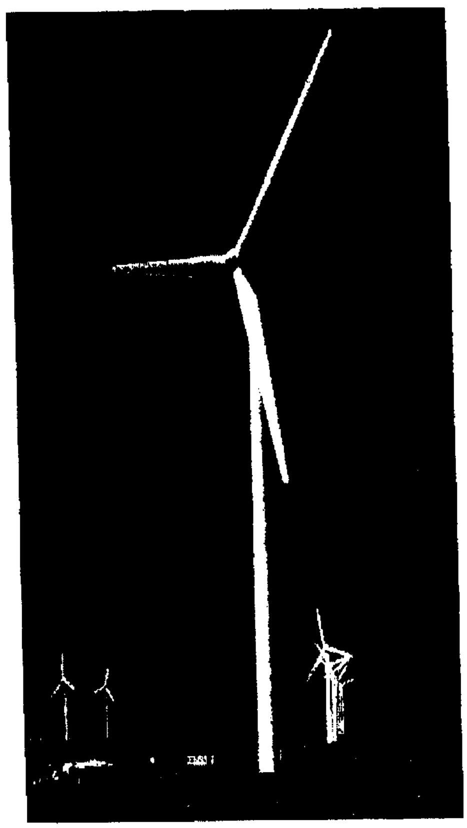
Tower design
- Multi-coated, conical tubular steel tower with safety ladder to the nacelle
- Load lifting system, load-bearing capacity over 200 kg
- Service platform for 100 m hub height (service lift optional)

Noise reduction
- Impact noise insulation of the gearbox and generator
- Sound reduced gearbox
- Noise reduced nacelle
- Rotor blades with minimised noise level

Lightning protection system
- Lightning receptors installed on blade tips
- Surge protection in electrical components

GE Wind Energy

GE WIND ENERGY 1.5s 60Hz WIND TURBINE GENERATOR TECHNICAL DESCRIPTION AND SPECIFICATIONS



Preliminary Wind Resource Assessment and Theoretical Energy Estimates

Northern Cheyenne Reservation, Montana

Prepared For:

DISGEN, Inc.
200 Union Blvd, Suite 304
Lakewood, Colorado 80228

Prepared By:

E.F. McCarthy & Associates, LLC
511 Frumenti Ct.
Martinez, CA 94553

April, 2003

Table of Contents

1.0 Introduction and Summary

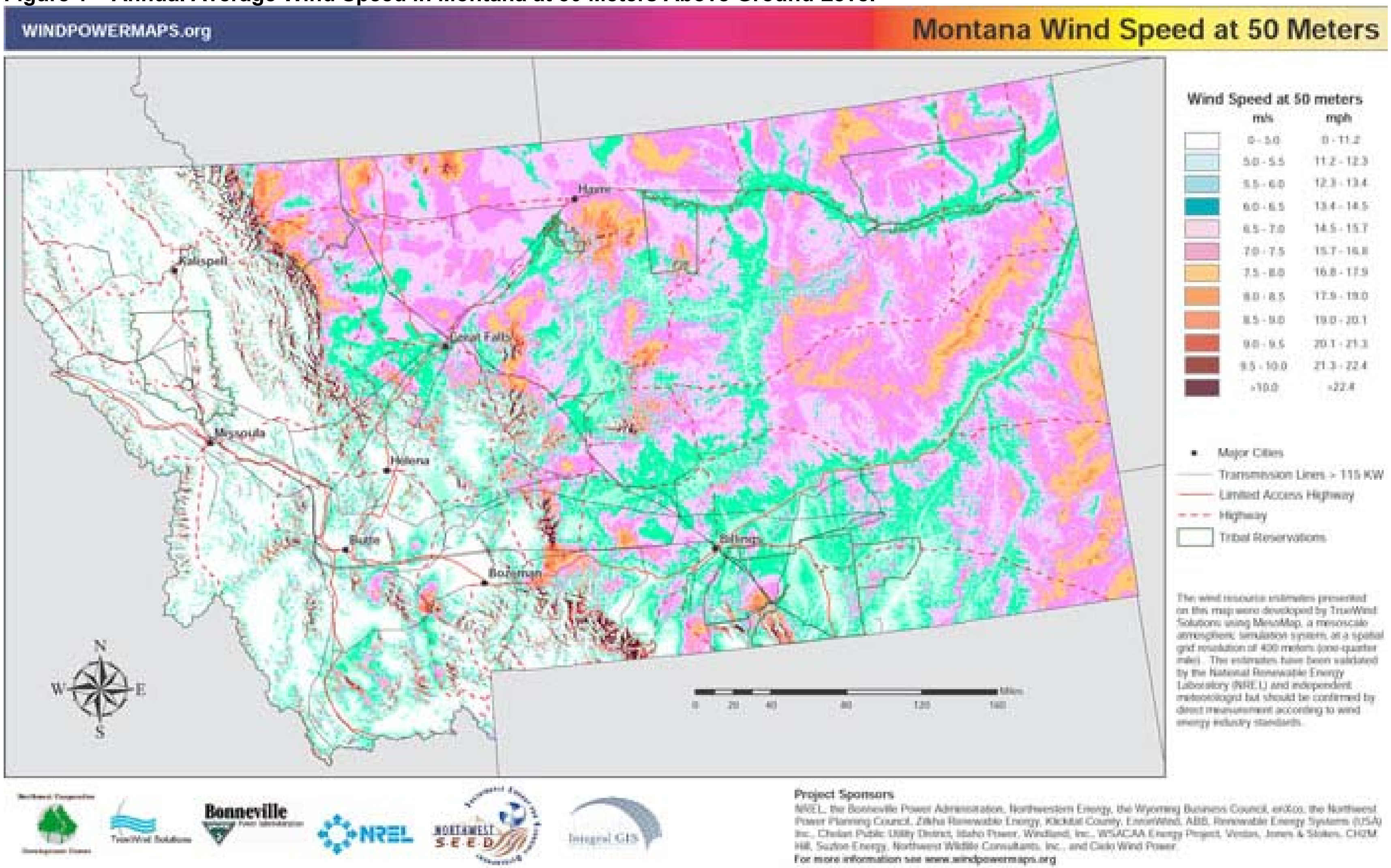
A preliminary wind resource assessment is prepared for a site known as Northern Cheyenne. This site is located in Southeastern Montana. A 50-meter meteorological tower was installed in November 2002 and is currently operating. One supplemental tower is also installed to gather additional wind data on the property. This preliminary wind resource assessment is based on historical wind data collected in the region.

The average wind speed projected for the Garfield Peak area at the 65 meter level is 18.1 mph; the average wind speed projected for an 80 meter level is 18.9 mph. A theoretical energy estimate, made for the GE 1.5MW turbine using these hub height wind speeds, indicates a gross capacity factor of 39% and 41%, respectively and a net capacity factor after losses of 34% and 35%, respectively.

2.0 Site Description

The site is located in southeastern Montana on the Northern Cheyenne Reservation. The general area consists of rolling hills and deep ravines. The land use is grazing and land cover is principally seasonal grasses. A few trees are evident in the lower elevation areas and in near ranches and cattle areas. A map depicting the annual average wind speed at 50 meters above ground level (agl) is presented in Figure 1.

Figure 1 – Annual Average Wind Speed in Montana at 50 Meters Above Ground Level



3.0 Meteorological Data

3.1 Data Sources

Meteorological data on the reservation are available from several sources. First, Montana Power Corporation operates three air quality stations on the reservation. These sites are Badger Peak, Garfield Peak, and Morningstar. Each site includes measurements of criteria air pollutants as well as wind speed and wind direction at 10 meters agl. Hourly wind speed and wind direction data are available from January 1, 1995 until December 31, 1999. Second, a Remote Automatic Weather Station (RAWS) site is located on Badger Peak. These data are collected principally for fire weather forecasting. The site is operated year round and hourly data area available. Data for a five year period from January 1998 until December 2002 are obtained from the Western Region Climate Center (WRCC) in Reno, Nevada. Finally, an on-site data collection program started in the late fall of 2002 with one 50-meter tower installed on the reservation and a second 20-meter tower installed in early January.

3.2 Climatology

The climatology for the Northern Cheyenne Reservation is based on the climatology for Billings, Montana (Table 1). The site is characterized has having cold dry winters and short, wet summers.

3.3 Air Quality Sites

Three air quality sites are located on the Northern Cheyenne Reservation:

Badger Peak	45.6483	106.5567	4,347 Feet
Garfield Peak	45.6031	106.4642	4,273 Feet
Morningstar	45.6681	1065189	4,311 Feet

The annual average wind speeds for the three air quality sites (Table 2) are 10.5 mph (4.7 mps) at Badger Peak, 14.0 mph (6.3 mps) at Garfield Peak, and 12.8 mph (5.7 mps) at Bright Star. The monthly average wind speeds are plotted in Figure 2, indicating the winter peak and the summer minimum. These data are collected at 10 meters agl. The mean hourly wind speeds at 10-meters agl for Garfield Peak are presented in Table 3.

Table 1 – Climatological Data for Billings, Montana

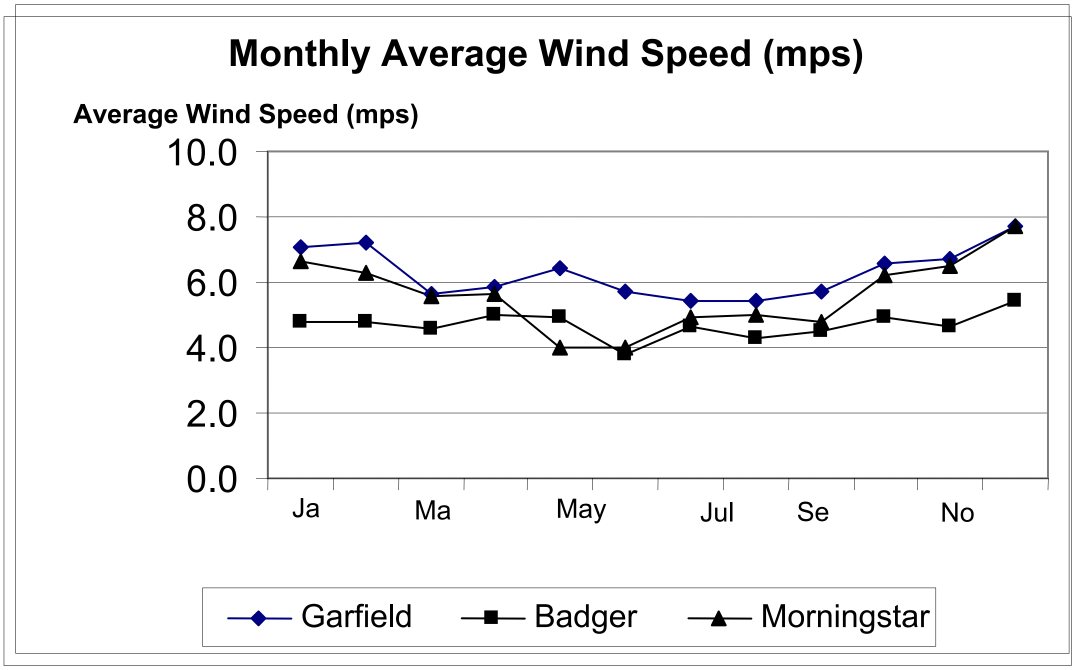
	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE (Deg. F)														
Normals														
-Daily Maximum		31.8	38.6	45.8	57.1	66.7	77.6	86.7	84.7	71.6	60.6	44.5	34.4	58.3
-Daily Minimum		13.7	19.4	25.2	34.0	43.3	52.0	58.3	56.7	46.5	37.5	25.6	16.5	35.7
-Monthly		22.8	29.0	35.5	45.6	55.0	64.8	72.5	70.7	59.1	49.1	35.1	25.5	47.1
Extremes														
-Record Highest	61	68	72	79	92	96	105	106	105	103	90	77	69	106
-Year		1953	1961	1986	1939	1936	1984	1937	1961	1983	1992	1993	1980	JUL 1937
-Record Lowest	61	-30	-38	-19	-5	14	32	41	35	22	-7	-22	-32	-38
-Year		1937	1936	1989	1936	1954	1969	1972	1992	1984	1991	1959	1983	FEB 1936
NORMAL DEGREE DAYS														
Heating (base 65 Deg. F)		1308	1008	915	582	316	119	12	42	242	498	897	1225	7164
Cooling (base 65 Deg. F)		0	0	0	0	6	113	244	219	65	5	0	0	652
AV. STATION PRES. (mb)	23	890.8	890.9	888.6	889.4	889.1	889.9	891.8	891.9	892.5	892.1	890.6	890.7	890.7
PRECIPITATION (in.)														
Water Equivalent														
-Normal		0.90	0.64	1.16	1.74	2.57	1.99	0.94	1.01	1.36	1.14	0.84	0.79	15.08
-Maximum Monthly	61	2.35	1.77	2.70	4.42	7.71	7.64	5.08	3.50	4.99	3.80	2.34	2.00	7.71
-Year		1972	1978	1954	1955	1981	1944	1993	1965	1941	1971	1978	1973	MAY 1981
-Minimum Monthly	61	0.04	0.05	0.13	0.06	0.40	0.24	0.04	0.05	0.06	0.01	T	0.05	T
-Year		1941	1977	1936	1962	1993	1961	1988	1955	1964	1987	1954	1957	NOV 1954
-Maximum in 24 hrs	61	1.41	0.65	1.01	3.19	2.83	2.78	2.32	2.47	2.19	1.98	1.37	0.96	3.19
-Year		1972	1986	1973	1978	1952	1937	1993	1965	1966	1974	1959	1978	APR 1978
Snow, Ice Pellets, Hail														
-Maximum Monthly	61	27.7	22.4	27.6	42.3	15.6	2.0	0.4	T	9.3	23.1	25.2	28.8	42.3
-Year		1963	1978	1935	1955	1981	1950	1993	1992	1984	1949	1978	1955	APR 1955
-Maximum in 24 hrs	57	16.6	9.0	10.5	23.7	15.3	2.0	0.4	T	7.5	11.2	15.3	13.7	23.7
-Year		1972	1944	1964	1955	1981	1950	1993	1992	1983	1980	.1959	1978	APR 1955
WIND														
Mean Speed (mph)	56	13.0	12.2	11.4	11.4	10.7	10.1	9.5	9.5	10.2	11.0	12.1	13.0	11.2
Prevailing Direction														
through 1964		SW	SW	SW	SW	NE	SW	SW	SW	SW	SW	SW	WSW	SW
Fastest Mile														
-Direction(!!)	52	W	W	NW	NW	NN	NW	N	NW	NW	NW	NW	NW	NW
-Speed(mph)	52	66	72	61	72	68	79	73	69	61	68	63	66	79
-Year		1953	1963	1956	1947	1939	1968	1947	1983	1949	1949	1948	1953	JUN 1968
Peak Gust														
-Direction(!!)	12	NW	W	NW	NW	NW	W	32	NW	NW	31	SW	27	32
-Speed(mph)	12	59	62	52	59	60	54	71	69	61	64	58	70	71
-Date		1986	1988	1990	1987	1988	1987	1995	1986	1989	1995	1990	1995	JUL 1995

(a) - Length of Record in Years, although individual months may be missing.
0.* or * - The value is between 0.0 and 0.05.
Normals - Based on the 1961 - 1990 record period.
Extremes - Dates are the most recent occurrence.
Wind Dir.- Numerals show tens of degrees clockwise from true north. "00" indicates calm. Resultant Directions are given to whole degrees

Table 2. Monthly Average Wind Speeds (mps) for Badger Peak, Garfield Peak, and Bright Star.

Badger	1998	1999	2000	Average
Jan	4.6	5.1	4.6	4.8
Feb	4.7	6.0	3.7	4.8
Mar	3.9	5.0	4.8	4.6
Apr	4.7	5.1	5.2	5.0
May	4.8	5.1	4.8	4.9
Jun	4.8	4.4	2.1	3.8
Jul	4.5	4.8	4.6	4.7
Aug	4.3	4.3		4.3
Sep	4.3	4.6	4.6	4.5
Oct	5.1	4.8		5.0
Nov	4.6	4.7		4.6
Dec	5.4	5.5		5.4
Annual	4.6	4.9		4.7
Garfield	**1998**	**1999**	**2000**	**Average**
Jan	6.7	7.4		7.1
Feb	5.7	8.7		7.2
Mar	4.3	6.9	5.8	5.7
Apr	5.8	6.1	5.6	5.8
May	5.9	6.4	6.9	6.4
Jun	6.1	5.4		5.7
Jul	5.1	5.7		5.4
Aug	5.5	5.3		5.4
Sep	5.6	5.8		5.7
Oct	6.6	6.6		6.6
Nov	6.5	6.9		6.7
Dec	8.1	7.2		7.7
Annual	6.0	6.6		6.3
Bright Star	**1998**	**1999**	**2000**	**Average**
Jan	6.5	6.9	6.5	6.6
Feb	5.6	8.1	5.1	6.3
Mar	4.3	6.0	6.4	5.5
Apr	5.4	5.4	6.1	5.6
May	5.3	0.5	6.1	4.0
Jun	5.7	0.2	6.0	4.0
Jul	4.6	5.2	5.1	5.0
Aug	5.0	4.9		5.0
Sep	5.1	5.6	3.6	4.8
Oct	6.0	6.5		6.2
Nov	6.3	6.7		6.5
Dec	7.1	8.4		7.7
Annual	5.6	5.4		5.6

Figure 2 – Monthly Average Wind Speeds (mps) for Garfield Peak, Badger Peak, and Morningstar



3.4 Raws Site

The annual average wind speed for the RAWS site at Badger Peak, measured at 2 meters agl is 10.4 mph (4.6 mps). The mean hourly wind speeds are presented in Table 3. The time stamps for these data are Greenwich Mean Time (GMT) or Universal Time (UTC) which is -7 hours from local standard time. The diurnal trend in the RAWS data shows a nighttime maximum and a day time minimum which is typical of higher elevation sites

Table 3. Mean Hourly Wind Speeds for the Garfield Peak Air Quality Site.

MEAN HOURLY WIND SPEEDS

GARFIELD PEAK MONTANA
GARFIELD PEAK 10M WIND SPEED (MPH)

01/01/95 - 12/31/99

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
01	16.4	16.4	15.5	16.0	15.5	14.8	13.1	15.9	15.9	16.5	15.9	16.1	15.7
02	16.4	16.4	15.3	15.4	15.3	14.6	13.0	15.7	16.0	16.5	16.2	15.9	15.5
03	16.4	16.2	14.7	14.5	14.5	14.2	13.4	14.7	15.3	16.1	16.5	16.0	15.2
04	16.2	16.4	14.4	13.9	14.0	13.5	13.0	14.2	15.1	15.9	16.3	15.9	14.9
05	15.7	16.2	14.3	13.6	13.5	12.8	11.9	13.6	14.4	15.3	16.3	16.4	14.5
06	15.2	16.3	13.9	13.0	12.6	12.0	10.9	12.8	13.7	15.4	15.8	16.5	14.0
07	14.4	16.2	13.6	12.6	11.7	11.6	9.8	11.0	12.7	15.1	15.4	16.9	13.4
08	14.6	16.1	13.0	12.5	11.9	11.7	9.8	9.7	11.5	14.4	15.4	16.7	13.1
09	14.6	16.3	12.4	12.6	12.1	11.9	10.1	9.3	11.1	14.6	15.2	16.7	13.1
10	14.5	16.2	12.0	12.7	12.3	12.1	10.0	9.6	11.4	14.3	14.8	17.0	13.1
11	14.2	16.0	12.3	12.8	12.2	12.2	10.3	9.9	12.0	14.3	14.8	17.0	13.2
12	14.1	16.0	12.5	13.0	12.4	12.2	10.4	9.9	12.6	14.6	14.5	17.0	13.3
13	13.7	15.9	12.4	13.1	12.6	12.3	11.0	10.3	12.8	14.6	14.3	16.3	13.3
14	13.3	15.3	12.2	13.0	12.2	12.3	11.1	10.3	12.5	14.2	13.7	15.8	13.0
15	13.3	14.3	12.2	12.8	12.4	12.5	11.0	10.3	12.4	14.0	13.7	15.2	12.9
16	13.9	13.2	12.0	12.2	12.4	12.2	10.9	10.0	11.5	13.4	14.0	15.0	12.6
17	15.0	13.2	11.3	11.9	12.2	12.2	11.0	10.3	10.6	13.4	14.0	15.6	12.6
18	15.2	13.9	11.8	11.7	12.0	11.6	11.4	10.8	10.8	14.3	14.2	16.2	12.9
19	14.8	14.8	13.0	11.9	12.1	12.1	11.4	11.6	12.0	15.1	14.5	16.3	13.3
20	15.0	15.0	14.0	12.7	13.3	12.8	12.2	12.6	13.5	15.6	15.3	16.4	14.1
21	15.5	15.4	15.0	13.8	14.0	13.4	12.7	13.9	14.5	16.2	15.9	16.7	14.8
22	15.9	16.2	15.0	14.9	14.5	14.6	13.0	15.8	15.2	16.9	16.2	16.2	15.3
23	18.9	16.8	15.7	16.0	15.9	14.4	13.4	16.2	15.6	20.9	17.8	17.2	16.6
24	15.9	16.4	15.6	15.6	15.3	14.4	13.1	16.0	15.6	17.1	15.7	16.5	15.6
Mean	15.1	15.6	13.5	13.4	13.2	12.8	11.6	12.3	13.3	15.4	15.3	16.3	14.0
Good Hours	2945	2644	3611	3574	3689	3594	2976	2873	2690	3429	3377	3673	
Missing Hours	775	740	109	26	31	6	744	847	910	291	223	47	

39,075 Hours of Good Data   4,749 Hours Missing   89.2% Data Recovery

Table 4. Mean Hourly Wind Speeds for the Badger Peak RAWS Site (1998 – 2002). The time is recorded as GMT which is -07 hours from Local Standard Time (LST)

MEAN HOURLY WIND SPEEDS

BADGER PEAK MONTANA
2M WINDSPEED (MPH)

01/01/98 - 12/31/02

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
01	11.1	10.2	8.4	9.0	9.5	13.9	10.0	9.0	8.0	9.1	9.8	10.8	9.8
02	11.3	10.6	9.0	9.5	9.5	14.8	10.4	9.1	8.7	9.4	10.2	11.3	10.2
03	11.4	10.7	9.9	9.9	10.6	15.9	11.2	10.2	9.6	10.0	10.2	11.3	10.8
04	11.5	10.5	10.2	10.3	10.6	14.2	12.1	10.4	10.3	10.5	10.1	11.4	10.9
05	11.3	10.8	10.4	10.7	11.0	16.2	11.5	10.8	10.4	10.8	10.7	11.7	11.2
06	11.4	10.7	10.8	11.4	10.8	14.1	11.4	11.0	11.2	11.8	10.9	11.6	11.4
07	11.3	10.6	10.6	11.6	10.9	15.6	11.8	11.3	11.2	11.7	11.0	11.9	11.5
08	11.0	10.5	10.9	11.2	10.8	11.4	10.8	11.1	11.2	11.5	11.0	11.8	11.1
09	11.3	10.4	10.5	11.3	11.3	13.8	10.5	10.9	11.1	11.5	10.9	11.7	11.2
10	11.3	10.4	10.0	11.7	11.1	14.7	10.3	10.8	10.6	11.0	11.5	11.4	11.1
11	11.3	9.8	10.1	11.2	11.3	13.5	10.0	10.8	10.7	10.5	11.6	11.2	10.9
12	11.4	9.6	9.9	10.7	10.6	10.7	9.5	11.0	10.4	10.0	11.5	11.7	10.6
13	11.1	10.0	9.5	10.8	9.5	10.6	8.4	10.3	9.8	10.5	11.3	11.7	10.3
14	11.3	10.1	9.3	10.4	9.6	9.6	8.1	9.3	9.0	10.1	10.9	12.0	10.0
15	11.0	9.9	8.9	10.3	9.9	11.7	7.8	8.9	8.6	9.6	10.8	11.6	9.8
16	10.6	9.9	8.7	10.1	10.4	11.7	7.7	8.7	8.7	9.4	10.5	11.5	9.7
17	10.4	9.9	8.9	10.3	10.3	12.1	7.9	8.6	8.5	9.2	10.5	11.7	9.8
18	10.3	9.7	9.0	10.2	11.0	12.4	7.9	8.5	9.1	9.1	10.6	11.6	9.8
19	10.3	9.6	9.1	10.2	10.6	12.1	7.9	8.3	9.3	9.5	10.6	11.7	9.8
20	9.9	9.4	9.2	10.2	11.1	14.1	8.0	8.6	8.9	9.4	10.5	11.7	9.9
21	9.9	9.6	9.1	10.5	11.1	12.6	8.3	8.6	9.0	9.7	10.4	10.9	9.9
22	9.7	9.6	8.9	10.2	10.6	12.8	8.5	8.8	8.7	9.2	9.5	10.3	9.6
23	9.6	8.7	8.9	10.3	10.8	13.7	9.1	8.6	8.6	8.6	9.0	10.0	9.5
24	10.7	9.1	8.3	9.4	10.2	15.3	10.0	8.8	8.0	8.3	9.6	10.5	9.7
Mean	10.9	10.0	9.5	10.5	10.5	13.3	9.6	9.7	9.6	10.0	10.6	11.4	10.4

Good Hours

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Good Hours	3556	2916	3270	2775	2875	2345	3511	3617	3473	3591	3507	2913
Missing Hours	164	468	450	825	845	1255	209	103	127	129	93	807

38,349 Hours of Good Data   5,475 Hours Missing   87.5% Data Recovery

3.5 On-Site Meteorological Monitoring Program

One primary tower was installed on Northern Cheyenne in November 2002. This 50-meter NRG Talltowers is instrumented with three levels of wind speed and two levels of wind direction. Maximum #40 anemometers and #200P wind directions sensors are used. The sensors are sampled once per second and hourly averages calculated using a NRG Systems 9300SA datalogger. The data are stored on flashcards which are removed for processing. A 20-meter tower is also installed on the reservation. This second tower was installed in January, 2003.

3.6 Wind Rose

Two wind roses which show the joint frequency of wind speed and wind direction are presented in Figures 3 (Badger Peak RAWS) and 4 (Garfield Peak AQ). The predominant wind directions appear to be south, southwest through west, and northwest.

3.4 Wind Shear

Wind shear is the change or increase in wind speed above ground level. The simple wind power law is expressed as:

$$U_2 = U1\,(Z_2/Z_1)^{\text{alpha}}$$

Where U_2 and U_1 are the wind speeds at the upper and lower levels, Z_2 and Z_1 are the upper and lower elevations, and alpha is the wind speed power law exponent. The typical value for the wind speed power law exponent is 0.14 (1/7 power law). Depending on terrain and surface roughness, the value may vary between 0.05 and 0.35. A conservative power law exponent of 0.14 is used in any hub height projections prepared in this report.

3.5 Projected Hub Height Wind Speeds

The hourly Garfield Peak Air Quality Site data are extrapolated to projected hub heights of 65 meter and 80 meters above ground level. A conservative power law exponent of 0.14 is used in these projections. These projections are presented in Tables 5 and 6. The estimated 65 meter annual average wind speed is 18.1 mph; the estimated 80 meter annual average wind speed is 18.9 mph.

3.6 Peak Wind Speed

The highest 3-second gust for the Northern Cheyenne site is estimated based on the peak wind speed information from the airport data collected at Billings, Montana. The peak wind speed measured at Billings, Montana over the period of record is 71 mph (31.7 mps). Selecting the highest value, 71 mph, and adjusting it from 7 meters (21 feet) to 80 meters (262 feet) above ground level using the wind speed power law and a power law exponent of 0.14 yields a peak wind speed of 99.7 mph (44.5 mps).

Figure 3 - Wind Rose for the Badger Peak RAWS Site. The number in the center, 12.2%, is the percentage of time the wind speeds are less than 5 mph.

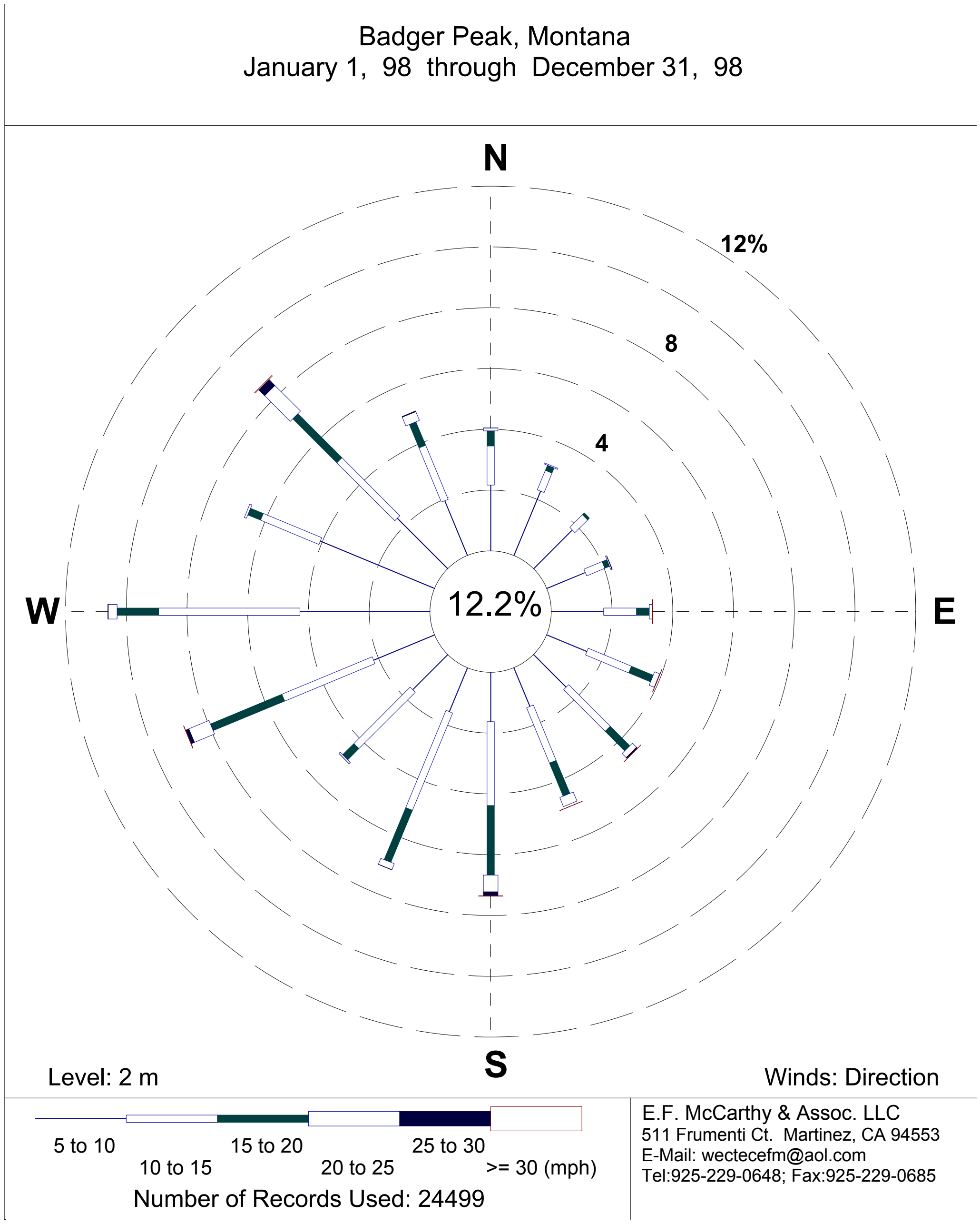


Figure 4 - **Wind Rose for the Garfield Peak AQ Site. The number in the center, 9.9%, is the percentage of time the wind speeds are less than 5 mph.**

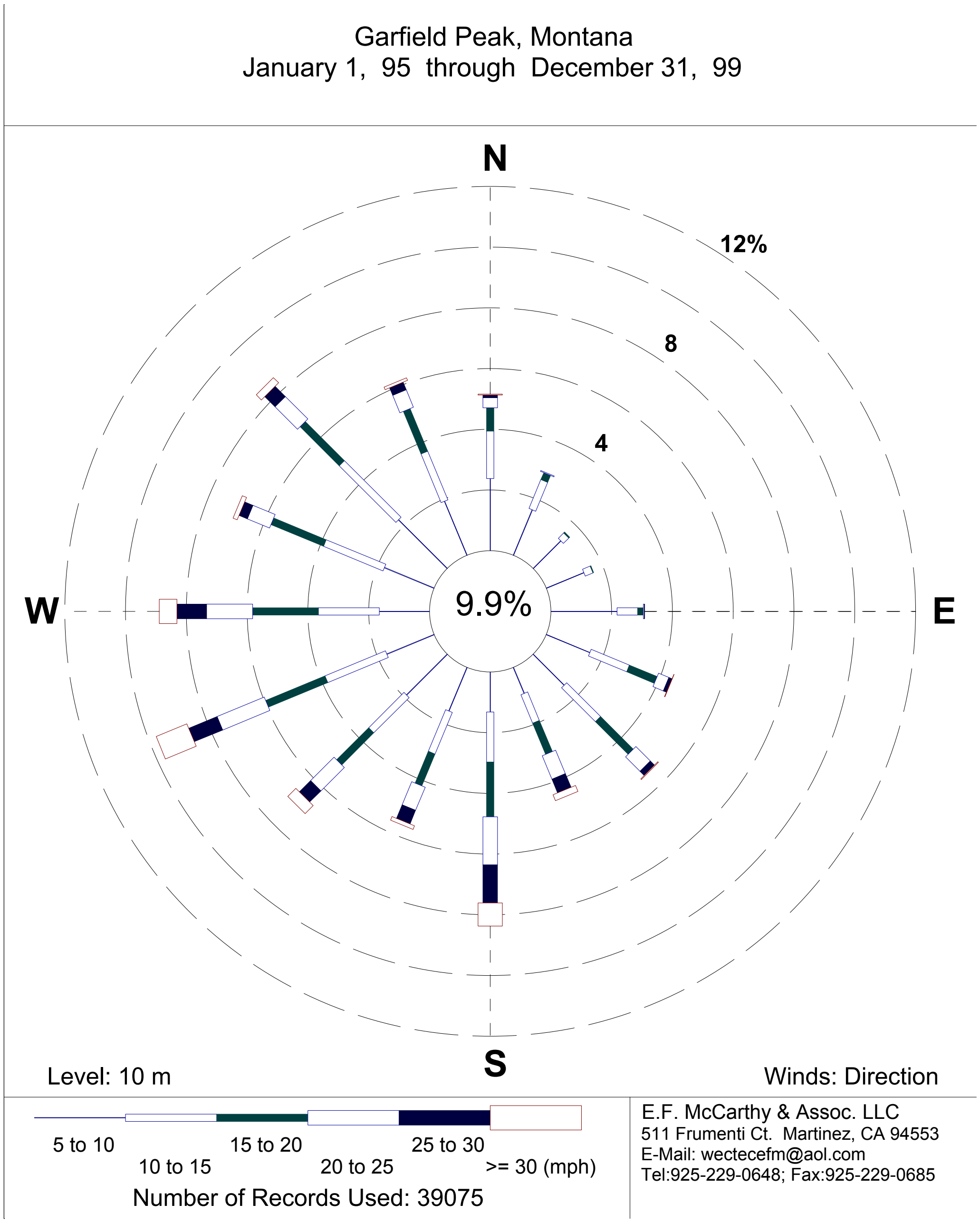


Table 5. Projected 65 Meter Wind Speeds (mph) for Garfield Peak.

MEAN HOURLY WIND SPEEDS

BADGER PEAK MONTANA
GARFIELD PK 65M WS (WS12 X 1.299) (MPH)

01/01/95 - 12/31/99

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
01	21.3	21.3	20.1	20.8	20.1	19.2	17.0	20.7	20.6	21.4	20.7	21.0	20.3
02	21.4	21.3	19.9	19.9	19.9	19.0	16.9	20.4	20.8	21.5	21.0	20.6	20.2
03	21.3	21.1	19.1	18.8	18.8	18.4	17.4	19.0	19.8	20.9	21.4	20.8	19.7
04	21.0	21.3	18.7	18.1	18.1	17.5	16.8	18.4	19.6	20.7	21.2	20.7	19.3
05	20.4	21.0	18.5	17.6	17.6	16.6	15.5	17.7	18.7	19.9	21.1	21.3	18.8
06	19.7	21.2	18.0	16.9	16.4	15.5	14.2	16.6	17.8	20.0	20.5	21.5	18.2
07	18.6	21.1	17.7	16.4	15.2	15.1	12.7	14.3	16.4	19.6	20.0	21.9	17.5
08	19.0	20.9	16.9	16.3	15.5	15.2	12.7	12.6	14.9	18.7	20.0	21.7	17.1
09	19.0	21.2	16.1	16.3	15.8	15.4	13.2	12.0	14.4	19.0	19.7	21.7	17.0
10	18.8	21.0	15.6	16.5	16.0	15.7	13.0	12.4	14.8	18.5	19.3	22.0	17.0
11	18.4	20.8	15.9	16.7	15.8	15.9	13.4	12.9	15.6	18.5	19.2	22.1	17.1
12	18.3	20.8	16.2	16.8	16.1	15.9	13.5	12.8	16.4	18.9	18.9	22.1	17.3
13	17.8	20.7	16.1	17.0	16.3	15.9	14.2	13.3	16.7	19.0	18.6	21.2	17.3
14	17.3	19.9	15.8	16.9	15.9	16.0	14.5	13.4	16.2	18.5	17.8	20.6	16.9
15	17.2	18.6	15.8	16.7	16.1	16.2	14.3	13.4	16.1	18.1	17.8	19.7	16.7
16	18.1	17.2	15.5	15.8	16.1	15.8	14.2	13.0	14.9	17.5	18.2	19.5	16.4
17	19.4	17.2	14.7	15.5	15.9	15.8	14.3	13.4	13.8	17.4	18.2	20.3	16.4
18	19.7	18.1	15.3	15.3	15.6	15.1	14.8	14.1	14.0	18.6	18.4	21.1	16.7
19	19.2	19.2	16.9	15.5	15.8	15.7	14.9	15.1	15.6	19.6	18.8	21.2	17.3
20	19.5	19.5	18.2	16.6	17.3	16.6	15.9	16.3	17.5	20.3	19.9	21.3	18.3
21	20.2	20.0	19.5	17.9	18.2	17.4	16.5	18.0	18.9	21.1	20.6	21.7	19.2
22	20.7	21.0	19.5	19.4	18.8	19.0	16.8	20.5	19.8	21.9	21.0	21.0	19.9
23	20.9	21.8	20.4	19.9	19.4	18.8	17.4	21.1	20.2	21.9	21.4	21.2	20.3
24	20.6	21.3	20.3	20.2	19.8	18.7	17.0	20.9	20.2	22.2	20.4	21.4	20.3
Mean	19.5	20.3	17.5	17.4	17.1	16.7	15.0	15.9	17.3	19.7	19.7	21.1	18.1
Good Hours	2943	2644	3611	3573	3688	3594	2976	2873	2690	3426	3376	3672	
Missing Hours	777	740	109	27	32	6	744	847	910	294	224	48	

39,066 Hours of Good Data   4,758 Hours Missing   89.1% Data Recovery

Table 6. Projected 65 Meter Wind Speeds (mph) for Garfield Peak.

MEAN HOURLY WIND SPEEDS

BADGER PEAK MONTANA
GARFIELD PK 80M WS (WS12 X 1.337) (MPH)

01/01/95 - 12/31/99

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
01	21.9	21.9	20.7	21.4	20.7	19.8	17.4	21.3	21.2	22.0	21.3	21.6	20.9
02	22.0	21.9	20.5	20.5	20.4	19.5	17.4	20.9	21.4	22.1	21.7	21.2	20.8
03	21.9	21.7	19.7	19.4	19.4	18.9	17.9	19.6	20.4	21.5	22.0	21.4	20.3
04	21.6	21.9	19.2	18.6	18.7	18.0	17.3	18.9	20.2	21.3	21.8	21.3	19.9
05	20.9	21.6	19.1	18.1	18.1	17.1	15.9	18.2	19.3	20.5	21.8	21.9	19.4
06	20.3	21.8	18.5	17.4	16.9	16.0	14.6	17.1	18.4	20.6	21.1	22.1	18.7
07	19.2	21.7	18.2	16.9	15.7	15.6	13.0	14.8	16.9	20.2	20.6	22.6	18.0
08	19.5	21.5	17.4	16.7	15.9	15.6	13.1	12.9	15.3	19.2	20.6	22.3	17.6
09	19.5	21.8	16.6	16.8	16.2	15.8	13.5	12.4	14.8	19.5	20.3	22.3	17.5
10	19.4	21.6	16.1	17.0	16.5	16.1	13.4	12.8	15.2	19.1	19.8	22.7	17.5
11	18.9	21.4	16.4	17.1	16.3	16.3	13.8	13.3	16.0	19.1	19.7	22.7	17.6
12	18.8	21.4	16.7	17.3	16.6	16.3	13.9	13.2	16.9	19.5	19.4	22.8	17.8
13	18.3	21.3	16.6	17.5	16.8	16.4	14.6	13.7	17.2	19.5	19.2	21.8	17.8
14	17.7	20.4	16.3	17.4	16.3	16.5	14.9	13.8	16.7	19.0	18.4	21.2	17.4
15	17.7	19.1	16.3	17.2	16.6	16.7	14.7	13.8	16.5	18.6	18.3	20.3	17.2
16	18.6	17.7	16.0	16.2	16.6	16.3	14.6	13.3	15.4	18.0	18.7	20.0	16.9
17	20.0	17.7	15.1	15.9	16.4	16.3	14.7	13.8	14.2	18.0	18.8	20.9	16.9
18	20.3	18.6	15.8	15.7	16.0	15.5	15.2	14.5	14.4	19.1	18.9	21.7	17.2
19	19.8	19.8	17.4	15.9	16.2	16.2	15.3	15.5	16.0	20.2	19.3	21.8	17.8
20	20.1	20.1	18.7	17.0	17.8	17.1	16.3	16.8	18.0	20.8	20.5	22.0	18.8
21	20.8	20.6	20.1	18.4	18.8	17.9	17.0	18.6	19.4	21.7	21.2	22.3	19.8
22	21.3	21.6	20.1	19.9	19.3	19.5	17.3	21.1	20.3	22.5	21.6	21.6	20.5
23	21.5	22.5	21.0	20.5	19.9	19.3	17.9	21.7	20.8	22.5	22.0	21.8	20.9
24	21.2	22.0	20.9	20.8	20.4	19.3	17.5	21.5	20.8	22.8	21.0	22.1	20.8
Mean	20.0	20.9	18.1	17.9	17.6	17.2	15.5	16.4	17.8	20.3	20.3	21.8	18.7

Good Hours	2943	2644	3611	3573	3688	3594	2976	2873	2690	3426	3376	3672
Missing Hours	777	740	109	27	32	6	744	847	910	294	224	48

39,066 Hours of Good Data   4,758 Hours Missing   89.1% Data Recovery

4.0 Wind Turbine Power Curve

The GE Wind 1.5 MW wind turbine (70M Rotor) is a three bladed, upwind, horizontal axis wind turbine employing variable pitch blade technology. The power curve for the GE Wind 1.5MW turbine for the Northern Cheyenne Site using an air density of 1.08 kg/m^3 is presented in Table 7.

Table 7 - GE Wind 70M Power Curve

Wind Speed (mps)	Power (kW)	Wind Speed (mps)	Power (kW)	Wind Speed (mps)	Power (kW)	Wind Speed (mps)	Power (kW)
4	28	10	946	16	1500	22	1500
5	87	11	1228	17	1500	23	1500
6	177	12	1420	18	1500	24	1500
7	299	13	1486	19	1500	25	1500
8	461	14	1500	20	1500	>25	0
9	676	15	1500	21	1500		

5.0 Annual Energy Estimate

5.1 Gross Annual Theoretical Energy Estimate

The wind speed frequency is combined with the GE Wind power curve to create the annual theoretical energy estimate for a single turbine. The theoretical gross energy output for the 70 meter GE Wind Turbine (1.5MW) on a 65 meter tower is 5,116,349kWh. The theoretical gross energy output for the 70 meter GE Wind Turbine (1.5MW) on an 80 meter tower is 5.331.350kWh.

5.2 Net Annual Theoretical Energy Estimate

The gross annual theoretical energy output is adjusted by various loss factors to estimate the actual or net energy delivered to the substation. These losses take into account the wind turbine out-of-service time associated with scheduled and unscheduled downtime, electrical line losses from the turbine to the substation, control system losses, array losses due to wake effects between adjoining turbines, and lost power associated with blade icing and blade soiling.

The annual net energy production for a single turbine is calculated using the following formula:

$$AEP_{net} = AEP_{gross} * (1- EL)$$

where AEP_{net} is the Annual Net Energy Production of the wind facility;

AEP_{gross} is the Annual Gross Energy Production of the wind facility;

EL is the product of individual energy losses (%);

EL is the product of the individual energy losses and is calculated as follows:

$$EL = 1-(1 - L_{array}) * (1 - L_{blade}) * (1 - L_{collect}) * (1 - L_{control}) * (1\text{-Availability})$$

where L_{array} = Array losses

$L_{soiling}$ = Blade contamination losses

$L_{collect}$ = Collection system from turbine to grid

$L_{control}$ = Control, grid, and miscellaneous losses

Availability = Availability is the percentage of calendar time that the turbines are functional and ready to deliver power to the grid.

Table 8. Theoretical Energy Projection for a GE Wind Turbine (1.5MW) on a 65 Meter Tower.

```
THEORETICAL WIND TURBINE PRODUCTION          01/01/95 - 12/31/99


Wind:      GARFIELD PK 65M WS (WS12 X 1.299)
         BADGER PEAK MONTANA

         Wind Speeds Multiplied By  1.00

Turbine: GE 1.5 SL (1500Kw)70M ROTOR 1.08KG/M**2

         Rated at:        1500 kW at 30.0 MPH
         Maximum Output:  1500 kW at 30.0 MPH


                                  Time            Production
    Status              MPH      hrs      %       KW-hrs     %
    ------             -----     ----    ----     ------   ----

  Below Cut-in       Under 10.0   9394    24.0

  Cut-in To Rated     10.1-30.0  24453    62.6  15,086,860   66.1

  Rated To Cut-out    30.1-56.0   5155    13.2   7,729,956   33.9

  Above Cut-out       Over 56.0     64      .2

  Contactor Closed               29608    75.8

kW-hrs at Capacity / Total kW-hrs    33.9

hrs at Capacity / hrs of Operation   17.4

Mean Wind Speed                      18.1 MPH

Energy Produced                22,816,810 kW-hrs


Annual Production Rate          5,116,349 kW-hrs

Capacity Factor                       .39



39066 hrs of Good Data   4758 hrs Missing     89.1% Data Recovery
```

Table 9. Theoretical Energy Projection for a GE Wind Turbine (1.5MW) on a 80 Meter Tower.

```
THEORETICAL WIND TURBINE PRODUCTION          01/01/95 - 12/31/99

Wind:      GARFIELD PK 80M WS (WS12 X 1.337)
         BADGER PEAK MONTANA

         Wind Speeds Multiplied By  1.00

Turbine: GE 1.5 SL (1500Kw)70M ROTOR 1.08KG/M**2

         Rated at:         1500 kW at 30.0 MPH
         Maximum Output:  1500 kW at 30.0 MPH
```

Status	MPH	Time hrs	Time %	Production KW-hrs	Production %
Below Cut-in	Under 10.0	8961	22.9		
Cut-in To Rated	10.1-30.0	24353	62.3	15,286,850	64.3
Rated To Cut-out	30.1-56.0	5663	14.5	8,488,779	35.7
Above Cut-out	Over 56.0	89	.2		
Contactor Closed		30016	76.8		

```
kW-hrs at Capacity / Total kW-hrs    35.7

hrs at Capacity / hrs of Operation   18.9

Mean Wind Speed                      18.7 MPH

Energy Produced                23,775,630 kW-hrs


Annual Production Rate          5,331,350 kW-hrs

Capacity Factor                       .41



39066 hrs of Good Data   4758 hrs Missing     89.1% Data Recovery
```

The loss factors assumed for this project include 3% for availability, 2% for electrical line losses, 7.5% for array and off-axis wind direction losses, 1% for turbulence and control, and 1% for blade contamination losses. The gross to net ratio is 0.862.

The calculated net energy production for a single turbine on a 65 meter tower using the loss factors presented above is 4,410,293kWh. The net capacity factor is 33.6%.

The calculated net energy production for a single turbine on a 80 meter tower using the loss factors presented above is 4,595,624kWh. The net capacity factor is 34.9%.

Appendix F

Geotechnical Analysis

Northern Cheyenne Tribe
North Cheyenne Reservation

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

NORTHERN CHEYENNE WIND PROJECT
NORTHERN CHEYENNE RESERVATION
NEAR LAME DEER, MONTANA

TERRACON PROJECT NO. 26045065
February 9, 2005

Prepared for:

Distributed Generation Systems
200 Union Boulevard, Suite 304
Lakewood, Colorado 80228

Prepared by:

Terracon
2110 Overland Avenue, Suite 124
Billings, Montana 59102
Phone: 406-656-3072
Fax: 406-656-3578

MONTANA
WALTER J.
FEEGER
16659 2/10/05
LICENSED
PROFESSIONAL ENGINEER

Terracon
2110 Overland Ave., Suite 124
Billings, MT 59102
(406) 656-3072 Fax: (406) 656-3578

February 9, 2005

Distributed Generation Systems
200 Union Boulevard, Suite 304
Lakewood, Colorado 80228

Attention: Ms. Krista Gordon

Re: Preliminary Geotechnical Engineering Report
Northern Cheyenne Wind Project
Terracon Project No. 26045065

Dear Ms. Gordon:

Terracon has completed a preliminary geotechnical engineering exploration for a proposed new 30 MW wind generation power project to be constructed on the Northern Cheyenne Reservation approximately 8.5 miles east of Lame Deer, Montana. This study was performed in general accordance with our proposal number D2604266, dated December 22, 2004, which was authorized by you on December 29, 2004.

The results of our engineering study, including the boring location diagram, laboratory test results, boring log, and the geotechnical recommendations needed to aid in the design of foundations and other earth connected phases of this project, are attached.

The soil profile at the turbine site consisted of about 4 inches of topsoil overlying approximately 4 feet of silty sand. The sand was underlain by interbedded siltstone and sandstone bedrock. The bedrock continued to the total depth explored of about 30.5 feet below existing grade.

Other design and construction recommendations, based on the geotechnical conditions, are presented in the report.

We appreciate being of service to you in the geotechnical engineering phase of this project and are prepared to assist you during the construction phases as well. If you have any questions concerning this report, please contact us at your convenience.

Sincerely,
TERRACON

Steven Weisenberger, E.I.T.
Staff Engineer

Walt Feeger, P.E.
Geotechnical Engineer

Copies to: Addressee (3)

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PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

NORTHERN CHEYENNE WIND PROJECT
NORTHERN CHEYENNE RESERVATION
NEAR LAME DEER, MONTANA

TERRACON PROJECT NO. 26045065
FEBRUARY 9, 2005

INTRODUCTION

This report contains the results of our preliminary geotechnical engineering exploration for a proposed new 30 MW wind generation power project to be constructed on the Northern Cheyenne Reservation approximately 8.5 miles east of Lame Deer, Montana.

The purpose of these services is to provide information and preliminary geotechnical engineering recommendations relative to:

- subsurface soil and bedrock conditions
- groundwater conditions
- foundation design

The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, similar structures and our understanding of the proposed project.

PROJECT DESCRIPTION

It is our understanding the specific size of wind turbine had not yet been determined. The structure's base elevation is expected to be approximately at the existing grade. Vertical loads, uplift forces and overturning moments were not available at the time of this report.

At this time, a preliminary geotechnical investigation has been requested to determine the suitability of the ridgeline for the proposed construction of the project and to identify preliminary geotechnical considerations for planning purposes. It is our understanding between 20 and 30 wind turbines may be constructed along the ridgeline. A final geotechnical exploration will be required once the final layout of the wind turbines has been decided upon, at which time a soil boring should be placed at each turbine location.

SITE EXPLORATION PROCEDURES

The scope of the services performed for this project included a subsurface exploration program, laboratory testing and engineering analyses.

Field Exploration: One test boring was drilled on January 27, 2005, to a depth of approximately 30.5 feet below existing grade. The boring was advanced with a truck-mounted drilling rig, utilizing solid stem augers.

The boring was drilled at a representative location along the existing ridgeline where the wind turbines will be constructed, and was located in the field at the time of drilling by use of a handheld GPS unit.

Our personnel recorded a lithologic log of the boring during the drilling operation. At selected intervals, samples of the subsurface materials were taken by driving split-spoon samplers. A bulk sample of subsurface materials was obtained from the auger cuttings.

Penetration resistance measurements were obtained by driving the split-spoon into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index in estimating the relative density, or consistency, of the materials encountered.

Laboratory Testing: The samples retrieved during the field exploration were delivered to the laboratory for evaluation by the project geotechnical engineer. The samples were visually classified in general accordance with the Unified Soil Classification System described in Appendix C. Samples of bedrock were classified in accordance with the general notes for Bedrock Classification. At that time, the field descriptions were confirmed or modified as necessary, and a laboratory testing program was formulated to determine physical properties of selected samples of the subsurface materials. A boring log was prepared and is presented in Appendix A.

Laboratory tests were conducted and the results are presented on the Boring Log and in Appendix B. The test results were used for the geotechnical engineering analyses and the development of foundation and earthwork recommendations.

Selected soil samples were tested for the following physical properties:

- Water Content
- Soluble Sulfates
- Atterberg Limits
- pH and Electrical Resistivity

SITE CONDITIONS

The site was located approximately 8.5 miles east of Lame Deer, Montana. The topography consisted of rolling hills and ridgelines, sparsely vegetated with native grasses and weeds, and the boring was located on a ridgeline with a number of drainages in close proximity.

SUBSURFACE CONDITIONS

Soil and Bedrock Conditions: As presented on the boring log, the soil profile consisted of about 4 inches of topsoil overlying approximately 4 feet of silty sand. The sand was underlain by interbedded siltstone and sandstone bedrock with the upper 2 feet being weathered. The underlying competent bedrock was hard and continued to the total depth explored of about 30.5 feet below grade.

Field and Laboratory Test Results: Field penetration test results indicate that the siltstone/sandstone is soft to moderately hard in its native state. However, it will weather and degrade very easily once exposed to the elements.

Field test results indicate that the sand soils were typically dense in relative density. Results of the laboratory tests indicate the siltstone/sandstone has a low to moderate water content and should exhibit a relatively low potential for volume change (swelling or shrinkage) with changes in the water content.

Groundwater Conditions: Groundwater was not observed in the boring at the time of field exploration. This observation represents groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater can be expected to fluctuate with varying seasonal, weather conditions and other factors. Evaluation of such factors is beyond the scope of this report.

ENGINEERING RECOMMENDATIONS

Geotechnical Considerations: The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the boring. Based on the preliminary geotechnical engineering analyses, subsurface exploration and laboratory test results, we recommend that the proposed turbine at this location be supported by either a drilled pier or mat foundation.

At this time, preliminary recommendations have been requested to determine the suitability of the ridgeline for the proposed construction of the project and to identify preliminary geotechnical considerations for planning purposes. A final geotechnical exploration will be required once the final layout of the wind turbines has been decided upon, at which time a soil boring should be placed at each individual location. The recommendations contained in this report are specific for this location. Additional design considerations may be required at other wind turbine locations if differing soil and bedrock conditions are encountered.

Preliminary design criteria for these two foundation systems are subsequently outlined.

Drilled Pier Foundation: Based on the subsoil conditions encountered, a drilled pier foundation may be used at this location. Conventional drilled pier equipment should be able to perform the excavations, however, hard drilling should be expected, especially where cemented sandstone lenses are encountered. Pre-drilling with a smaller diameter auger, and subsequently reaming to a larger diameter, is one technique frequently used to penetrate hard materials. Specialized equipment, such as rock teeth or rock barrels, may also be necessary. The following guidelines should be followed during the design of the foundation:

1. The drilled pier should have a minimum embedment into bedrock of 10 feet and a minimum length of 25 feet.

2. It is our opinion that an end bearing pressure of 20 kips per square foot (ksf) can be used for the pier at a depth of 25 feet below grade. A skin friction of 1000 pounds per square foot (psf) can be applied to the sides of the pier for all but the top five feet of pier.

3. For lateral resistance, a passive earth pressure of 400 psf per foot of depth can be used for the portion of the pier in bedrock. Ignore passive resistance within the top 5 feet. The lateral earth pressure does not include any factor of safety.

4. The pier hole should be properly cleaned prior to placement of the concrete.

5. The lack of water in the boring indicates de-watering will likely not be required. However, if groundwater is encountered, it should either be removed, or the tremie method of placing concrete should be used after the hole has been cleaned. Concrete should be placed in the pier the same day it is drilled.

Mat Foundation: Based on the subsoil conditions encountered, a mat foundation may also be used at this location. The mat may be designed for a maximum allowable bearing capacity of 5000 psf bearing on competent interbedded siltstone/sandstone. The design bearing capacity applies to dead load plus design live load conditions. The base of the foundation should be a minimum of 48 inches below adjacent finished grade for frost protection.

Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction.

Resistance to uplift and horizontal load can be approximated as follows. The ultimate uplift resistance should be approximated using the weight of the mat, plus the weight of soil directly above the mat. Effective unit weights of 100 pcf for soil and 150 pcf for concrete can be used for these calculations. The ultimate uplift capacity should be divided by an appropriate factor of safety to obtain the allowable uplift capacity. Due to the low unit weight of the on-site soils, imported granular fill or lean concrete, placed as backfill above the mat, may be needed to prevent overturning.

The ultimate horizontal capacity should be approximated using passive earth pressure against the face of the mat. The passive earth pressure should be taken as 200 psf per foot of depth for the site sand soils. The ultimate horizontal capacity should be divided by an appropriate factor of safety to obtain the allowable horizontal capacity.

Seismic Considerations: The combination of the project location and subsurface conditions were used to select the appropriate seismic parameters in accordance with the procedures presented in the 2000 International Building Code (IBC). The subsurface conditions are interpreted as being consistent with Site Class C. The calculated Design Spectral Response values S_{DS} and S_{D1} are 0.128 and 0.049, respectively.

EARTHWORK

The following presents recommendations for site preparation, excavation, and subgrade preparation on the project. Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils and other geotechnical conditions exposed during the construction of the project.

Strip and remove any vegetation, debris and other deleterious materials from the proposed structure area. Stripped materials consisting of vegetation and organic materials should be wasted from the site. Where exposed and required, excavation of the silty sand will likely require heavy-duty excavation equipment.

Excavations penetrating bedrock may require the use of specialized heavy-duty equipment. Drilling and minor blasting may also be needed to facilitate rock break-up and removal. Consideration should be given to obtaining a unit price for difficult excavation in the contract documents of this project.

On-site soils should be moisture conditioned within a water content range of optimum to 3 percent above optimum, and compacted to at least 95 percent of the maximum dry density as determined by ASTM D 698. Imported soils, if required, should be submitted to Terracon for review and preparation of specific recommendations regarding placement and compaction, if approved for use. Experience has shown that the silty sand soils encountered at this site are moisture sensitive. Specifically, extra care must be taken during reworking and compaction of the soils in order to obtain a uniform water content throughout the fill.

CORROSION PROTECTION

A bulk sample from Boring B-1 was submitted for soluble sulfate testing. The sulfate test was in progress at the time of this report. The results of the test along with recommendations will be submitted under separate cover once they are finished.

Laboratory electrical resistivity tests were also performed on a bulk sample obtained from Boring B-1. The test yielded a result of 5,700 ohm-cm in the upper soils. A pH test performed on the same sample yielded a result of 7.8. Based on this information, the sand soils should be considered to be moderately aggressive towards corrosion of buried metals. If corrosion of buried metal is critical, it should be protected using a non-corrosive backfill, wrapping, coating, sacrificial anodes, or a combination of these methods, as designed by a qualified corrosion engineer.

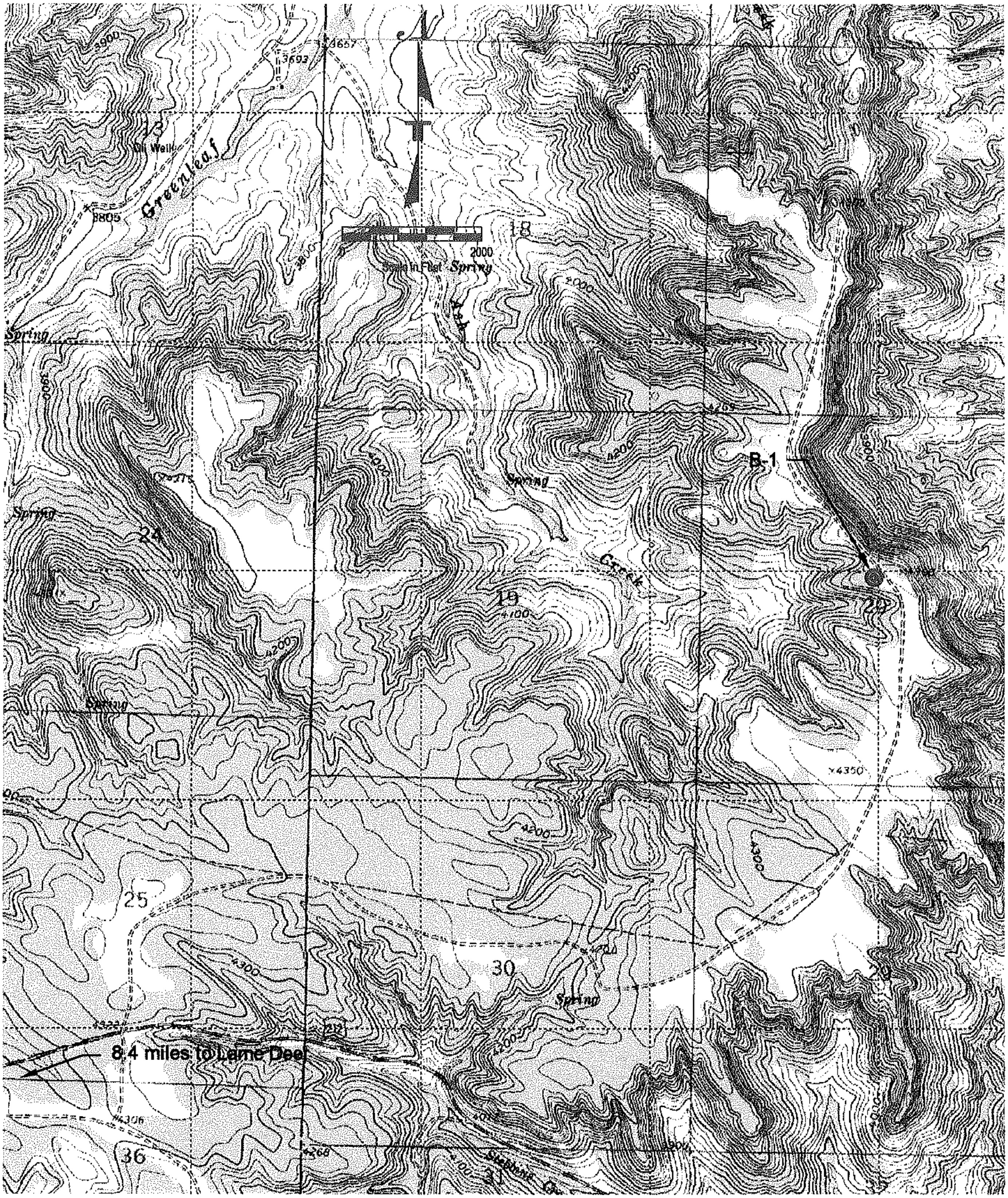
GENERAL COMMENTS

Terracon should be retained to provide a final geotechnical investigation for each wind turbine site and review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, grading, foundation and construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during, or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken.

This report has been prepared for the exclusive use of Distributed Generation Systems for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.



Boring Location Diagram

Northern Cheyenne Wind Project

Near Lame Deer, Montana

Job #	Date	Drawn	Scale
26045065	2-9-05	SW	As Shown

2110 Overland Avenue
Suite 124
Billings MT 59102
406-656-3072

Terracon

LOG OF BORING NO. B- 1

CLIENT
Distributed Generation Systems

SITE **Northern Cheyenne Reservation**
Lame Deer, MT.

PROJECT
Northern Cheyenne Wind Project

Boring Location: N 45° 39' 1.0", W 106° 27' 3.0"

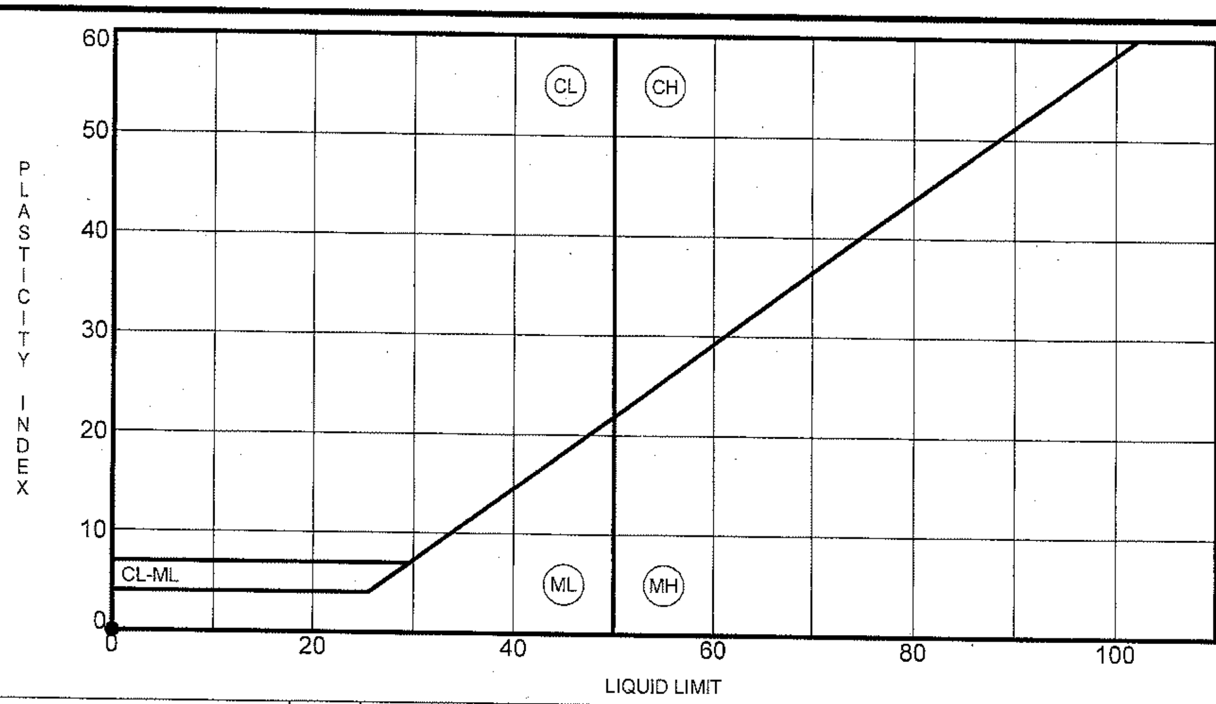
Graphic Log depth	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, ft.	SAMPLES: SPT - N BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: DRY UNIT WT pcf	TESTS: UNCONFINED STRENGTH, psf	
0.4	**TOPSOIL**				BS						pH = 7.8 ER = 5700 ohm-cm
4	**SILTY SAND**; Red, very stiff to stiff, dry to moist, fine sand, contains some deteriorated bedrock fragments.				ST	1.0		17			
	WEATHERED INTERBEDDED SILTSTONE/SANDSTONE; Red, very soft rock, moist, fractures very easily.	5			SS	1.5	42				
6					SS	0.9	50/0.4	14			
	INTERBEDDED SILTSTONE/SANDSTONE; Red, soft to moderately hard rock, moist, fractures easily.	10			SS	0.3	50/0.3	9			
		15			SS	0.2	50/0.2				
					BS			9			
		20			SS	1.2	76/0.7				
		25			SS	0.8	50/0.3				
	Hard cemented sandstone lens from 27 to 29 feet.				BS						
30.8		30			SS	0.8	50/0.3				
	Bottom of Hole.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER DEPTH OBSERVATIONS, ft		
WD	▽ None 1-27-05	▼
WD	▼	▼
WD	AD	

Terracon

BORING STARTED			1-27-05
BORING COMPLETED			1-27-05
RIG	BK-81	FOREMAN	SW
LOGGED	SW	JOB #	26045065



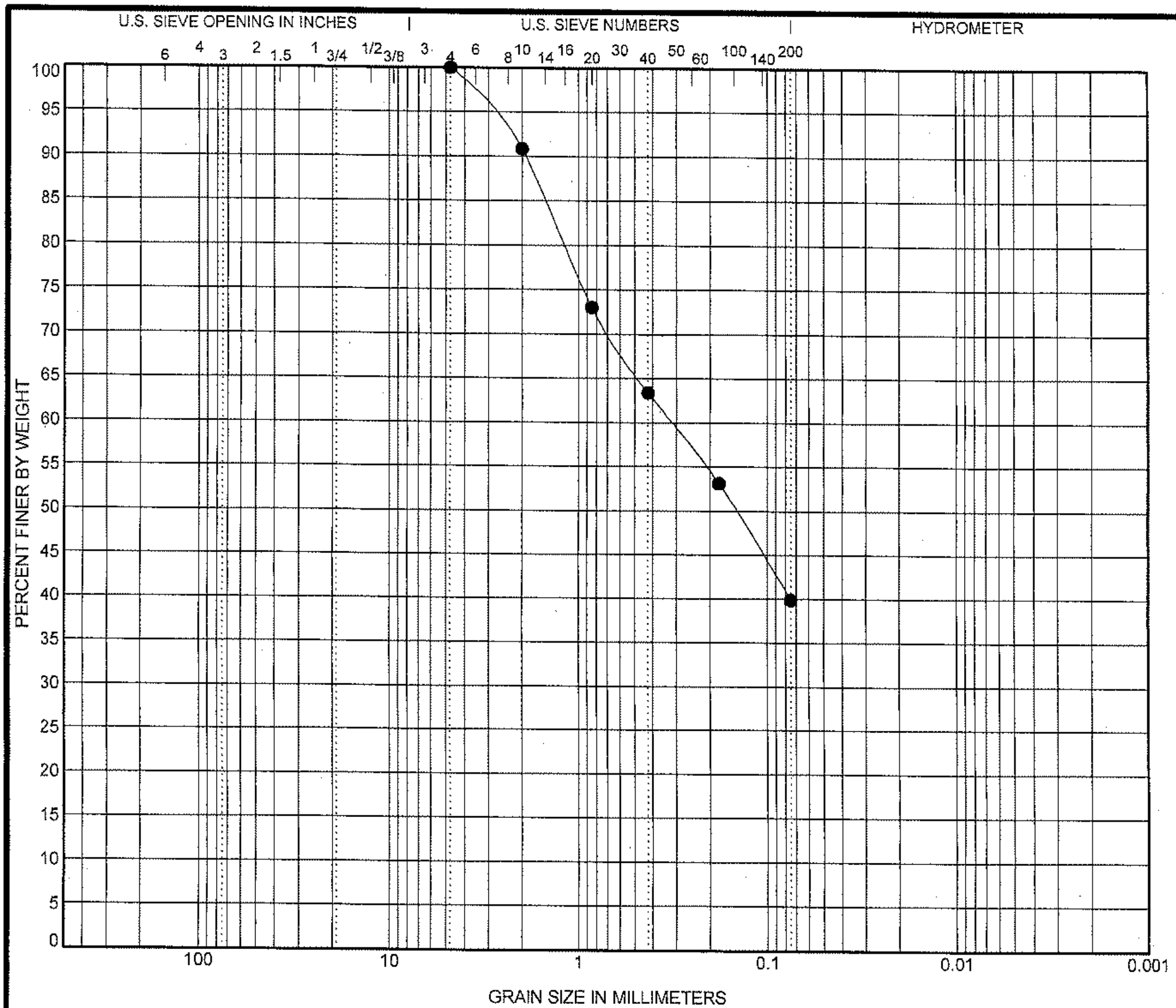
	Specimen Identification		LL	PL	PI	%Fines	Classification
●	**B- 1**	**5.5ft**	**NP**	**NP**	**NP**	**40**	**SILTY SAND(SM)**

Terracon

LIQUID & PLASTIC LIMIT TEST RESULTS

Project: Northern Cheyenne Wind Project
Site: Northern Cheyenne Reservation Lame Deer, MT
Job #: 26045065
Date: 2-8-05

TC ATTERBERG LIMITS 26045065.GPJ TERRACON.GDT 2/8/05



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● B- 1	5.5ft	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B- 1	5.5ft	4.75	0.319			0	60	40	

TC_GRAIN_SIZE 26045065.GPJ TERRACON.GDT 2/8/05

Terracon

GRAIN SIZE DISTRIBUTION

Project: Northern Cheyenne Wind Project
Site: Northern Cheyenne Reservation Lame Deer, MT
Job #: 26045065
Date: 2-8-05

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-^{3}/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel[F, G, H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[E]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G, H, I]
			Fines classify as CL or CH	SC	Clayey sand[G, H, I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line[J]	CL	Lean clay[K, L, M]
			$PI < 4$ or plots below "A" line[J]	ML	Silt[K, L, M]
		organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$	OL	Organic clay[K, L, M, N]
					Organic silt[K, L, M, O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K, L, M]
			PI plots below "A" line	MH	Elastic silt[K, L, M]
		organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$	OH	Organic clay[K, L, M, P]
					Organic silt[K, L, M, Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A]Based on the material passing the 3-in. (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K]If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains $\geq$ 30% plus. No. 200 predominantly sand, add "sandy" to group name.

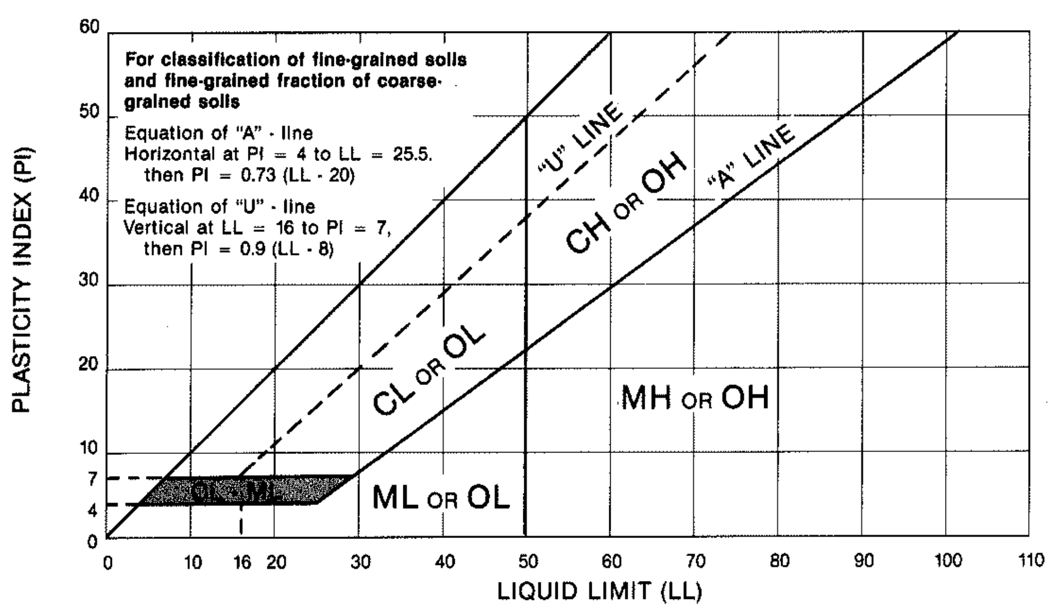
[M]If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]$PI \geq 4$ and plots on or above "A" line.

[O]$PI < 4$ or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.



Terracon

GENERAL NOTES

Sedimentary Rock Classification

DESCRIPTIVE ROCK CLASSIFICATION:

Sedimentary rocks are composed of cemented clay, silt and sand sized particles. The most common minerals are clay, quartz and calcite. Rock composed primarily of calcite is called limestone; rock of sand size grains is called sandstone, and rock of clay and silt size grains is called mudstone or claystone, siltstone, or shale. Modifiers such as shaly, sandy, dolomitic, calcareous, carbonaceous, etc. are used to describe various constituents. Examples: sandy shale; calcareous sandstone.

LIMESTONE	Light to dark colored, crystalline to fine-grained texture, composed of $CaCo_3$, reacts readily with HCl.
DOLOMITE	Light to dark colored, crystalline to fine-grained texture, composed of $CaMg(CO_3)_2$, harder than limestone, reacts with HCl when powdered.
CHERT	Light to dark colored, very fine-grained texture, composed of micro-crystalline quartz ($Si0_2$), brittle, breaks into angular fragments, will scratch glass.
SHALE	Very fine-grained texture, composed of consolidated silt or clay, bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, claystone or mudstone.
SANDSTONE	Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc. Cement usually is silica but may be such minerals as calcite, iron-oxide, or some other carbonate.
CONGLOMERATE	Rounded rock fragments of variable mineralogy varying in size from near sand to boulder size but usually pebble to cobble size (½ inch to 6 inches). Cemented together with various cementing agents. Breccia is similar but composed of angular, fractured rock particles cemented together.

PHYSICAL PROPERTIES:

DEGREE OF WEATHERING

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS AND DEGREE OF CEMENTATION

Limestone and Dolomite:

Hard	Difficult to scratch with knife.
Moderately Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Soft	Can be scratched with fingernail.

Shale, Siltstone and Claystone

Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be easily dented but not molded with fingers.

Sandstone and Conglomerate

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

BEDDING AND JOINT CHARACTERISTICS

Bed Thickness	Joint Spacing	Dimensions
Very Thick	Very Wide	>10′
Thick	Wide	3′ - 10′
Medium	Moderately Close	1′ - 3′
Thin	Close	2″ - 1′
Very Thin	Very Close	.4″ - 2″
Laminated	—	.1″ - .4″

Bedding Plane	A plane dividing sedimentary rocks of the same or different lithology.
Joint	Fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.
Seam	Generally applies to bedding plane with an unspecified degree of weathering.

SOLUTION AND VOID CONDITIONS

Solid	Contains no voids.
Vuggy (Pitted)	Rock having small solution pits or cavities up to ½ inch diameter, frequently with a mineral lining.
Porous	Containing numerous voids, pores, or other openings, which may or may not interconnect.
Cavernous	Containing cavities or caverns, sometimes quite large.

Appendix G

Photo Simulations
And
Community Meeting Material

Northern Cheyenne Tribe
North Cheyenne Reservation

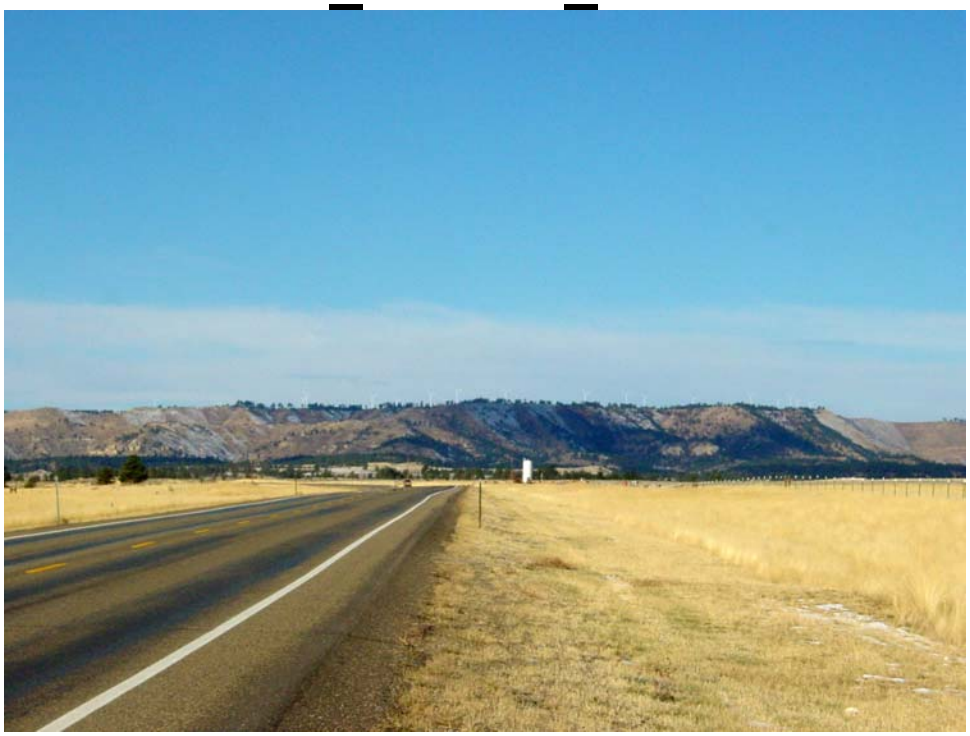
Northern Cheyenne Tribe

Wind Farm

Photo Simulations

Simulated Photos

FisherButte_Review_11-22-03



HW212_MM58_West of Site

Pre Installation Photos

Ashland-Heritage-
N45 35.33 W106 15.95

Fisher Butte
West of Site
N45 33.39 W106 31.27

**HW39_Spur_North of Site-
N45 47.38 W106 31.82**

**HW212_MM58_West of Site-
N45 36.58 W106 21.02**

HW447_North of Ashland-N45 40.945 W106 18.212

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Project Summary

- Project cost is fully funded by DOE and BIA
- Disgen is the contractor serving the NCT
- Project has been sized at 30 megawatts (30MW)
- Number of turbines will be 15 to 20
- The location is on the ridge at Garfield Peak
- Electrical interconnection will be to TRECO
- Energy buyer is to be determined

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

- The project will create revenue for the NCT for 30 years
- It will not provide low cost electricity to individual homes
- The concept is to create revenue for the NCT to provide capital for further economic development
- The NCT may own the project over time

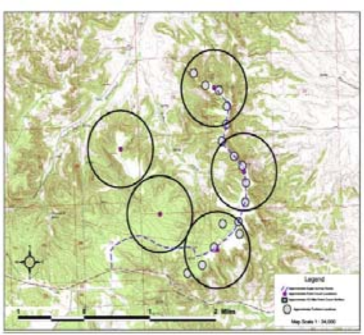
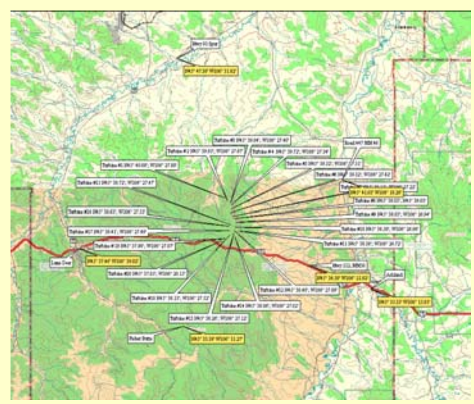


Figure 1. Locations of proposed turbines, point count stations and the eagle survey route.



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Morningstar Wind Project Presentation
August 25, 2005

Complete Pre-Construction Development

- Completed Wind Studies and prepared report
- Completed site layout
- Completed photo-simulations
- Completed environmental field studies
- Completed draft Environmental Assessment
- Completed initial interconnection studies
- Completed initial power purchase agreement form
- Completed initial project economic pro-forma

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Complete Pre-Construction Development (2)

- Completed inventory of wind turbine costs
- Identified potential power purchasers
- Negotiated with Southern Montana G&T and TRECO
- Interfaced with Rural Utilities Services (RUS) for non-recourse debt
- Identified potential tax investor partners

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Open Issues

- Who will buy the energy?
- Does NCT want to own the project eventually?
- Will BIA or others have significant issues with the Environmental Assessment?

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Action Items

- Obtain NCT approval for LLC structure
- Find a committed Power Purchaser
- Complete a PPA
- Complete the facilities study for transmission
- Obtain RUS approval for non-recourse loan or a debt guarantee from BIA

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Project Finance Objectives

- Maximize Tribal Economic Benefits
- Eliminate Tribal Risk
- Avoid Need for Tribal Investment
- Allow No Tribal Debt
- Establish Tribal Employment Preference
- Utilize Production Tax Credits for Wind Energy
- Preserve Tribal Cultural Values
- Minimize Environmental Impacts

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Project Structure

Create Project Limited Liability Company (LLC) with Members
- Northern Cheyenne Tribe
- Equity Tax Investor
- Project Managing Administrator (Member), Disgen or Other Qualified Firm

NCT and Equity Tax Investor Share in Economic Benefit

Project Managing Administrator
- Manages Project, Contract Administration and Accounting

Project Manager Reports to NCT and Equity Investor

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

LLC Operating Agreement

- Defines Allocation of Economic Benefits Among Members
- NCT Receives:
  - Landowner Payments
  - Jobs and Training for Project Maintenance
  - Property Tax Equivalent
  - Administration Fees
  - Sales Tax Equivalency
- Equity Tax Investor Receives:
  - Repayment of Investment
  - Production Tax Credit Value
  - Commercially Reasonable Rate of Return
- Project Administrator Manages Project and Trains Tribal Administrators

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Cost Issues

- **Southern indicates need for further transmission facilities studies; $42,000**
- **Disgen has obtained the funds ($50,000) from BIA**
- **Financing Requires Lawyers and Analysts;**
  Contracts and Modeling
- **Disgen has engaged professionals, paying them upon successful financing;**
  Estimated cost $500,00, paid from financing
- **Disgen has engaged multiple potential equity investor candidates**

Northern Cheyenne Tribal Council
Morningstar Wind Project Presentation
August 25, 2005

Estimated Tribal Economic Benefits (25 years)

Category	Annual	Project Life
O&M Labor (jobs)	$200,000(esc)	$5,000,000
Landowner Rent	$ 98,000(esc)	$2,450,000
Tribal Administration	$151,000(esc)	$3,775,000
Sub Total	$449,000(esc)	$11,225,000
Potential Upside		
Property Tax Payments (Maybe)		$1,300,000
Total Potential		$12,525,000

Appendix H

Financing Alternatives

Northern Cheyenne Tribe
North Cheyenne Reservation

NORTHWESTERN ENERGY

Northern Cheyenne Wind Project

IN RESPONSE TO THE REQUEST FOR PROPOSALS FOR RENEWABLE RESOURCES

SUBMITTED TO

NORTHWESTERN ENERGY

BY

DISTRIBUTED GENERATION SYSTEMS, INC. (DISGEN)

ON BEHALF OF

THE NORTHERN CHEYENNE TRIBE

200 UNION BLVD, SUITE 304
LAKEWOOD, CO 80228
TEL: (303) 531-5523
FAX: (303) 531-5527
www.disgenonline.com

AUGUST 12, 2004

RESPONSE PREPARED BY:

Krista Gordon
Manager of Engineering

RESPONSE CERTIFIED BY:

J. Scott Osborn
Director of Finance and Administration

DISGEN

Distributed Generation Systems, Inc.
200 Union Blvd, Suite 304
Lakewood, CO 80228-1831
Tel: 303-531-5523
Fax: 303-531-5527
Cell: 303-883-7635
E-Mail: Daleosb@msn.com
www.disgenonline.com

August 12, 2004

Dear Mr. Lewis

Distributed Generation Systems Inc. (Disgen) is pleased to submit the attached proposal, on behalf of the Northern Cheyenne Tribe, in response to NorthWestern Energy's bid for wind energy. Disgen serves the Northern Cheyenne Tribe under an Energy Services Contract and has been directed and authorized by the Tribe to submit this bid.

The Northern Cheyenne Tribe has long pursued a strategy of economic development and sustainability. In 2002, with the technical support of Disgen, the Tribe was awarded a Renewable Energy Feasibility Grant from the Department of Energy (DOE). Upon the successful completion of the feasibility assessment, the Tribe made application to DOE for partial funding of pre-construction development activities for a 30 MW wind facility. The grant was awarded to the Tribe in October 2003. The detailed avian studies, approved by US Fish & Wildlife Service, are underway and no significant impacts have been identified. Scoping meetings, in support of an Environmental Assessment under the National Environmental Policy Act, have been conducted and a Finding Of No Significant Impact is expected The analyses of the transmission system interconnecting to the Tongue River Electric Coop (TRECO) is complete and supports the 30 MW of wind capacity proposed herein. The Tribe is solidly in support of the project and will receive economic development benefits through operations and maintenance jobs, landowner fees and project ownership revenues. The value to the Tribe is approximately $7.0 million in present value. These funds will be utilized to help offset some rather dramatic health and education issues that plague the Tribe. The Tribe is expected to co-own the facility with a taxable entity such that the federal tax credits available for wind energy are fully enjoyed by the customers of NorthWestern Energy

The energy and environmental attributes will be generated starting in late 2005 for a price of $38.90 per MWh at the interconnection point to TRECO. The price is proposed to escalate at a rate of one and one-half percent (1.5%) per year for twenty-five (25) years. The energy may be delivered through TRECO to the Colstrip Power Plant for an incremental fee of $1.00 per MWh.

While I am sure that NorthWestern will receive bids with lower prices than the Northern Cheyenne Tribe can offer from its more moderate wind site, we request that NorthWestern consider this bid as one from a minority contractor that will be a watershed event for Native Americans throughout the United States. This project is quite small given the size of the solicitation and if NorthWestern has a diversification of supply strategy for minority providers, the Northern Cheyenne wish to be considered as such.

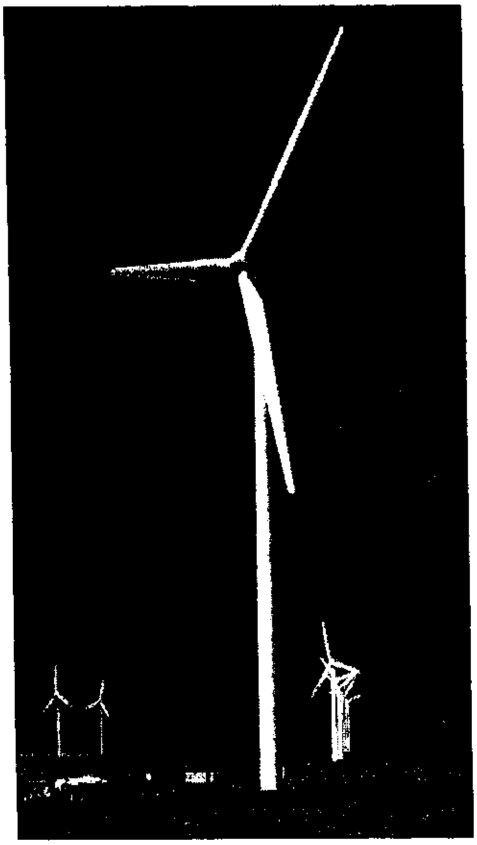
The project we are proposing is the first utility scale wind facility developed for the benefit of Native Americans. President Bush recently commented on seeking ways to aid in the self determination of tribes and wind energy represents a significant opportunity to achieve that objective. The utility firms that participate in the earliest of these projects will reap superb public relations benefits while doing an excellent job of aiding the Northern Cheyenne Tribe in becoming more independent of federal government aid.

I am happy to discuss with you at your convenience the details of the project and any other ways you might consider for working with the Northern Cheyenne. I look forward to your response and to follow-up conversations.

Sincerely,

Dale Osborn
President

GE WIND ENERGY 1.5s 60Hz WIND TURBINE GENERATOR TECHNICAL DESCRIPTION AND SPECIFICATIONS



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APPENDICES B AND B2

Pricing
The bundled price for the physical energy (kWh) and Renewable Energy Credits (RECs) is 3.89 cents escalating. All financial details may be seen in Appendix I.

Performance Assurances
The Project is willing to provide a contract termination clause in the Power Purchase Agreement (PPA) if the wind-adjusted projected output falls below 75% on an annual basis.

Environmental Attributes
It is assumed that all Environmental Attributes will accrue to Northwestern.

Environmental Impacts and Compliance
The environmental impacts associated with the project are discussed in the Ecological Baseline Study written by West, Inc. A copy of this study is included in Appendix J. A list of the permits required has been included in Appendix G.

Property & Other Taxes
The Project has assumed responsibility for all taxes up to the point of delivery at Colstrip.

No Reassignment
In the event of an award from Northwestern, the resulting contracts and obligations shall not be sold or reassigned without the prior written permission of Northwestern. The Project understands that Northwestern will only grant such if it is assured that the new entity is capable of maintaining all of the criteria stated within this RFP and the respective PPA. In addition, the Project understands that Northwestern may require additional security as a condition of approval for such reassignment.

Conflict of Interest Disclosure
Disgen and the Tribe are not aware of any existing relationships between the Project team and Northwestern or its employees.

Signature and Certifications
Please reference the Cover Letter written and signed by Dale Osborn, President of Disgen.

Resource Technology
The generation facility (Project) will consist of twenty (20) upwind three-bladed horizontal axis wind turbines. The output rating for each turbine will be 1.5MW, which will produce a total project output of 30MW. The turbines will be off-white machines sitting atop towers 64.7 meters tall with rotors 70.5 meters in diameter. The turbines will be manufactured by GE Wind. A general turbine specification along with various pieces of technical detail has been included in Appendix A.

Delivery Point
The delivery point for the facility's output will be at Colstrip, Montana. Northwestern Energy is currently one of the purchasers of the coal-fired power from Colstrip, so the Project would like to negotiate with Northwestern for the use of its transmission capacity flowing out of Colstrip. Estimates for all equipment required to deliver the power to Colstrip have been included in the bid price. A technical discussion of the delivery path can be found in the Impact Study completed by Electrical Consultants, Inc. for the Northern Cheyenne Tribe. This study is included in Appendix B.

Project Development Status and Schedule
Construction has not yet commenced on this project, but a significant portion of the development work has already been completed. A spreadsheet describing the tasks completed and a schedule for remaining tasks has been included in Appendix C. Additionally, a copy of the Tribal Renewable Energy Quarterly Progress Report for 2^{nd} Quarter, 2004 submitted to the Department of Energy has been included in Appendix C.

Diurnal Wind Data
The Project has collected wind data at 30, 40, and 50 meters using a meteorological tower located on the site. The tower was placed by Ed McCarthy. Mr. McCarthy has a vast amount of experience working with wind projects and assessing their wind resources. He has provided a Wind Assessment Report which as been included in Appendix D.

Avian Policy and Review
Chris Bergen of Disgen has reviewed Northwestern's avian policy and believes this site meets the requirements listed therein. Baseline studies and pre-construction monitoring are being completed. The site will soon be qualified for development.

Experience and Qualifications of the Project Team
For this response to Northwestern's solicitation, Disgen and the Tribe have accumulated a highly experienced and qualified team to manage all aspects of the Project. Biographies and Statements of Qualifications can be found in Appendix E. The wind assessment is being managed by Ed McCarthy. The environmental studies are being managed by West, Inc. The interconnection study has been managed by Electrical Consultants, Inc. The construction of the Project will be managed by GE TEAM with subcontractors TVIG (Tennessee Valley Infrastructure Group) and Olsen-Beal Cranes. Disgen is managing the pre-construction development work and is responsible for the submission of this bid. A hierarchy of Disgen staff is also included in Appendix E.

Financial
Please reference Appendix I.

Schedule
A schedule of tasks that have not yet been completed is listed on page 4 of the Tribal Renewable Energy Quarterly Progress Report in Appendix C.

Site Control
A letter explaining which lands are under control for development of the project is included in Appendix F. These lands contain all turbine locations and site roads. There will be no additional easements needed for transmission corridors since the transmission line to which the Project will be connected runs through the site.

Environmental Review
Environmental issues relative to development of the project are well defined and are being thoroughly analyzed. An Ecological Baseline Study is currently underway that gathers pre-construction data on the wildlife use; determines the presence of federal or state threatened, endangered, proposed, candidate sensitive-status plants and animals and their habitat; estimates potential constructions impacts to wildlife habitat, and identifies potential project modifications or mitigations to reduce potential negative impacts. The Baseline Study is 85% complete. Both winter and spring avian use studies are finished, along with a vegetation and wetland inventory. To date the site has exhibited normal avian use--i.e: migratory bird corridor, or endangered species nest. Raptor use of the area is low, especially among the eagle population with zero Bald Eagle sitings and only a few Golden Eagles spotted in or near the project area during point count surveys. Fall migration studies are still needed before accurate predictions of avian use can be made. Fall studies will be complete in late October to conclude final item in the Baseline Study Protocol.

The Ecological Baseline Study Protocol created by Western EcoSystem Technology, Inc. (West) will describe the studies and methodologies. The studies were conduced using West's personnel and contracted tribal wildlife technicians. Also included with the Ecological Baseline Study Protocol is the Phase One Screening Report, a preliminary fatal flaw analysis conducted on the site identifying potential risks prior to investing in further project development costs. Included with the Phase One Screening Report is the PII Index conducted for the site based on recently released guidelines by the U.S. Fish and Wildlife Service. None of these studies have identified major environmental issues that would potentially affect the development of the project.

An Environmental Assessment (EA), required by the National Environmental Policy Act (NEPA) is currently being drafted and should be finalized with a Finding of No Significant Impact from the Bureau of Indian Affairs (BIA) by early December 2004. A public scooping meeting was conducted on November 21, 2003 on the Northern Cheyenne Reservation as required by NEPA. Public notice was placed in local papers and posted in public areas. Comments were received and are being integrated into the EA report. In addition to the public scooping meeting required under NEPA, the tribe has held quarterly meetings within its regional communities to update and educate the tribe on the project. Disgen has presented the project and its progress on numerous occasions to the Tribal Council, Economic Development Authority, and Environmental Protection Division.

Permits
A spreadsheet describing the various permits required for the Project has been included in Appendix G.

Interconnection/Transmission Construction Requirements
A complete interconnection study has been completed by Electrical Consultants, Inc. It includes thermal, voltage, contingency, and loss analysis. It also includes preliminary interconnection facility cost estimates. The study was conducted assuming the power from the Project would be scheduled into Northwestern's service area. The interconnection of the Project was assumed to be on Tongue River Electric Cooperative's (TRECO) system. A copy of the study may be found in Appendix B.

The facility costs included in the ECI report are preliminary budgetary numbers. They are conservative estimates that are not likely to be greatly exceeded. However, if the cost of steel continues to fluctuate significantly, the facility costs may increase somewhat. This is not expected.

The primary contact at TRECO is Harold Hanson, the General Manager. He may be reached at (406) 784-2341. The primary contact at ECI is Dave Maehl, Interconnect Engineer. He may be reached at (406) 259-9933.

Financing
The Northern Cheyenne Wind facility will be financed utilizing a traditional non-recourse project finance structure. The project is bid utilizing a non-escalating Production Tax Credit (PTC) of 1.8 cents for ten years. Should the PTC not be extended as currently being considered in conference committee in the congress, the pricing will be adjusted accordingly. Should the PTC be extended as an escalating PTC, then the pricing proposed herein shall be adjusted downward accordingly. The debt/equity ratio is approximately 50/50 which is customary for a PTC based financing. The debt coverage ratio is 1.35 which is slightly aggressive.

It is the plan of the Northern Cheyenne to enter into a partnership with a taxable entity to fully own the project. Such a structure will provide for the first Native American owned utility scale wind facility in the United States and fully utilize any PTC for the benefit of the customers of Northwestern. While the Northern Cheyenne and Disgen have had discussions on such a structure with three taxable entities; it is not possible, in our opinion, for any financial entity to make firm commitments on providing equity and debt until such time as the power purchase agreement and interconnection agreements are completed. While financial entities may provide a general commitment to review and consider financing, the power purchase agreement provides the necessary motivation for firm commitments.

The Northern Cheyenne Tribe wishes to remind Northwestern that it is a Section 8 minority supplier and wishes to be considered as such in the evaluation of this proposal.

Construction
A site visit with Olsen-Beal Cranes and Disgen was conducted on 9 August, 2004. Following that visit, construction estimates were generated in a coordinated effort between Olsen-Beal, TVIG, and GE TEAM. A letter from GE TEAM describing the budgetary Balance of Plant estimates is included in Appendix H. The budgetary estimate includes turbine erection, building and upgrading of site roads, erosion control, turbine foundation design and installation, and substation design and installation. Operations and Maintenance costs are beyond the scope of GE TEAM's estimate of $9.982 million.

Testing
The GE 1.5MW machine has been certified by Germanischer Lloyd. The Power Curve meets the measurement standards of *IEC Wind Turbine Generator Systems – Part 12: Wind turbine Performance Testing, First Edition 1998-02* and *MEASNET Power Performance Measurement Procedure – Version 1 September 1997*. Further discussion can be found on pages 17-18 of the *GE Wind Energy 1.5s 60Hz Wind Turbine Generator Technical Description and Specifications* in Appendix A.

In addition, wind monitoring will continue post-construction to verify the turbines' power curve.

Commercial Operation
- Type of equipment: GE 1.5MW wind turbine.
- Detailed meteorological data: (See Appendix D.)
- Proposed capacity factor guarantees: The Project is willing to provide a contract termination clause in the Power Purchase Agreement (PPA) if the wind-adjusted projected output falls below 75% on an annual basis.
- Avian impact studies: Baseline studies are being completed.
- Treatment of green tags: All Renewable Energy Credits (RECs) will accrue to Northwestern should a PPA be awarded to the Northern Cheyenne Tribe.
- Treatment of the production tax credit: The pricing provided in this proposal assumes that the PTC will be reinstated in its form from December, 2003.
- Planned maintenance schedules: The Project assumes a normal maintenance schedule that is standard to the GE 1.5MW machine.
- Fixed O&M costs: The O&M costs are budgeted to be $33,000 (escalating) per turbine per year for both scheduled *and* unscheduled maintenance.
- Variable O&M costs: Disgen believes the escalation of the $33,000 figure listed above plus the fixed O&M costs reasonably cover the O&M needs of the Project.
- Estimates of forced outages for given technology: There are no known transmission constraints that would require the Project to disconnect from the grid in a non-emergency situation.
- Minimum operating levels: A standard availability guarantee from a wind turbine manufacturer is 95%.
- Ramp rates: The turbines have a cut-in wind speed of 4 m/s on a 10-minute average and a cut-out speed of 25 m/s on a 10-minute average.
- Cost escalators for O&M: The scheduled and unscheduled maintenance are assumed to escalate at a rate of 2%.

Additional Information
Please reference Appendix K for location information on the Project including maps.

Energy projects are a wonderful opportunity for tribes like the Northern Cheyenne. Their Reservation has remarkable potential for a wind project, and the Tribe is poised to derive a significant amount of economic development stimulus from a project such as this. Further in-depth discussion may be found in the Comprehensive Economic Development Strategy report found in Appendix L.