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Visual Simulations

To	Susan Quinnell, ND State Historic Preservation Office
Subject	Foxtail Wind Energy Center Visual Simulations Summary Dickey County, North Dakota
From	AECOM
Date	November 3, 2017, amended from Feb. 23, 2017

Introduction and Purpose

Foxtail Wind, a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC (NEER) is proposing to develop the Foxtail Wind Energy Center (Project) in Dickey County, southeastern North Dakota. The Project will be constructed and operated by Northern States Power Company (NSP), a subsidiary of Xcel Energy (Xcel). NSP/Xcel currently proposes to construct the Project in 2018 and 2019. Foxtail Wind plans to complete permitting through the North Dakota Public Service Commission in 2017.

The Project will have a nameplate capacity of approximately 150 megawatts (MW); consisting of up to 75 wind turbines and associated facilities. The Whitestone Hill Battlefield Site Boundary is approximately 2 miles from the closest proposed turbine. To ensure all visual impacts are considered, NEER contracted AECOM to complete visual simulations of the Project from the Whitestone Hill Battlefield Site. This summary and the accompanying figures are an addendum to the initial viewshed summary dated February 23, 2017.

Methods

On December 4, 2016, photographs were taken from Whitestone Hill near Soldier's monument (viewpoint) facing south toward the Project area. Turbine locations from the October 4, 2016 array were simulated in the photographs using the WindFarm software program. The WindFarm software program creates a photomontage using the photographs taken at the viewpoint and turbine data to create realistic renderings of what the turbines will look like on the horizon from the viewpoint location.

The following information is input to WindFarm:

- Turbine coordinates
- Turbine geometry (hub height and rotor diameter)
- High resolution (10 meter) terrain data
- Viewpoint coordinates
- Date of photograph
- Lighting (bright sunlight, weak sunlight, cloudy or dark)
- Locator coordinates (locations of landmarks in the photograph)
- Angle of the photograph (rotation horizontally)
- Pitch of the photograph (rotation vertically)

Based on the high resolution terrain data, turbine coordinates and turbine geometry, WindFarm creates a wire framework from the viewpoint location to the proposed turbines. The photographs taken at the viewpoint were overlaid on the wire frame and were adjusted based on the angle and pitch of the photograph, the locations of landmarks in the image, and the terrain on the horizon from the wire frame. Once the photograph was aligned with the wire frame the turbines were rendered.

At the request of the North Dakota State Historic Preservation Office (ND SHPO) a second round of photographs were taken on June 16, 2017. These photographs are meant to supplement the December photographs, showing the Project area from several different locations, with brighter contrasting vegetation, and with the updated turbine array from July 14, 2017. See **Figure 1** for the locations of these additional photo points and **Table 1** for a rationale for their choosing.

Table 1. New Point Locations and their Rationale

Point Name	Direction to Project Area	Location	Rationale
1	SSW	Intersection of 85th St. SE and 73rd Ave. SE	Will show the viewshed of the Project from within the Whitestone Hill Study Area (where the battle likely took place) surrounding the Historic Site. When combined with all the other points, it will also help show a progression of how the impacts diminish as you get further from the Project area.
2	SSW	Top of Whitestone Hill; Original Viewshed Photo Location	A retake of the previous photos from the same photo point; the highest point for several miles, 2.6 miles away from the nearest turbine, and a point within the Whitestone Hill Battlefield Historic Site.
3	SSW	Entrance to Whitestone Hill Battlefield Historic Site	Shows the Project from an area at Whitestone Hill Battlefield Historic Site where the hilly landscape acts as a physical barrier.
4	SSW	Intersection of 87th St. SE and 73rd Ave. SE	When combined with the other photos will help show changes in distance and landscape from measurable distances (slightly over 1 mile from turbines).
5	SSW	Intersection of 88th St. SE and 73rd Ave. SE	When combined with the other photos will help show changes in distance and landscape from measurable distances (less than 0.5 miles from turbines).

Results

The visual simulations completed for the December 4, 2016 photographs for the entire Project area as well as various distance bands are summarized in **Table 2**. There were no turbines located within 2 miles of Whitestone Hill. In the 2 to 3 mile band, eight turbines were visible from Whitestone Hill (**Figure 2**). Additionally, 19 turbines were visible in the 3 to 4 mile band (**Figure 3**), 18 turbines were visible in the 4 to 5 mile band (**Figure 4**), and 12 turbines were visible in the 5 to 6 mile band (**Figure 5**). At all distances, 75 turbines were visible (**Figure 6**). Due to the cloudy sky and snowy landscape, the rendered turbines blend into the background image.

Table 2 also includes a summary of the distance bands for visual simulations completed for Photo point 2 for the June 16, 2017 photograph. The closest turbine to Whitestone Hill was moved over half a mile (0.62) further away in the July 14, 2017 array compared to the October 4, 2016 array. There are no turbines located within 2.6 miles of Whitestone Hill or within the first distance band (0 to 2 miles). For the July 14 array, there are two fewer turbines within the second closest distance band (2 to 3 miles) from the nearest turbine compared to the October 4 array. Additionally, 24 turbines were visible in the 3 to 4 mile band, 17 turbines were visible in the 4 to 5 mile band, and 10 turbines were visible in the 5 to 6 mile band. At all distances, 75 turbines were visible (**Figure 8**).

Table 2. Summary of Number of Turbines for each Distance Band

Distance Band	October 4, 2016 Array		July 14, 2017 Array	
	Number of Visible Turbines	Distance of Closest Turbine (miles)	Number of Visible Turbines	Distance of Closest Turbine (miles)
0-2 miles	0	N/A	0	N/A
2-3 miles	8	2.01	6	2.63
3-4 miles	19	3.02	24	3.07
4-5 miles	18	4.08	17	4.04
5-6 miles	12	5.03	10	5.00
All distances	75	2.01	75	2.63

Conclusions

The comparison of the visual simulations taken in December 2016 using an October 2016 array to updated simulations from the same points in July 2017 using the final array also from July 2017 show fewer turbines within the immediate two distance bands (0 to 2 miles and 2 to 3 miles) from the Whitestone Battlefield Historic Site. As a result of NEER's consultation with the North Dakota SHPO, all turbines were removed from within 2 miles of the site. Voluntary efforts by NEER further resulted in the elimination of turbines at an increased distance from the Whitestone Battlefield Historic Site (originally 2 miles and now 2.6 miles) as well as a reduction in the number of turbines visible within the second distance band or between 2 to 3 miles from the Whitestone Battlefield Historic Site (originally 8 visible and now only 6 visible).

In addition to these voluntary efforts to reduce the potential visibility of turbines from the Whitestone Battlefield Historic Site, NEER has also been working with Tribes in the area who have expressed interest in the project to perform a study on the sites of religious and cultural importance to the Tribes on the Foxtail Project site. NEER contracted with the Tribal survey firm Makoche Wowapi (Wilson Mentz Consultants) to complete surveys and support preparation of a joint Class III Cultural Resources Inventory with AECOM. As a result of the field surveys and subsequent avoidance recommendations provided to NEER, a total of fifty (50) turbines were moved, relocated or abandoned in favor of locations that had less cultural or environmental sensitivity. Based on these efforts, AECOM is recommending a finding of *No Significant Sites Affected* for the Foxtail Wind Energy Center viewshed analysis and no further work for the Project as mapped herein.

Enclosures:

Figure 1: Viewshed Photo Points for June 16, 2017 Photographs

Figure 2: Turbines visible at 2 to 3 miles from Whitestone Hill

Figure 3: Turbines visible at 3 to 4 miles from Whitestone Hill

Figure 4: Turbines visible at 4 to 5 miles from Whitestone Hill

Figure 5: Turbines visible at 5 to 6 miles from Whitestone Hill

Figure 6: Turbines visible at all distances from Whitestone Hill

Figure 7: Turbines visible from Photo Point 1 to the south

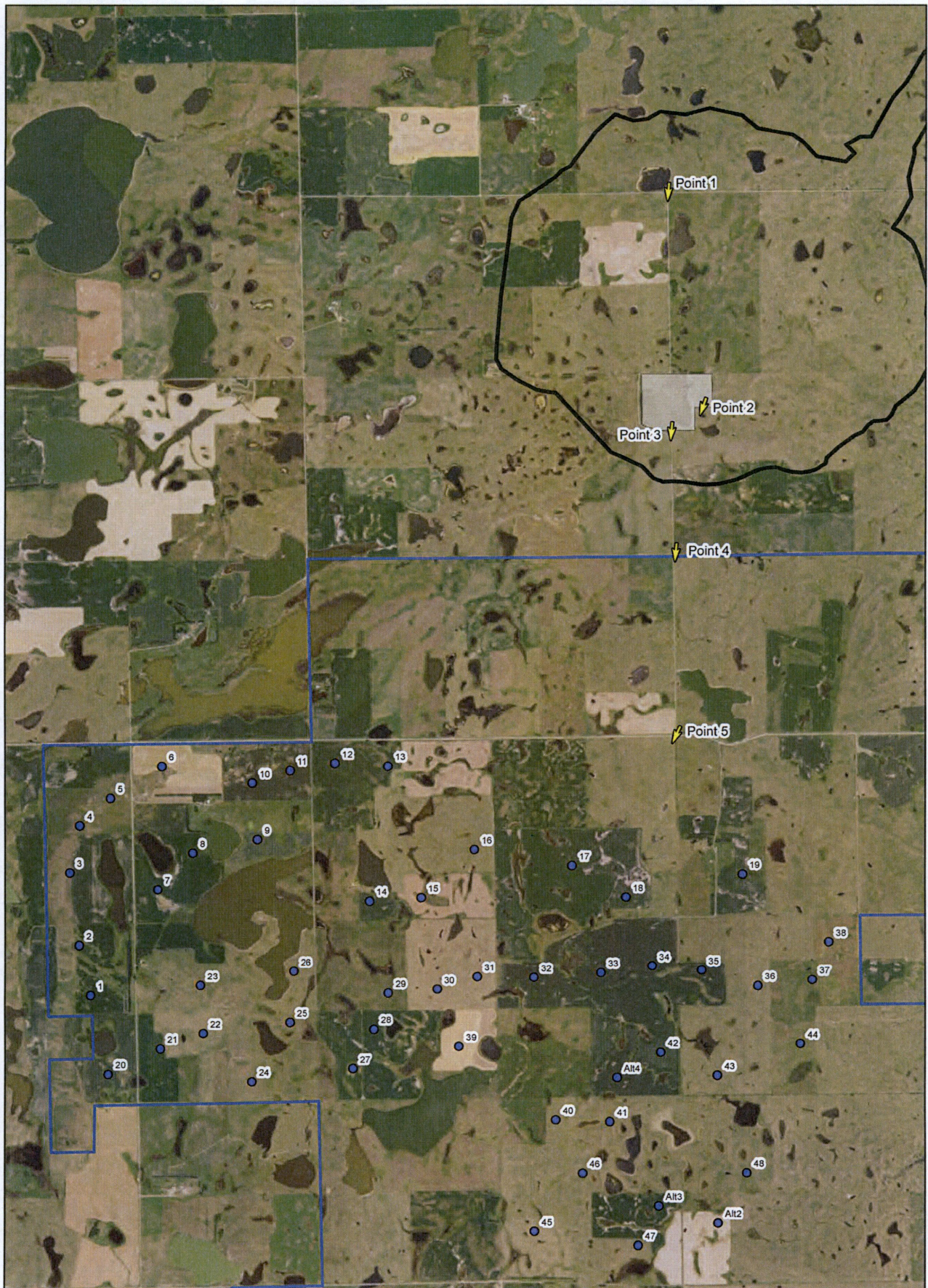
Figure 8: Turbines visible from Photo Point 2, the original photo location, to the south

Figure 9: Turbines visible from Photo Point 3 to the south (no turbines visible)

Figure 10: Turbines visible from Photo Point 4 to the south

Figure 11: Turbines visible from Photo Point 5 to the south

Figure 12: Turbines visible from Photo Point 5 to the west



- Legend**
- Photo Points*
 - Turbines
 - Project Boundary
 - Whitestone Study Area
 - Whitestone Battlefield Site
- * The point of the arrow indicates photo direction



0 0.225 0.45 0.9 Miles

Figure 1: Viewshed Photo Points
 Foxtail Wind Energy Center
 Cultural Resources Survey
 Dickey County, ND

Date Saved: 10/2/2017 10:30:36 PM

Coordinate System: NAD 1983 StatePlane North Dakota South FIPS 3302 Feet



Figure 2: Turbines visible at 2 to 3 miles from Whitestone Hill.

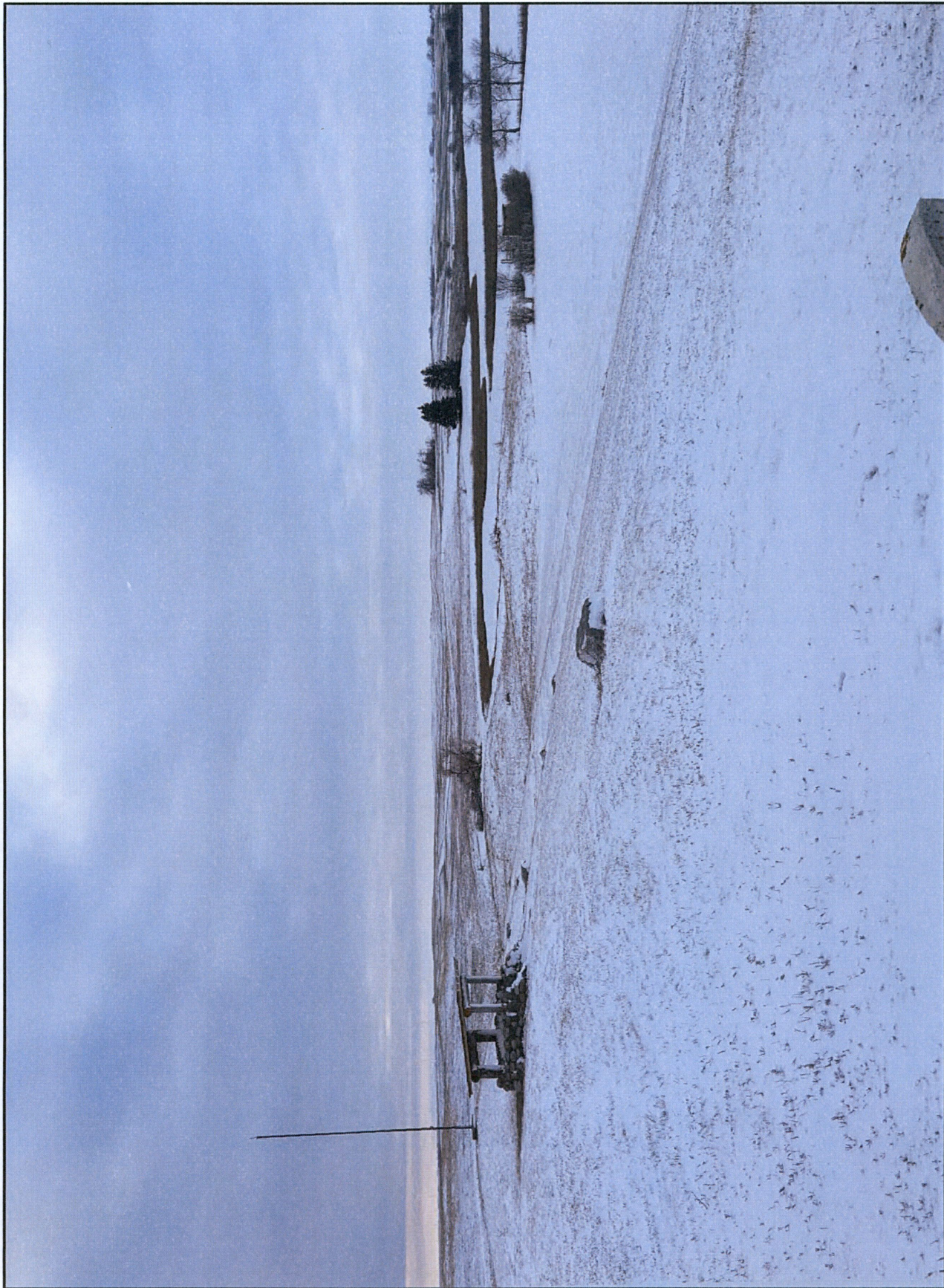


Figure 3: Turbines visible at 3 to 4 miles from Whitestone Hill.



Figure 4: Turbines visible at 4 to 5 miles from Whitestone Hill.



Figure 5: Turbines visible at 5 to 6 miles from Whitestone Hill.



Figure 6: Turbines visible at all distances from Whitestone Hill.



Figure 7: Turbines visible from Photo Point 1 to the south.



Figure 8: Turbines visible from Photo Point 2, the original photo location, to the south.



Figure 9: Turbines visible from Photo Point 3 to the south (no turbines visible).



Figure 10: Turbines visible from Photo Point 4 to the south.

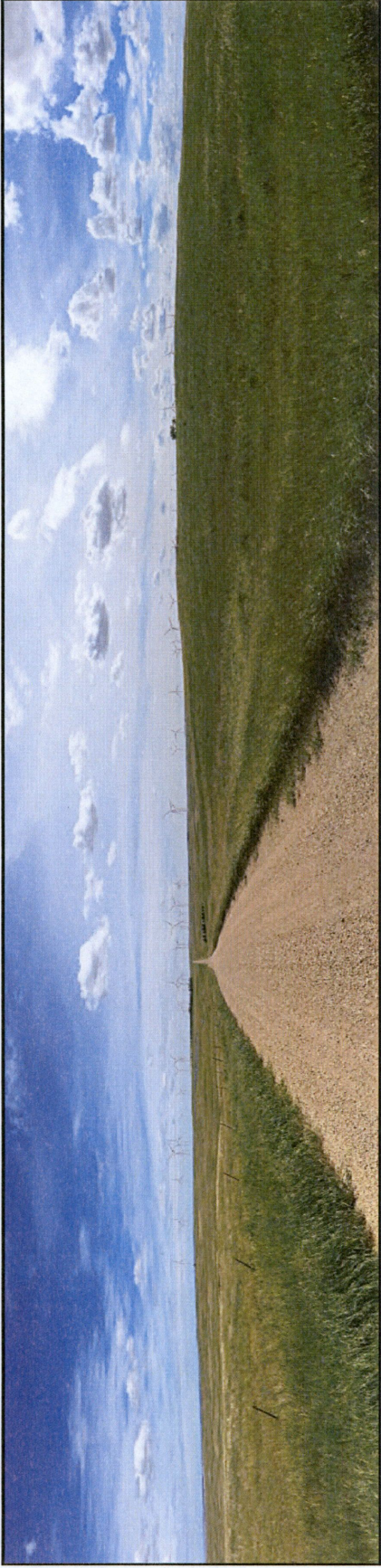


Figure 11: Turbines visible from Photo Point 5 to the south.



Figure 12: Turbines visible from Photo Point 5 to the west.

