DOE/EA-1859

FINAL
ENVIRONMENTAL ASSESSMENT

for the

KIRKWOOD COMMUNITY COLLEGE WIND TURBINE PROJECT

CEDAR RAPIDS, IOWA

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
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COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy

TITLE: *Environmental Assessment for the Kirkwood Community College Wind Turbine Project* (DOE/EA-1859)

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ABSTRACT: The U.S. Department of Energy (DOE) has provided Federal funding to the Iowa State Energy Office (ISEO) under the State Energy Program (SEP). ISEO is seeking to provide $1,050,000 of its SEP funds to Kirkwood Community College (College), who would use these funds to purchase equipment for one 2.5-megawatt wind turbine.

Before DOE decides whether to authorize ISEO to provide SEP funds to the Kirkwood Community College Wind Turbine Project (proposed Wind Turbine Project), DOE must first complete review under the *National Environmental Policy Act* (NEPA). Thus, this EA analyzes the potential environmental impacts of the construction, operation, and decommissioning of the proposed project and the alternative of not implementing this project (the No-Action Alternative).

The proposed wind turbine project is expected to offset an average of more than 35 percent of the College's electrical demand from nonrenewable energy with renewable wind power production. Ultimately, this transition to renewable energy production will offset the College's use of imported energy, stabilize long-term energy costs, and reduce the environmental impacts resulting from the use of fossil energy. Achievement of the proposed Wind Turbine Project will have the indirect effect of reducing the College's overall carbon footprint. The Wind Turbine Project would also promote collaboration among industry, government, and the College for research and workforce education. Overall, the turbine would stand 427 feet at its tallest blade extent. The project would include an approximately 400 foot access road, and 1,120 feet of underground electrical transmission cables to connect the project to an existing distribution line. The proposed project would be located on approximately two acres of land owned by the College in Cedar Rapids, Linn County, Iowa.

AVAILABILITY: This EA is available for review on the DOE Golden Field Office Reading Room Website, http://www.eere.energy.gov/golden/Reading_Room.aspx, and the DOE NEPA Website, http://nepa.energy.gov/DOE_NEPA_documents.htm.

ACRONYMS AND ABBREVIATIONS

APE	area of potential effect
CFR	Code of Federal Regulations
College	Kirkwood Community College
dBA	decibel on an A-weighted scale, used to approximate the human ear's response to sound
DNL	Day Night Average Sound Level (also L_{dn})
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EA	Environmental Assessment
FAA	Federal Aviation Administration
GHG	greenhouse gas
ISEO	Iowa State Energy Office
MBTA	*Migratory Bird Treaty Act*
MW	Megawatt
NEPA	*National Environmental Policy Act*
NRHP	National Register of Historic Places
Recovery Act	*American Recovery and Reinvestment Act of 2009*
SEP	State Energy Program
SHPO	State Historic Preservation Office (r)
U.S.C.	United States Code
USACE	U.S. Army Core of Engineers
USFWS	U.S. Fish and Wildlife Service

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APPENDICES

1. INTRODUCTION

The Iowa State Energy Office (ISEO) is proposing to provide a portion of its State Energy Program (SEP) grant to Kirkwood Community College (College) to purchase equipment for one 2.5-megawatt wind turbine generator on the College's campus in Cedar Rapids, Iowa. The goal of the College Wind Turbine Project is to offset an average of more than 35 percent of the College's electrical demand from nonrenewable energy with renewable wind power production. Ultimately, this transition to renewable energy production will offset the College's use of imported energy, stabilize long-term energy costs, and reduce the environmental impacts resulting from the use of fossil energy. When running at full capacity, the turbine would offset over 50 percent of the Cedar Rapids campus demand on peak load days, 70 to 80 percent on low demand (low heat, low cool) days, and 100 percent at night. Achievement of the proposed Wind Turbine Project will have the indirect effect of reducing the College's overall carbon footprint. The Wind Turbine Project would also promote collaboration among industry, government, and the College for research and workforce education.

The purpose of this Environmental Assessment (EA) is to evaluate the potential environmental impacts of authorizing ISEO to provide SEP funding to the College Wind Turbine Project . DOE's Proposed Action would authorize a total of $1,050,000 in SEP grant expenditures by the College to purchase equipment for the proposed Wind Turbine Project. The total cost of the proposed Wind Turbine Project would approximately be 8,100,000. Other funding for the Wind Turbine Project is expected from the Iowa Alternate Energy Revolving Loan Program loans ($3,000,000) and from the College's sources ($3,050,000). Federal funding of projects requires compliance with the *National Environmental Policy Act of 1969* (42 U.S.C. 4321 *et. seq.*; NEPA). In accordance with NEPA implementing regulations, DOE is required to evaluate the potential environmental impacts of Federal funding decisions. Thus, preparation of this EA addresses NEPA compliance and the related environmental impacts of the Proposed Action.

The purpose of the DOE SEP is to promote the conservation of energy and reduce dependence on imported oil by helping States develop comprehensive energy programs and by providing them with technical and financial assistance. SEP is authorized under the *Energy Policy and Conservation Act*, as amended (42 U.S.C. 6321 *et seq.*). States can use SEP funds for a wide variety of activities related to energy efficiency and renewable energy (42 U.S.C. 6321 *et seq*. and 10 CFR Part 420). In the *American Recovery and Reinvestment Act of 2009* (Pub. L. 111-5, 123 Stat. 115; Recovery Act), Congress appropriated $3.1 billion to the DOE SEP, and the State of Iowa received $40,546,000, pursuant to a Federal statutory formula for distributing these funds.

1.1 National Environmental Policy Act and Related Procedures

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

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

- Examines the potential environmental impacts of the Proposed Action and the No-Action Alternative;

- Identifies unavoidable adverse environmental impacts of the Proposed Action;

- Describes the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and

- Characterizes any irreversible and irretrievable commitments of resources that would be involved should DOE decide to implement its Proposed Action.

This EA provides DOE and other decisionmakers the information needed to make an informed decision about the construction, operation, and eventual decommissioning of the proposed 2.5 Megawatt Wind Turbine Project. The EA evaluates the potential individual and cumulative impacts of the proposed project. For purposes of comparison, this EA also evaluates the impacts that could occur, if DOE did not provide funding (the No-Action Alternative), under which DOE assumes the project would not proceed. The EA does not analyze other action alternatives.

The proposed Wind Turbine Project site is not within a 100-year or 500-year floodplain; therefore, this EA does not include a floodplain assessment. Similarly, the proposed project would not affect wetlands. However, this EA describes how DOE considered and evaluated these features of the natural environment in accordance with requirements of Executive Orders 11988, *Floodplain Management,* and 11990, *Protection of Wetlands,* and DOE's implementing procedures in 10 CFR Part 1022, *Compliance with Floodplain and Wetland Environmental Review Requirements*.

1.2 Purpose and Need

1.2.1 PURPOSE AND NEED OF DOE'S PROPOSED ACTION

DOE's purpose and need is to ensure that SEP funds are used for activities that meet congressional statutory aims to improve energy efficiency, reduce dependence on imported oil, decrease energy consumption, create and retain jobs, and promote renewable energy. Providing funding as part of the State of Iowa's SEP subgrant to the College would partially satisfy the need of DOE to assist U.S. cities, counties, states, territories, and American Indian tribes to develop, promote, implement, and manage energy efficiency and conservation projects and programs designed to:

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

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

1.2.2 KIRKWOOD COMMUNITY COLLEGE'S PURPOSE AND NEED

The purpose of the Wind Turbine Project is to reduce the College's reliance on imported carbon-based energy, stabilize long-term energy costs, and reduce impacts resulting from energy production and use on the environment. Secondarily, the College is proposing to create a vocational training program focusing on renewable energy. The on-campus wind turbine would also serve as a laboratory for students.

1.3 Public Involvement and Consultations

1.3.1 PUBLIC SCOPING

In accordance with applicable regulations and policies, DOE sent scoping letters to potentially interested local, State, and Federal agencies, including the Governor of Iowa, the Iowa State Historic Preservation Office (SHPO), U.S. Fish and Wildlife Service (USFWS), the U.S. Army Corps of Engineers (USACE), Federal Emergency Management Agency Region 7, and to representatives of the Sac and Fox Tribe of the Mississippi in the State of Iowa. DOE also sent scoping letters to other potentially interested individuals and organizations to solicit public comment (Appendix A), published the scoping letter on DOE's Golden Field Office's Public Reading Room (http://www.eere.energy.gov/golden/reading_room.aspx), and advertised the scoping comment period from October 13 to November 15, 2010, in the *Cedar Rapids Gazette*. The scoping letter described DOE's Proposed Action and requested assistance in identifying potential issues to be evaluated in the EA.

In response to the scoping letter, DOE received two comments. Those comments, which are included in Appendix A, were from the State of Iowa, Department of Natural Resources, and Iowa State Archaeologist. For both, DOE and the College are following the guidance provided, which is normal compliance with regulations.

The College also conducted a public meeting on December 7, 2010, to discuss the College's proposal to construct and operate a wind turbine in the College's main campus in Cedar Rapids, Iowa. Meeting notification was sent to 1,700 residents in the area, email notification was sent to local, State, and Federal agencies with potential interest, and a meeting notice was published in the *Cedar Rapids Gazette*. The meeting was conducted and five individuals attended (Appendix A). No written comments were received.

1.3.2 CONSULTATIONS

Below is summary of the consultations that were conducted. Consultation request and response letters are included in Appendix B.

Iowa State Historic Preservation Office

A "Request for SHPO Comment" form and supporting documentation was hand-carried to the Iowa SHPO on August 10, 2010, requesting information on historic properties within and near the proposed site. The form also contained a certification that no historic properties will be affected by the proposed Wind Turbine Project. In a letter dated August 24, 2010, the Iowa SHPO concurred that the Wind Turbine Project would have no adverse effects on historic properties (Appendix B).

U.S. Fish and Wildlife Services

Representatives of the College corresponded with the USFWS and received a letter dated August 24, 2010, in which USFWS concurred that the proposed Wind Turbine Project would be located in an area that has no suitable habitat for the Federally listed prairie bush clover (*Lespedeza leptostachya*) or western prairie fringed orchid (*Platanthera praeclara*) and would have no effect on these species. USFWS noted that the Federally listed endangered Indiana bat (*Myotis sodalist*) does not occur in Linn County, but could migrate through the area and that the placement of the turbine is not adjacent to any migratory areas, refuges, major flyways, or known avian nesting areas (Appendix B). The College would monitor the wind turbine for impacts to birds and bats and would notify DOE and USFWS if operation of the wind turbine results in mortality of these species.

U.S. Army Corps of Engineers

On July 2, 2010, the College sent a request for a wetlands determination to the USACE. The Kirkwood received a response from USACE dated July 14, 2010, which stated that the proposed Wind Turbine Project property does not contain any wetland areas or other waters of the United States and that Department of Army authorization is not required (Appendix F).

Federal Aviation Administration

On April 20, 2010, the Federal Aviation Administration (FAA) issued a "Determination of No Hazard to Air Navigation" to the College. Determination is for the 427-foot wind turbine located at the proposed Wind Turbine Project site (Appendix B).

1.3.3 DRAFT ENVIRONMENTAL ASSESSMENT

DOE issued the Draft EA for comment on April 16, 2011, and posted it on the DOE Golden Field Office Reading Room Website (http://www.eere.energy.gov/golden/Reading_Room.aspx) and DOE NEPA Website (http://nepa.energy.gov). DOE sent postcards to the individuals listed in Appendix A of this EA to notify them of the EA's availability on the web and to announce a 15-day public comment period on the Draft EA. A Notice of Availability was published in the local paper, *Cedar Rapids Gazette*. The comment period ended on April 21, 2011. DOE received no comments on the Draft EA.

2. PROPOSED ACTION AND ALTERNATIVES

2.1 DOE's Proposed Action

DOE's Proposed Action in this EA is to authorize ISEO to expend Federal SEP funding to purchase equipment for the College Wind Turbine Project (Proposed Action), a 2.5-megawatt wind turbine generator, on the College campus in Cedar Rapids, Iowa. The College's Wind Turbine Project will include construction, operation, and eventual decommissioning.

DOE has authorized ISEO to use a percentage of its Federal funding for preliminary activities, including the preparation of this EA and associated analyses. Such activities are associated with the proposed Wind Turbine Project and do not impact the environment or represent an irreversible or irretrievable commitment by the DOE in advance of the conclusion of the EA for the proposed Wind Turbine Project.

2.2 Kirkwood Community College's Proposed Project

The College proposes to design, construct, operate, and eventually decommission the wind turbine on its campus. Specifically, the College would use SEP funding to purchase wind turbine equipment to offset more than 35 percent of the College's electrical demand using renewable wind power production. The Wind Turbine Project would support the College's transition from non-renewable energy to renewable wind power production. The Wind Turbine Project would also support the College's Sustainability Center, which is a proposed vocational training program focusing on renewable energy. The Sustainability Center is not part of the proposed Wind Turbine Project.

2.2.1 PROJECT LOCATION AND USES

The proposed Wind Turbine Project would be located on the campus of the College in Cedar Rapids, Linn County, Iowa (Figure 2-1). The College is an established educational facility with a large campus located in the southern part of Cedars Rapids. The area surrounding the College has a combination of established development including light industrial, residential, and transportation corridors (Figure 2-2). The campus has over 35 buildings and facilities (Figure 2-3). The proposed site of the Wind Turbine Project is north of the baseball/softball fields (item 7 in Figure 2-3) and east of the Community Training and Response Center (item 6 in Figure 2-3); an area currently maintained as a vacant grass field. Adjacent land use includes play fields, a wooded creek area, campus buildings, and vacant maintained campus land. It is located in Section 15, Township 82 North, Range 7 West (Figure 2-2).

2.2.2 DESCRIPTION OF PROPOSED FACILITY

The proposed Wind Turbine Project would consist of a single 2.5-megawatt wind turbine with a total height of 427 feet above ground level. The wind turbine being evaluated in this EA is the Clipper Liberty 2.5 MW CW99 turbine. The height of the tower at its hub is 262 feet and the blades are 164 feet long. The nearest building, a garage that is part of the College Training and Response Center, is 630 feet to the west. The nearest residence is 1,040 feet north of the proposed turbine location. The Wind Turbine Project would be connected to the Alliant Energy distribution grid via a new underground electrical cable to existing overhead electrical distribution lines located about 2,000 feet northwest of the turbine (Figure 2-4). Other turbines will be considered by the College during procurement. For example, the GE 2.5 MW turbine is under consideration and has physical characteristics that are similar to the Clipper Liberty. Chapter 3 includes a discussion where differences in the wind turbines may make an analytical difference.

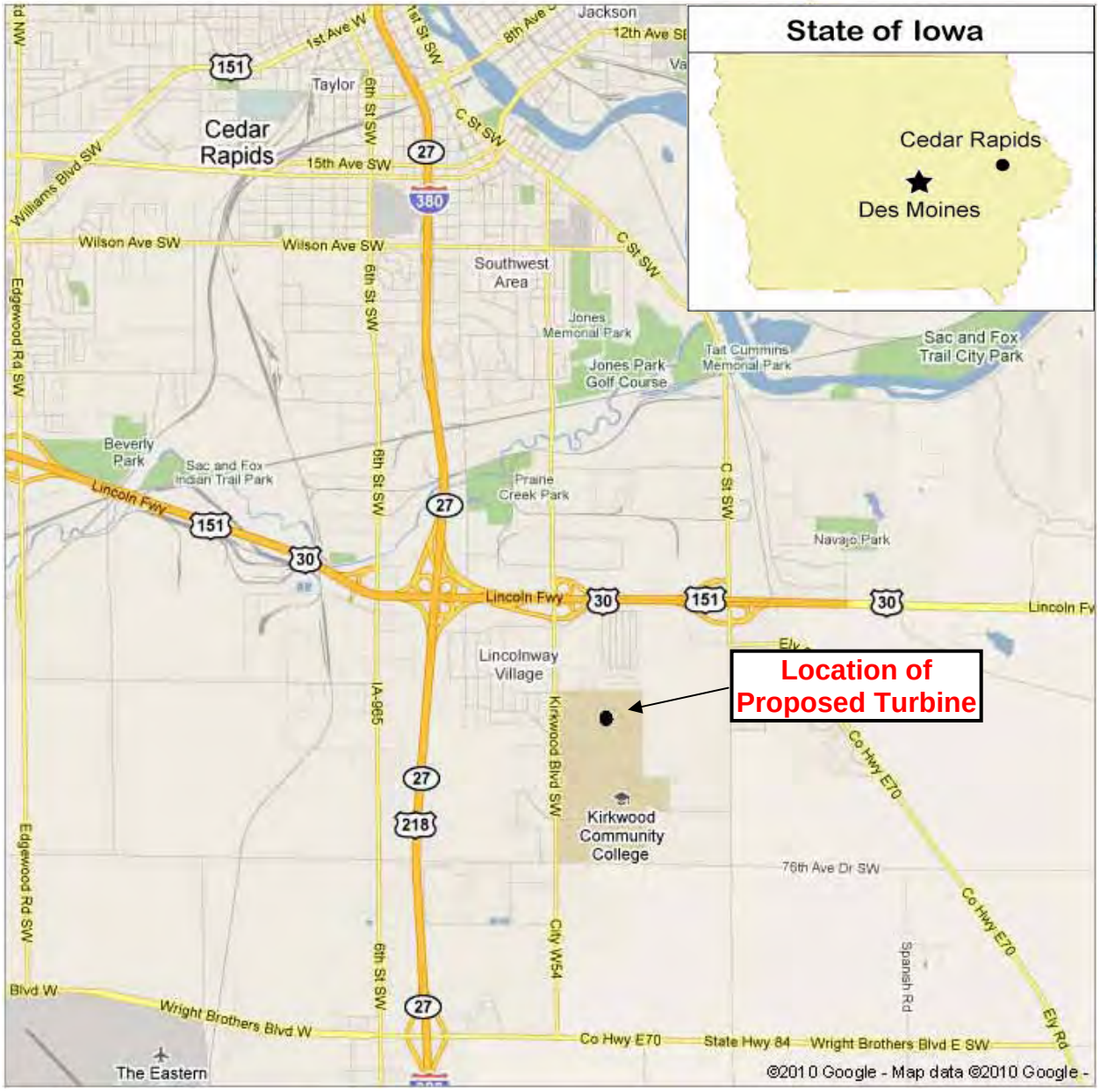

Figure 2-1. General Location Map

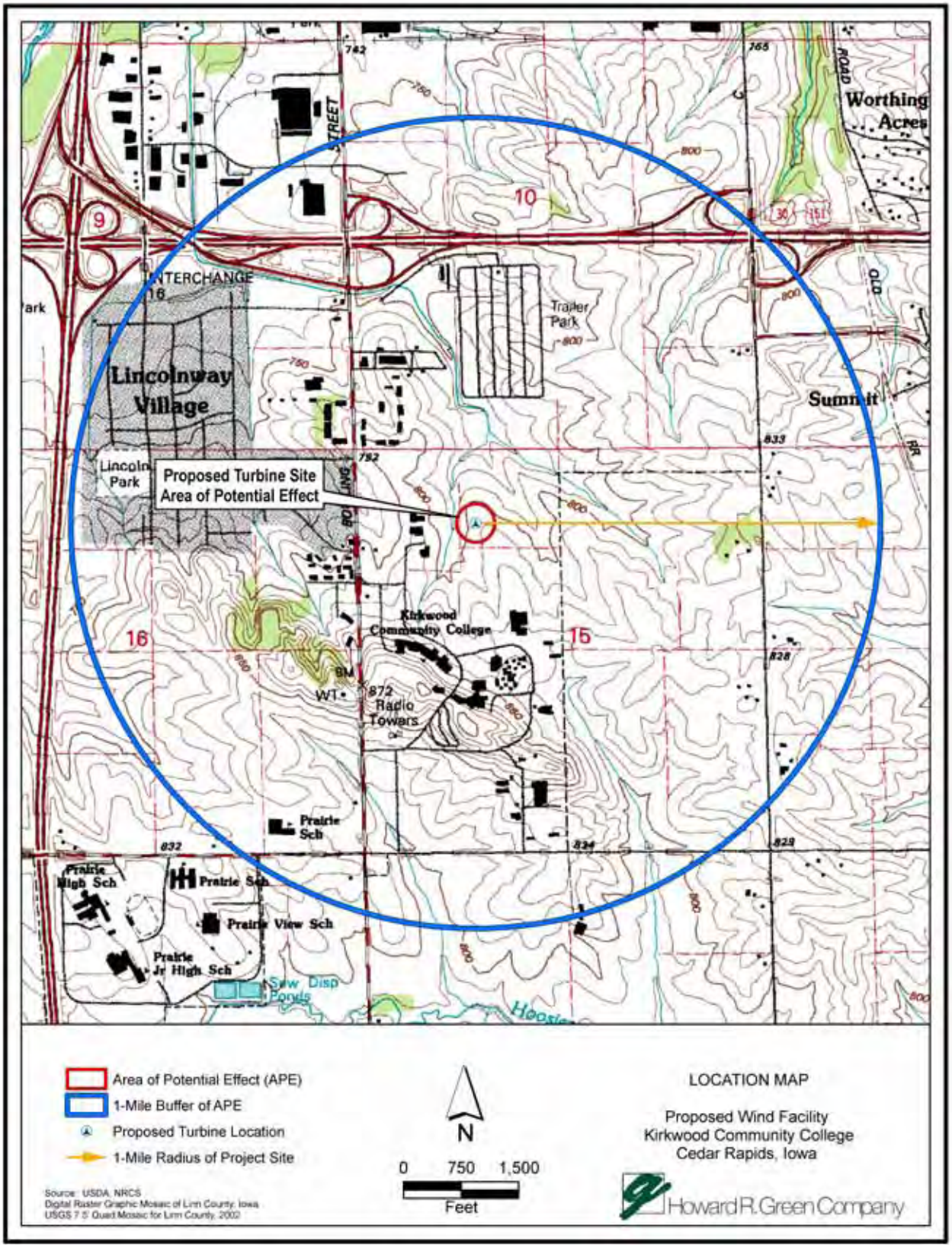

Figure 2-2. Location of Wind Turbine Project on Kirkwood Community College Campus

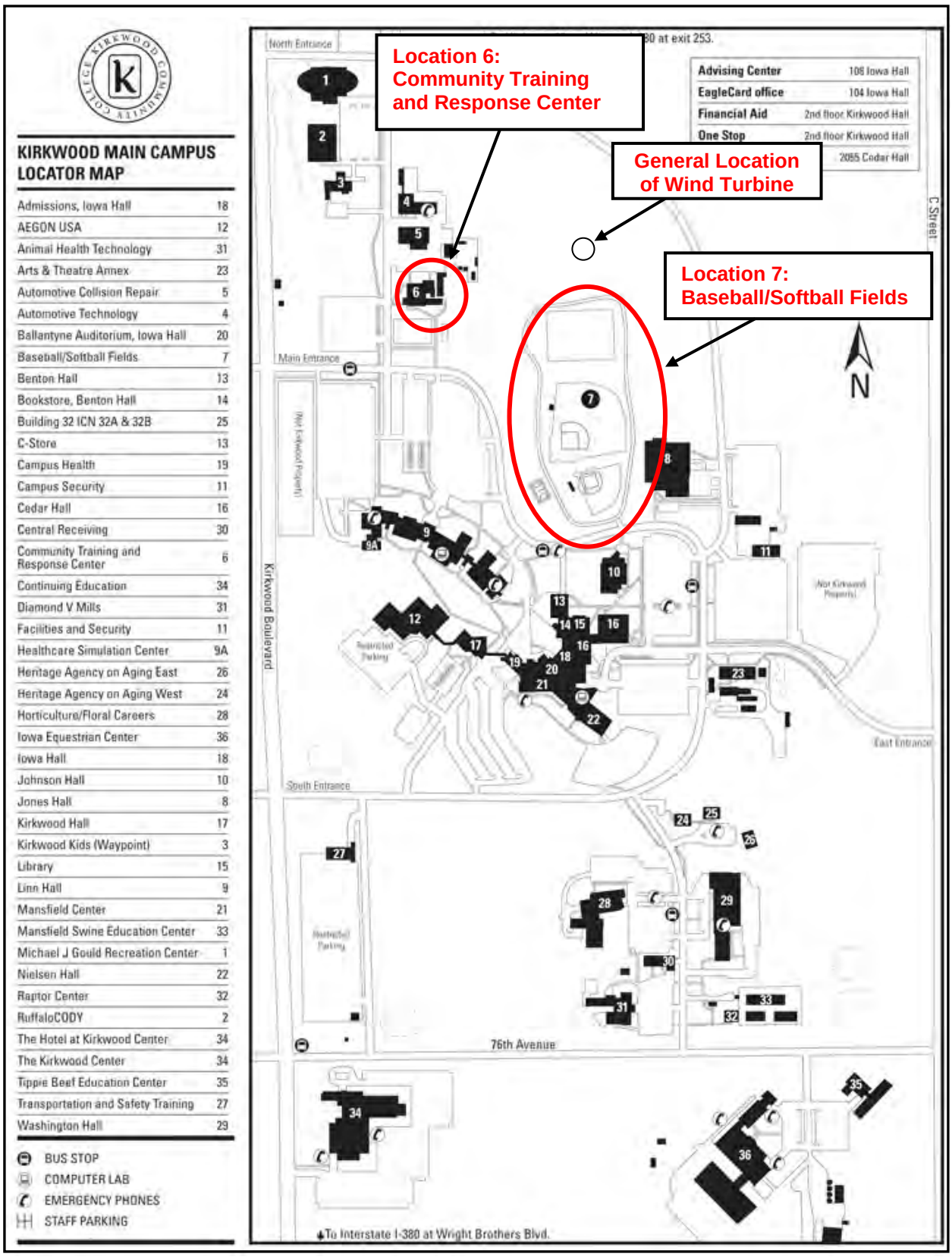

Figure 2-3. Kirkwood Community College Map

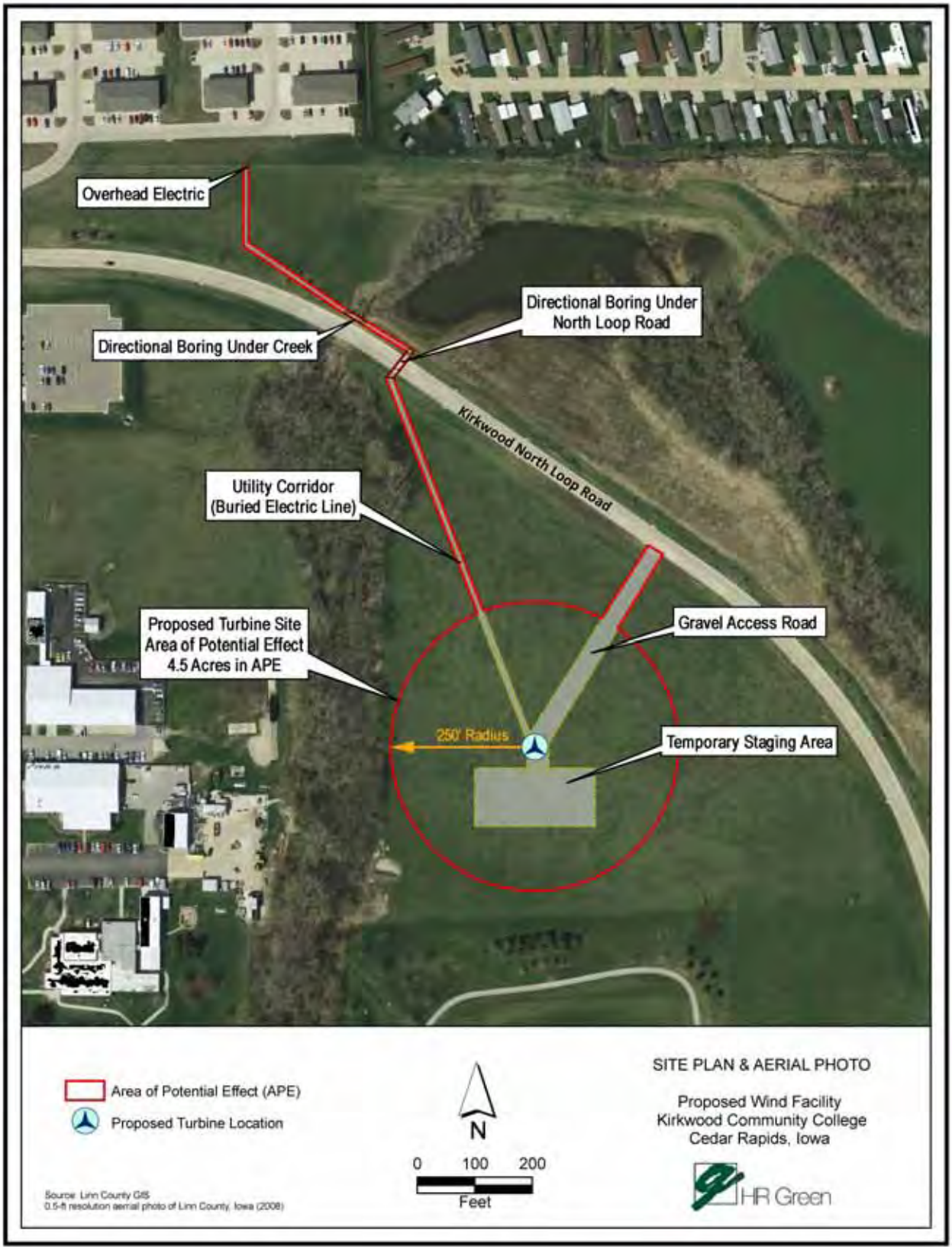

Figure 2-4. Kirkwood Community College Wind Turbine Project Site Plan

The tower and turbine would extend to a height of 427 feet above ground level. The base of the turbine tower would occupy an area of approximately 165 square feet. The buried concrete foundation would have a diameter of about 53 feet and would be approximately six feet in height. The foundation pedestal on which the tower would be mounted would be approximately 18 feet wide and 4.5 feet high, half of which would be below ground level. The turbine would be connected via an underground cable of approximately 1,120 feet to the distribution grid at the nearest point of interconnection. A gravel access road of approximately 400 feet would be constructed from nearby Kirkwood Boulevard Northeast. A temporary staging area would be created adjacent to the access road in the vicinity of the tower foundation.

2.2.3 CONSTRUCTION AND INSTALLATION

Construction of the wind turbine is anticipated to begin in 2011. The Wind Turbine Project would follow a progression that includes engineering, permitting, and detailed design; construction, and installation; commissioning; and operation. The anticipated timeframe from engineering to operations is approximately 1 year. All projects under DOE's award to Iowa SEP must be completed and operational by April 30, 2012.

Installation of the single turbine and required infrastructure would require the temporary disturbance of up to two acres of land that has been graded or otherwise previously disturbed. Trenchless technology would be used to install approximately 1,250 feet of buried electrical cable from the turbine to an existing overhead electrical line (Figure 2-4). Directional boring would be used to install the electrical cable under the North Loop Road and an adjacent creek. An approximately 400-foot-long gravel access road would be constructed from the existing Kirkwood North Avenue SW to the turbine tower. Once the wind turbine was constructed, the temporary staging area and the path of the buried electrical line would be restored to existing conditions. The wind turbine foundation and immediate area, which would be fenced, and the gravel access road would be the only long-term commitments of land. Use of the area is and would continue to be for institutional and public purposes as part of the College's property. The area surrounding the proposed wind turbine location and outside the fenced area would continue to be used for a variety of purposes, including commercial, office, residential, and agricultural uses.

Construction would be in accordance with an approved erosion and sedimentation control plan and in compliance with all other applicable requirements. The turbine tower would arrive on trucks in two or three pieces and would be assembled onsite. The turbine nacelle and blades would arrive separately on trucks. A large crane would be used to assemble the tower, place the nacelle on top of the tower, and attach the blades to the nacelle hub. Construction of the foundation, tower erection, turbine nacelle placement, and blade installation would be contingent on temperature and weather conditions (Figure 2-5).

2.2.4 OPERATION

The College would operate the Wind Turbine Project with Alliant Energy, the local electric power company, according to operating, maintenance, and safety procedures specifically recommended by the turbine's manufacturer. As part of operating the wind turbine, the College would properly train al workers for turbine maintenance and safety. Routine maintenance of the turbine would be necessary to maximize performance and identify potential problems or maintenance issues. The turbine would be remotely monitored daily to ensure operations were proceeding efficiently. All problems would be reported to Wind Turbine Project operations and maintenance personnel, who would perform both routine maintenance and most major repairs. Most servicing would be performed up tower without removing the turbine from the tower, thus greatly reducing the need for a crane. In addition, all access roads and the grounds around the wind turbine would be regularly inspected and maintained to minimize erosion.

Figure 2-5. Simulation of the Wind Turbine Project Installation

2.2.5 DECOMMISSIONING

Impacts evaluated with respect to the decommissioning of the turbine would be similar to those considered for construction of the turbine. The turbine and other infrastructure would be expected to have a useful life of at least 15 to 20 years. Retrofitting the turbine with upgrades might allow the turbine to produce efficiently for many years after the original useful life. When the Wind Turbine Project is terminated, the College will be responsible for decommissioning. The turbine and other infrastructure would be decommissioned and all facilities would be removed to a depth of approximately three feet below grade. The soil surface would be restored as close as possible to its original condition. Buried equipment would either be removed or safely secured and left in place. Salvageable items (including fluids) would be sold, reused, or recycled as appropriate; unsalvageable material would be disposed of at authorized and approved disposal sites. All decommissioning construction activities would be performed in accordance with the manufacturer's guidelines as well as all applicable Federal, State, and local regulations.

2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not allow Iowa to use its SEP funds for the proposed project. For purposes of this EA, DOE assumes for the No-Action Alternative that the project, therefore, would not proceed without Federal funding. This assumption allows a comparison between the potential impacts of the project as proposed and the impacts of not proceeding with the project. Without the proposed project, the operations and energy usage of the nearby community would continue as otherwise

planned but without the proposed wind project; therefore, the community would continue to use electricity primarily generated using fossil fuels and the potential reduction in greenhouse gases would not be realized. The ability of the State of Iowa to use its SEP funds for energy efficiency and renewable energy activities would be impaired, as would its ability to create jobs and invest in the nation's infrastructure in furtherance of the goals of the Recovery Act.

2.4 Committed Measures

The College has committed to the following measure and procedure to minimize or avoid environmental impacts if the Proposed Action is carried forward:

The College will develop a joint monitoring effort and assign the project in a collaborative effort to faculty in the Industrial Arts (wind technology students), Horticulture (parks and recreation students), and, as required, Math (statistics) departments. The campus Environmental Committee will review the monitoring efforts annually and report findings to the DOE and USFWS.

If any of the residents in the shadow flicker area comes forward and says that the shadow flicker is causing annoyance, the College would pay reasonable costs to provide shading devices such as shades, blinds, or vegetation to mitigate the effect.

Per State regulations, the College intends to submit a Notice of Intent to the Iowa Department of Natural Resources prior to starting construction. This Notice would be for storm water discharges under a General Permit No. 2 for construction activities as part of the National Pollutant Discharge Elimination System Program.

The College would use standard best management practices for the construction industry to reduce risks to workers. This would include complying with Occupational Safety and Health Agency regulations at 29 CFR Part 1926, "Safety and Health Regulations for Construction."

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This chapter of the EA examines in detail the potential environmental impacts of the proposed Wind Turbine Project and of the No-Action Alternative for the following affected environmental resource areas:

- Land Use
- Visual Quality
- Noise
- Cultural Resources and Historic Preservation
- Biological Resources
- Water Resources – Surface Water
- Human Health and Safety
- Transportation
- Socioeconomics and Environmental Justice
- Air Quality
- Infrastructure and Energy

Other resource and subject areas commonly addressed in DOE EAs are identified in Section 3.2 along with a basis for excluding them from the more detailed analysis.

3.1 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the use of Federal funds for a portion of the cost of the wind turbine equipment under proposed project; therefore, there would not be any impacts to the resource areas analyzed in this EA. However, without the proposed project, approximately 35 percent of the College's average annual electrical power that could have been provided by the Wind Turbine Project would continue to be purchased from the Alliant Energy Corporation. Fuel sources for the electricity generated by Alliant Energy include coal (61 percent), natural gas (31 percent), oil (6.3 percent), wind (1.2 percent), and hydroelectric (0.6 percent). Therefore, fossil fuels represent the vast majority of the fuel sources used to provide electricity to the College. Thus, carbon dioxide emissions from electricity generation to serve the college would remain the same under the No-Action Alternative, and the college would not meet its objective of reducing its carbon footprint.

Additionally, the jobs created and retained by construction and operation of the wind turbine would not be realized and the local area would forego the economic benefit associated with these new jobs.

3.2 Environmental Resource Areas Not Carried Forward for Further Analysis

Consistent with CEQ and DOE NEPA implementing regulations and guidance, DOE focuses the analysis in an EA on topics with the greatest potential for environmental impacts. This sliding-scale approach is consistent with NEPA [40 CFR 1502.2(b)], under which impacts, issues, and related regulatory requirements are investigated and addressed with a degree of effort commensurate with their importance. DOE concluded that the proposed Wind Turbine Project would result in no impacts or minor impacts to the following resource areas and did not carry them forward for detailed description and analysis.

3.2.1 GEOLOGY AND SOILS

Construction would occur in an open, undeveloped area with loamy and sandy soils that overlie glacial till (Quade et al. 1998). Preliminary Wind Turbine Project plans indicate the construction of the turbine foundation would require 12 to 20 feet of below-grade excavation, depending on geotechnical considerations. The specific foundation system would be developed as part of the detailed project design using applicable and appropriate engineering criteria, but there should be nothing unique or unusual in the site's geology and soils that would hinder or adversely affect the proposed project. As described in more detail in the discussion of surface water, the College would take actions during construction to minimize soil erosion and, because the area has only a mild slope, there would be little potential for soil erosion. After construction is completed and the site revegetated, the potential for soil erosion should be no different than under existing, pre-Wind Turbine Project conditions.

The Wind Turbine Project site, like the rest of Iowa, is considered to be an area of low seismic risk (DNR 2010a; USGS 2010), and it is unlikely that earthquake activity would occur and result in adverse impacts to the proposed project. The Wind Turbine Project would not affect or be adversely affected by site geology.

3.2.2 WATER RESOURCES – GROUNDWATER

The College would use water, provided by the City of Cedar Rapids, as necessary during construction for soil compaction and dust suppression. Such water demand would be short term, approximately two months. The City of Cedar Rapids obtains its water from groundwater, specifically, the alluvial aquifer that is fed primarily from the Cedar River (Cedar Rapids 2010a). The Wind Turbine Project would require excavation to a depth of 12 to 20 feet for the wind turbine foundation. This area is known to be interspersed with clay lenses and perched water bodies, so groundwater could be encountered during construction. However, because excavation would involve a very small area (approximately 20 cubic yards or less), construction activities would not adversely affect such groundwater or deeper aquifers.

There would be no water needs during operation of the wind turbine, and there would be no storage of hazardous substances that could be released and migrate to groundwater. The College would handle, collect, transfer, and reuse or recycle the small amounts of oil and lubricants used during maintenance in accordance with applicable Federal, State, or local regulations.

3.2.3 WASTE MANAGEMENT

Solid wastes generated during installation include equipment packaging materials and construction-related material debris. Minimal solid wastes would be generated during operation of the turbine. Solid wastes that are anticipated to be generated during decommissioning include dismantled equipment and construction-related material debris. No hazardous wastes would be generated during installation, operation, or decommissioning. The College would handle, collect, transfer, and dispose of all wastes generated over the life of the proposed project in accordance with applicable Federal, State, and local regulations. Used oil (e.g., spent gearbox oil, hydraulic fluid, and gear grease) would be generated during operation of the wind turbine, but it would not be considered a waste because it can be reused and/or recycled. The College currently has an existing oil recycling program for used oil generated from its maintenance vehicles and would manage used oil from the wind turbine in accordance with this existing recycling program and with applicable Federal, State, and local regulations.

3.2.4 INTENTIONAL DESTRUCTIVE ACTS

DOE considers intentional destructive acts (that is, acts of sabotage or terrorism) in its EAs and environmental impact statements (DOE 2006). Construction and operation of the College Wind Turbine Project would not involve the transportation, storage, or use of radioactive, explosive, or toxic materials. The Wind Turbine Project would not offer any particular attractive targets of opportunity for terrorists or saboteurs to inflict adverse impacts on human life, health, or safety. In the unlikely event an attack were to occur, its consequences would be similar to those of an accident, such as those discussed in Section 3.3.7 of this EA.

3.3 Considerations Carried Forward for Further Analysis

3.3.1 LAND USE

3.3.1.1 Affected Environment

The proposed wind turbine would be located on the southern edge of Cedar Rapids, on the College campus. Land use in the vicinity of the proposed Wind Turbine Project is a combination of institutional, commercial, office, residential, and agricultural. The proposed project site is currently a maintained, vacant grass field on the college campus. The field is bordered to the north, east, and west by large deciduous trees and to the south by baseball and softball fields. The closest residences are about 1,040 feet to the north of the proposed wind turbine site. These residences are in a trailer park on the north side of the college campus. Two groups of apartments immediately west of the trailer park are only slightly further from the wind turbine site, with the closest apartment building about 1,080 feet away. The next closest residential areas are more than 1,600 feet to the west and would be separated from the wind turbine by a built-up portion of the college campus as well as Kirkwood Boulevard. The closest buildings to the proposed turbine site are part of the college, about 660 feet to the west. To the south and southwest of the Wind Turbine Project site, the nearest buildings are also college facilities, with the closest about 1,150 feet away. To the east, across a cultivated field and a grassy area are two commercial office buildings (about 2,300 feet away).

According to the Comprehensive Plan for Cedar Rapids (Cedar Rapids 1999), the proposed wind turbine would be located on land with a designated land use of “institutional/public” along with the rest of the college campus. Land use designations immediately surrounding the campus include: low-, medium-, and high-density residential; office; and commercial.

Because of the height of the proposed wind turbine, there are other land uses in the surrounding area that could be impacted. The wind turbine has the potential to interfere with air navigation and the operation of transmission towers. The Eastern Iowa Airport is slightly more than 3 miles southwest of the proposed Wind Turbine Project site. There are also several communications and cellular towers within a mile of the project site; the closest being the two 400-foot-tall communications towers in the southwestern part of the campus, about 3,000 feet from the Wind Turbine Project site.

In August 2010, the City of Cedar Rapids put into effect Ordinance No. 032-10, which is “an ordinance amending Chapter 32 of the Municipal Code of the City of Cedar Rapids, Iowa, the Zoning Ordinance, by adding a new Subsection 32.04.030.A.46 to allow the use of Wind Energy Conservation Systems as a conditional use of all land use districts.” This ordinance was subsequently revised by the City Council in February 2011 as the result of a request from College, primarily due to a very stringent shadow flicker requirement in the August 2010 version (Cedar Rapids 2011). A few of the key requirements identified in the most recent ordinance (issued as Ordinance No. 007-11) that would be applicable to the proposed Wind Turbine Project are summarized as follows:

- The distance from the wind turbine to the nearest property line must be no less than 110 percent of the wind turbine's height.

- All wires between the wind turbine and substations must be underground.

- Wind turbine sound (under normal operating conditions) as measured at the property line must comply with decibel limits set in Chapter 56 of the Municipal Code ("Motor Vehicle Noise and Noise Limits from Certain Sound Sources").

- Shadow flicker from the wind turbine may not exceed 30 hours per year on a residential property.

3.3.1.2 Direct and Indirect Impacts

Implementation of the proposed Wind Turbine Project would temporarily commit up to 2 acres of previously disturbed land. Once the wind turbine is constructed, the College would restore both the temporary staging area and the path, where the electrical line would be installed, to existing conditions. The wind turbine foundation and the gravel access road would be the only long-term commitment of ground, though the college plans to install a fence around the turbine. The general land use of the area is and would continue to be institutional/public since it is part of the college's property. The area surrounding the proposed wind turbine location would continue to be used for a variety of purposes, including commercial, office, residential, and agricultural.

Per the Cedar Rapids ordinance on Wind Energy Conservation Systems (Ordinance No. 032-10), the proposed location of the wind turbine would be consistent with the City's zoning for that area, provided requirements in the ordinance were met. Shadow flicker and sound level requirements are addressed in this EA in Sections 3.3.2 and 3.3.3, respectively. With regard to set backs from adjacent property lines, the height of the evaluated wind turbine would be approximately 427 feet from its base to the tip of the rotor blade at its highest point. According to the ordinance, the required set back is 110 percent of this height, which is 470 feet. The nearest property lines, which are to the north and the east, are approximately 1,000 feet from the proposed wind turbine site, well over the required 470 feet. As required by this ordinance, the College would bury electrical lines that would run from the wind turbine to the nearest existing transmission lines.

Once the wind turbine was constructed, it would present a possible risk to air traffic due to its total height of 427 feet. The College addressed this issue by requesting that the FAA conduct an aeronautical study with regard to the Wind Turbine Project. In its response to the College, the FAA stated the "study revealed that the structure would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities" (see Appendix B). This determination was contingent upon the following conditions: (1) the structure must be marked and/or lighted in accordance with specific FAA guidelines; and (2) the FAA must be notified if the project is abandoned or within 5 days of the construction reaching is greatest height. The letter further states the determination expires on April 20, 2012, two years after the date of issuance. Based on the FAA's determination, DOE concludes that the Wind Turbine Project would have no adverse impacts on air traffic of the area and, in that regard, would not present a conflict of land use.

Wind turbines have the potential to interfere with existing microwave systems and broadcast stations by physically blocking line-of-sight between transmitters and, in case of television signals, by reflecting signals that can result in "ghosting" in receptions. To address this potential issue, the College arranged for a private entity (Comsearch) with expertise in the subject matter, to perform an evaluation of the proposed Wind Turbine Project. The report from the evaluation (included in Appendix E) identifies several microwave paths that pass through an area of interest around the proposed turbine location; however, the

report concludes "the proposed turbine was not found to have a potential conflict with the incumbent microwave paths."

3.3.2 VISUAL QUALITY

3.3.2.1 Affected Environment

Visual quality refers to the scenic or visual appeal of the landscape and includes all natural and manmade objects (moving and stationary) that are visible on the landscape (BLM 2005a). The visual character of the Wind Turbine Project site is that of a grassy, maintained area that is somewhat isolated from ground view from off-campus areas due to trees in the surrounding area. (Depending on the location of the observer, the trees would not obstruct the view of an installed wind turbine.) To the south, there is less tree cover; however, baseball and softball fields as well as the main portion of the campus separate the proposed project site from off-campus areas. The Kirkwood North Loop Road cuts through the open grassy area, making the proposed turbine site clearly visible from this road. Beyond the trees to the north and northwest are residential areas; to the west are college buildings and more residences beyond. Beyond the trees to the east are open fields; beyond the fields are large office complexes and associated vehicle parking.

The College and the proposed wind turbine site are at the southern edge of Cedar Rapids, with much of the surrounding area already developed or partially developed. The Wind Turbine Project area is also within the area designated as the Iowa City/Cedar Rapids Tech Corridor, with the Iowa City area representing the next largest community to the south. Large vertical structures already in the general area include two communications towers, two water towers, several cellular towers, billboards, and overhead utility towers within a mile of the proposed wind turbine site (H.R. Green 2010). This area, at the southern edge of Cedar Rapids, is not characterized with any specific scenic significance.

Shadow Flicker

Another potential visual impact associated with wind turbines is shadow flicker. Shadow flicker is defined as alternating changes in light intensity caused by a moving object (such as a rotating rotor blade) casting shadows on another object. Shadow flicker from wind turbines can occur when moving turbine blades pass in front of the sun, creating alternating changes in light intensity or shadows. These flickering shadows can cause an annoyance when cast on nearby "receptors," such as residences, schools, and hospitals. The spatial relationship between a wind turbine and a receptor, the location of trees, topography, buildings, and other obstacles, and weather characteristics such as wind speed/direction, and cloud cover, are key factors related to shadow flicker impacts. The effect is most pronounced when the sun is at a low angle and shadows are long.

The farther the observer is from the wind turbine, the smaller the portion of the sun being blocked, allowing the distance to diffuse (weaken) the shadow. Efforts to model shadow flicker are generally limited to an area within about 1,000 meters (3,280 feet) of wind turbines and many references set 10 rotor diameters as the distance beyond which shadow flicker is of little concern. In the case of the proposed Wind Turbine Project, the wind turbine being evaluated (the Clipper Liberty 2.5 MW CW99 turbine) has a rotor diameter of 99 meters (325 feet), so the impact area of primary concern would lie within about 990 meters (3,250 feet) of the proposed turbine site.

To model shadow flicker for the Wind Turbine Project, DOE considered only those areas where the wind turbine blade would block more than 20 percent of the sun disk, which is based on the premise that the smaller the portion of the sun blocked by the blade, the less intense the shadow. The distance from the wind turbine encompassed by the 20 percent criterion is about 4,000 feet. The 4,000-foot distance includes residential areas to the north and west, the commercial area to the east, and the college campus

facilities to the west and south. [Note: The criterion of considering areas where 20 percent or more of the sun would be blocked by the turbine blade was an option in the computer model used in the evaluation. Literature for the model indicated the criterion is based on a German guideline (EMD 2010). It was selected because it conservatively provided results for locations further away than the "ten rotor diameters" often used as an informal guideline in shadow flicker evaluations.]

Because of the strobe-like effect of shadow flicker, there have been investigations into whether it might have the potential to produce epileptic seizures in individuals with photosensitivity. It has been determined that modern utility-scale wind turbines do not have the potential to cause these types of problems because of their relatively slow blade rotation. One study (Harding et al. 2008) reported that flickers with a frequency greater than 3 hertz could pose a potential for inducing photosensitive seizures; that is, a light flashing at a rate of more than 3 times per second. The American Epilepsy Foundation reports that lights flashing in the range of 5 to 30 hertz are most likely to trigger seizures and recommends that flash rates of visual alarms be kept under 2 hertz (Epilepsy Foundation 2010). A wind turbine with three blades would have to make a full revolution every second (or 60 revolutions per minute) to reach a frequency of 3 hertz. The Clipper 2.5 MW CW99 wind turbine being evaluated for this Wind Turbine Project operates within the range of 9.6 to 15.5 revolutions per minute (Clipper 2010). This would put the flicker frequency created by this wind turbine at 0.48 to 0.78 hertz; well below rates identified with photosensitivity issues.

Health or safety concerns aside, shadow flicker is often considered annoying by those exposed. For example, in rooms with windows exposed to sunlight, the rotating blades could cause a shadow in the room every one to two seconds and during certain times of the year, this could go on for up to about an hour (but could occur only once per day). The closer the room to the wind turbine, the more intense the shadow (that is, the more contrast there is between the dark and light intervals). The level of annoyance this might cause is very subjective and would depend on the individual and the activity being performed. Depending on the options available and the level of annoyance, the exposed individual might choose to move to an unaffected portion of the building, close blinds or drapes to block the sunlight (and the shadows), or change the activity being performed. If no such options were available or if the level of annoyance was low, the exposed individual would likely continue with ongoing activities.

The locations where shadow flicker would occur are dependent on the relative positions of the sun and the wind turbine. Impacts depend on the position of observers relative to the line of sight to the sun through the turning rotor. Once a wind turbine location is set, the changing position of the sun by time of day and time of year can be used along with geometric relationships to determine the locations and duration of shadow flicker under ideal conditions for flicker generation. These ideal conditions (or worst-case conditions in terms of impacts) include no cloud cover or fog (that is, the sun is shining), a continuously rotating turbine, and constant wind direction from the wind turbine directly into or away from the sun (so the turbine rotor would be facing directly into or away from the sun). The opposite or contrary situation to this last condition would be if the wind was blowing at a 90-degree angle to the sun's relative position; for example, if the sun was in the western sky and the wind was blowing from the south. In this case, the sun would shine on the narrow side or silhouette of the rotor, and very little moving shadow would be generated.

3.3.2.2 Direct and Indirect Impacts

Visual Effects

Construction of the wind turbine would involve the presence of heavy equipment, construction workers and their vehicles, trucks delivering large pieces of equipment, dust and vehicle exhaust emissions, and, for a 1 to 2 week period, a crane to lift the wind turbine components. All of these items would be in contrast to the normal visual landscape of the site. However, these actions would be of relatively short

duration and would occur primarily in an area that is somewhat shielded from ground view in much of the surrounding area. The crane would be the exception and would be visible for some distance when in the upright position, as would the wind turbine components as they were erected. Because there would be only one wind turbine involved, the duration of construction would be relatively short (estimated at about 2 months), and the overall size of the construction effort would be relatively modest. Decommissioning would require the same types of activities as construction and, similarly, would be expected to have minimal visual effects (other than the change of eliminating the visual impact of the wind turbine).

Once construction was complete, the Wind Turbine Project would result in a tall, narrow structure on the outer boundary of Cedar Rapids. The College commissioned a Visual Impact Assessment to evaluate the effect of the wind turbine's appearance on the surrounding area. This assessment, included in Appendix D of this EA, involved the use of commercial software to simulate views of the wind turbine from various locations in the surrounding area. Based on the simulations, the wind turbine would be visible from most areas adjacent to the campus. From the south entrance to the campus, however, the view of the turbine would likely be obstructed from view by trees. From the southwestern edge of the campus, the wind turbine would be visible; however, much of the tower would be obstructed from view by a hill or ridge that runs through the center of the campus. The wind turbine would be clearly visible from U.S. Highway 30 that runs east to west to the north of the campus. The wind turbine would not be visible from Palisades/Kapler State Park, approximately 11 miles to the east, or from the Amana Colonies, approximately 20 miles to the southeast. Both of these areas are recognized for their scenic and cultural significance.

The wind turbine would have pilot warning and obstruction avoidance lighting, but as identified in Section 3.3.5 of this EA, the College would use the minimum amount of FAA-required lighting to minimize the risk of birds and bats being attracted to the lights. There would be a single, dual-system light located atop the nacelle (the housing for the wind turbine's mechanical and electronic components at the top of the tower). The dual system would consist of a flashing white light of medium intensity during daytime and twilight, and a red flashing beacon during nighttime. The FAA Advisory Circular that provides the applicable lighting guidelines describes avoiding use of the flashing white light during nighttime as a measure that reduces environmental concerns (FAA 2007). The lights would be similar to those normally found on communication towers and, as a result, are familiar to most people. People generally would not find the lights to be intrusive when inside their residences or other buildings, or during outdoor activities.

Although the wind turbine would be a prominent feature in the landscape and one of the tallest structures in Cedar Rapids, the College has concluded that the presence of the wind turbine would be consistent with future development in the Iowa City/Cedar Rapids Tech Corridor and would provide a visual landmark for identifying the campus' location and that of surrounding areas of interest. A single wind turbine located within the campus would result in minimal impacts to the area's visual resources.

Shadow Flicker

The College commissioned a shadow flicker analysis to evaluate the impacts of the proposed Wind Turbine Project (Appendix D). The study used WindPro software to calculate the daily duration of shadow flicker during a year under ideal conditions in areas surrounding the proposed turbine. These ideal conditions, as described in Section 3.3.2.1, are those that would generate the longest duration of flicker. The study then incorporated representative meteorological data consisting of average values for monthly distribution of wind direction and for days per month of cloud cover. These were used to produce values by month and location for reducing shadow flicker due to (1) cloud cover, (2) the wind blowing from the wrong direction to cause shadow flicker at a location, and (3) the wind turbine operating less than 100 percent of the time (assuming an average operational rate of 80 percent, based on the wind characteristics of the area). The applicable reduction values were applied to the maximum possible shadow flicker values

based on the specific months (in the case of cloud cover and wind direction) the shadow flicker would occur at a specific location. Results of this effort are summarized in the shadow flicker contour map shown in Figure 3-1 (taken from the shadow flicker analysis report) in which the contours represent the expected number of hours per year the area would be exposed to shadow flicker. As can be seen in the figure, the contours extend predominantly east to west in response to the movement of the sun. The butterfly shape is caused by changes in the relative position of the sun during the year. Figure 3-1 also shows the locations, labeled A through L, of specific receptors, primarily residences, that were selected as possible worse-case receptors because they are representative of residences closest to the proposed wind turbine site. The model estimated shadow flicker durations for each of these receptors in addition to the general contour lines. Table 3-1 provides a summary of the maximum (potential) hours of shadow flicker that could be experienced at the residences with no reduction factors. The table also shows the reduction values applied to each of the maximum shadow flicker values and the results. The reductions are shown in three steps: 1) cloud cover, 2) wind direction attributed to meteorological conditions and 3) the average percentage of time the wind turbine would be operating. The estimated 20 percent for non-operational time includes downtime for maintenance as well as periods when wind would be too low or too high for the wind turbine to operate. Information in the table is presented in detail that includes the months in which the shadow flicker could occur at each site. As can be seen in the table, the cloud cover reduction varies by month; the wind direction reduction is based on an annual wind rose, so it does not vary by month, but does vary by location.

Also shown in Table 3-1, the residential locations that could be affected the most by shadow flicker could potentially experience as many as 65 to 70 hours of flickering over the course of a year. During the times of the year it could occur (that is, when the receptor location was lined up with the wind turbine and the sun), a specific location could be exposed to flickering events that could last just a couple of minutes per day to events that could last about an hour a day. It would occur in the mornings for the receptors on the west side of the wind turbine and in the evenings for receptors to the east. Appendix D of this EA identifies the times and days of the year that flickering could occur for each of the evaluated locations.

Although the maximum hours of shadow flicker exposure are considered possible, they would require a specific alignment of several variables to occur every time the sun and the wind turbine were in the right relative position. Given the natural variability of wind speed and direction and the distribution of cloudy days, it is unlikely that the maximum hours would be reached. Based on the reductions calculated in the shadow flicker study and summarized in Table 3-1, it is more likely that as a result of the variable meteorological conditions, the highest exposure of shadow flicker would occur to residences in the area of locations D and G (Figure 3-1 and Table 3-1) and those exposures would be in the range of 14 to 20 hours per year. Given the reduction factors were generated from averages of weather data, actual shadow flicker could vary from year to year, but over multiple years, average exposures would be expected to be consistent with the reduced values. DOE's evaluation of the potential effects of shadow flicker is based on the expected, reduced exposure values.

As described in Section 3.3.1, the City of Cedar Rapids has amended its zoning ordinance to address wind energy conservation systems (Ordinance No. 007-11, Chapter 32). The amendment includes a requirement for shadow flicker, which reads, "The shadow flicker from a Large Wind Energy Conservation System may not exceed 30 hours per year on a residential property." It is clear that the intent of the ordinance is to limit the amount of shadow flicker exposure to residences. Results of the shadow flicker analysis indicated that the proposed College Wind Turbine Project would be in compliance with the most recent version of the Cedar Rapids ordinance.

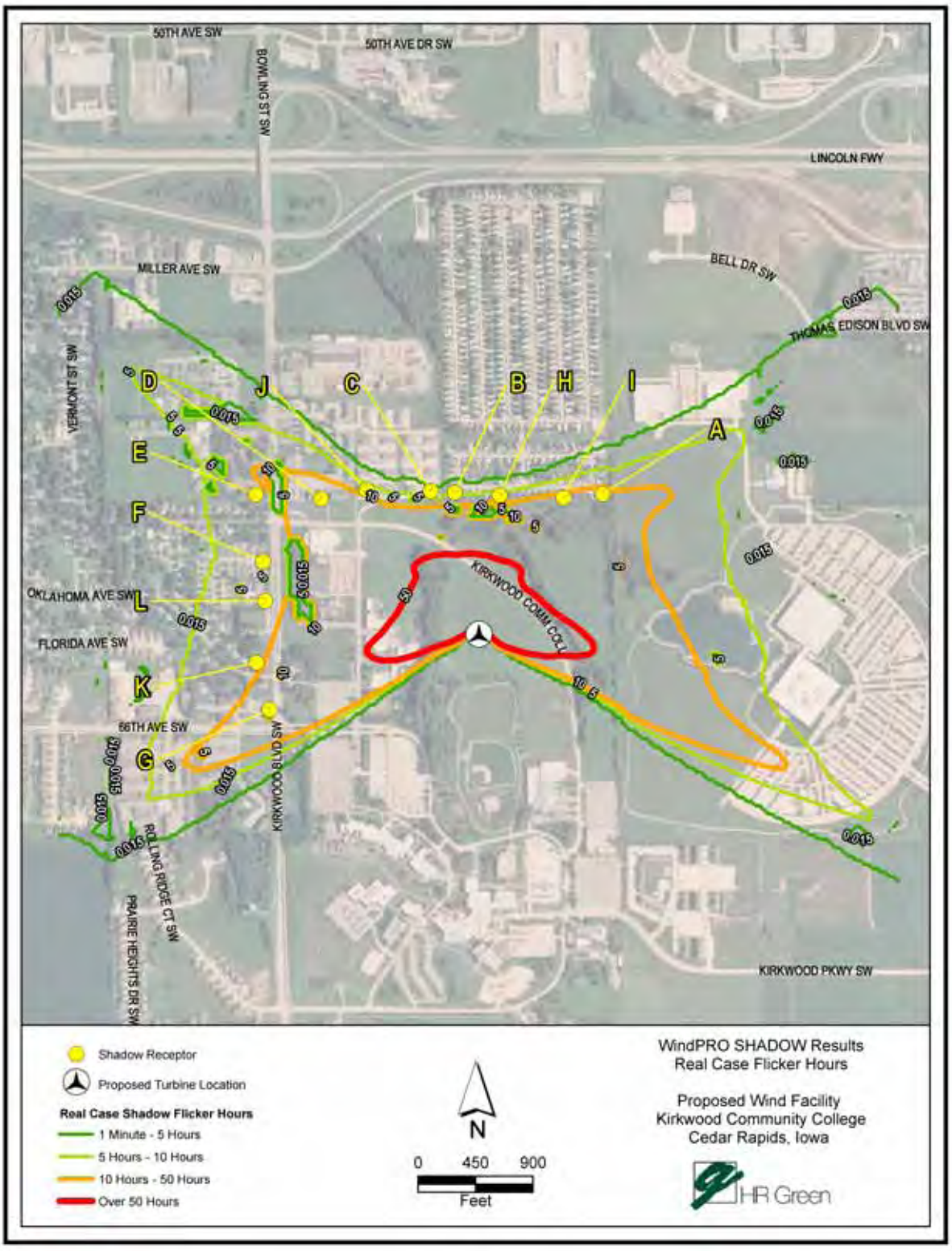

Figure 3-1. Shadow Flicker Contour Map [showing "real case" (anticipated) shadow flicker exposure contours labeled in hours per year. Specific locations (A through L) are labeled with both maximum and real case exposures.]

Table 3-1. Maximum and Expected Duration of Shadow Flicker

Receptor Location	Months of Occurrence	Maximum Shadow Flicker (hours)[a]	Reductions for Expected Conditions (percent)			Reduced Shadow Flicker (hours)[b]
			Cloud Cover	Wind Direction	Percent Operating	
A	January	24.6	47	55	80	5.0
	February	0.4	50	55	80	0.1
	November	15.1	37	55	80	2.4
	December	28.3	35	55	80	4.3
Yearly Total		**68.4**				**11.8**
B	January	4.1	47	69	80	1.0
	December	18.0	35	69	80	3.4
Yearly Total		**22.1**				**4.4**
C	January	0.1	47	70	80	0.0
	December	7.3	35	70	80	1.4
Yearly Total		**7.4**				**1.4**
D	January	23.5	47	71	80	6.1
	February	1.1	50	71	80	0.3
	November	15.6	37	71	80	3.3
	December	25.2	35	71	80	4.9
Yearly Total		**65.4**				**14.6**
E	January	11.5	47	70	80	3.0
	February	6.5	50	70	80	1.8
	October	0.9	49	70	80	0.3
	November	16.4	37	70	80	3.4
	December	0.7	35	70	80	0.1
Yearly Total		**36.0**				**8.6**
F	February	5.8	50	65	80	1.5
	March	9.2	50	65	80	2.4
	September	1.3	58	65	80	0.4
	October	14.0	49	65	80	3.6
Yearly Total		**30.3**				**7.9**
G	April	0.4	53	57	80	0.1
	May	21.2	59	57	80	5.7
	June	17.9	64	57	80	5.2
	July	21.9	65	57	80	6.5
	August	7.2	61	57	80	2.0
Yearly Total		**68.6**				**19.5**
H	January	8.5	47	63	80	2.0
	November	0.9	37	63	80	0.2
	December	24.9	35	63	80	4.3
Yearly Total		**34.3**				**6.5**
I	January	22.4	47	58	80	4.8
	November	11.6	37	58	80	2.0
	December	31.4	35	58	80	5.0
Yearly Total		**65.4**				**11.8**
J	January	9.5	47	72	80	2.5
	November	2.2	37	72	80	0.5
	December	22.7	35	72	80	4.5
Yearly Total		**34.4**				**7.5**
K	April	16.3	53	60	80	4.1
	May	1.4	59	60	80	0.4
	August	14.2	61	60	80	4.2
	September	3.7	58	60	80	1.0
Yearly Total		**35.6**				**9.7**
L	March	14.3	50	64	80	3.6
	April	1.5	53	64	80	0.4
	September	14.1	58	64	80	4.1
	October	2.0	47	64	80	0.5
Yearly Total		**31.9**				**8.6**

Table 3-1. Maximum Hours of Shadow Flicker (continued)

Receptor Location	Months of Occurrence	Maximum Shadow Flicker (hours)[a]	Reductions for Expected Conditions			Reduced Shadow Flicker (hours)[b]
			Cloud Cover	Wind Direction	Percent Operating	

Note: Maximum hours that could be experienced annually at nearby residences and the reduced hours when meteorological conditions and non-operational times are considered

a. These are the maximum values under ideal conditions for shadow flicker generation. These ideal conditions include no clouds; the wind turbine operating at all times; the wind direction being along the line formed by the sun, the turbine, and the receptor; and no obstacles between the wind turbine and receptor that would block sunlight.

b. Due to rounding of the reduction factors, monthly values shown here may differ slightly from those that would be calculated using the table's reduction factors. Values here are taken from the Shadow Flicker Assessment report in Appendix D.

Considering only the impacts to the human environment from exposure to shadow flicker, there are no firm criteria on what is acceptable or unacceptable. As noted previously there are no specific, identified health impacts associated with the exposures. The level of annoyance is very subjective and depends on how the exposed portion of the facility is being used, and on the individual observer. If an individual is annoyed by the phenomenon, a solution can be as simple as temporarily moving to an unaffected portion of the facility, hanging drapes or blinds, or planting screening vegetation. It is recognized, however, that such solutions may not always be available or practical and, in some cases, feeling the need to implement a solution just adds to the annoyance. There are some guidelines or reference points on what some might term acceptable levels of exposure to shadow flicker occurrences. The Danish Wind Industry Association identifies a court case in Germany in which a judge set 30 hours of actual shadow flicker per year as a tolerable level (DWIA 2003). The National Wind Coordinating Committee, a collaboration of U.S. industry and government groups, identifies shadow flicker of 20 to 30 hours per year as the threshold for concern (NWCC 2006). Based on this information, all of the residential locations in the vicinity of the proposed wind turbine would be expected to have average exposure levels deemed tolerable by the German court and considering just the meteorological reductions, would be at or below the threshold of possible concern based on National Wind Coordinating Committee criteria.

The map (Figure 3-1) from the shadow flicker study shows that some roads near the proposed wind turbine site would also be subjected to shadow flicker. The highest amounts, expected to be more than 50 hours per year, would be along Kirkwood North Loop Road, which borders the wind turbine site to the north, northeast, and east (but which includes no residences in proximity to the wind turbine site). Kirkwood Boulevard, running north-to-south to the west of the wind turbine site, would also experience some shadow flicker, possibly in the range of 10 to 20 hours per year. Drivers passing through these road segments during a shadow flicker event would have an experience comparable to driving late or early in the day while sunlight flickers through nearby trees, vegetation, or other tall structures; that is, conditions experienced often by most drivers. Although the roads would be subjected to shadow flicker events, individuals would be moving through the area and would be exposed to only short durations of the phenomenon.

A single wind turbine operating on the College campus in Cedar Rapids, Iowa would not be expected to generate shadow flicker impacts beyond which most guidelines define as acceptable. It is recognized, however, that some individuals might find any exposure to shadow flicker unacceptable and in such cases, those individual could be adversely affected, but there is no evidence to date that such individuals would be harmed by the low duration exposures expected in this case.

3.3.3 NOISE

Sound is a result of fluctuating air pressure. The standard unit for measuring sound pressure levels is the decibel. A decibel is a unit that describes the amplitude (or difference between extremes) of sound equal to 20 times the logarithm to the base 10 of the ratio of the measured pressure to the reference pressure,

which is 20 micropascals. Typically, environmental and occupational sound pressure levels are measured in decibels on an A-weighted scale (dBA). The A-weighted scale deemphasizes very low and very high frequency components of sound in a manner similar to the frequency response of the human ear. Using the A-weighting filter adjusts certain frequency ranges (those that humans detect poorly) (Colby et al. 2009). Typical indoor and outdoor sound levels are shown in Table 3-2.

Table 3-2. Common Outdoor and Indoor Sound Sources and Typical Associated Sound Levels (dBA)

Common Outdoor Sound Levels	dB(A)	Common Indoor Sound Levels
		Rock Band
Jet flyover at 1,000 ft	110	
	100	Inside Subway Train (New York)
Gas Lawnmower at 3 ft		
Diesel Truck at 50 ft	90	
Noisy Urban Daytime		Food blender at 3 ft Garbage Disposal at 3 ft
	80	Very loud Speech at 3 ft
Gas Lawnmower at 100 ft		
	70	
Commercial Area Heavy Traffic at 300 ft		Normal Speech at 3 ft
	60	Large Business Office Quiet Speech at 3 ft Dishwasher Next Room
	50	Small Theater, Large Conference Room (Background)
Quiet Urban Nighttime		
	40	
Quiet Suburban Nighttime		Library
	30	Bedroom at Night Concert Hall (Background)
Quiet Rural Nighttime		
	20	Broadcast and Recording Studio
	10	
	0	Threshold of Hearing

Noise is any unwanted, undesirable sound. It has the potential to interfere with communication, damage hearing, and, in most cases, is viewed as an annoyance. Noise can occur in different volumes and pitches depending on the type of source and distance from the source. It is important to consider the amount of noise that would be created during both the installation and operation phases of the proposed project to avoid inconveniencing people working or living in the surrounding areas (HUD 2009).

The U.S. Environmental Protection Agency (EPA) identifies noise levels necessary to protect public health and welfare against hearing loss, annoyance, and activity interference in its document, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA 1974). These noise levels are in terms of an average "24-hour exposure" and over long periods of time such as years. A cumulative 24-hour measure of noise accounts for the moment-to-moment fluctuations in A-weighted decibel levels due to all sound sources during 24 hours, combined.

A 24-hour exposure level of 70 dBA is indicated by EPA as the maximum level of environmental noise at which any measurable hearing loss over a lifetime may be prevented, and levels of 55 dBA or less outdoors and 45 dBA or less indoors are defined as preventing activity interference and annoyance to human receptors. For noise-sensitive areas such as where people sleep, EPA considered Day Night Average Sound Level (DNL) values. The DNL values represent energy averages over a 24-hour period, but a 10-decibel penalty is added to sounds that occur between 10 p.m. and 7 a.m. Accordingly, in residential areas, for example, EPA's guidelines for sound levels to avoid activity interference and annoyance are DNL levels of 55 dBA outdoors and 45 dBA indoors. At those levels (or less), spoken conversation and other daily activities such as sleeping, working and recreation, can occur without interference.

In 1981, the Federal government concluded that noise issues were best handled at the State or local government level. As a result, the EPA phased out Federal oversight of noise issues to transfer the primary responsibility of regulating noise to State and local governments. The EPA has an existing design goal of a DNL less than or equal to 65 dBA and a future design goal DNL of 55 dBA for exterior sound levels (EPA 1977). It is important to note that the EPA noise guidelines are design goals and not enforceable regulations. However, these guidelines and design goals are useful tools for assessing the affected environment.

3.3.3.1 Affected Environment

The Cedar Rapids noise regulations are set forth in the Cedar Rapids, Iowa, Code of Ordinances, Chapter 56, "Motor Vehicle Noise and Noise Limits from Certain Sound Sources." An ordinance amendment (Ordinance No. 032-10) to Chapter 32, Zoning, of the Cedar Rapids Code of Ordinances specifically addresses wind energy conservation systems. Although the Chapter 56 ordinance does not identify wind turbines as a regulated sound source, an amendment to Chapter 32, which added Subsection 32.04.030.A.46, stipulates that "sound produced by the turbine under normal operating conditions, as measured at the property line, shall comply with the decibel limits set forth in Chapter 56 of the Municipal Code." The applicable Cedar Rapids noise regulations are shown in Table 3-3. The regulations set maximum permissible sound levels from sources (noise generators) as measured at the boundary of the receiving property and, as shown in the table, the maximum sound levels vary depending on the nature of the receiving property's use. In the case of residential areas, the allowable sound levels also vary by time of day. Unlike the EPA noise guidelines, the Cedar Rapids noise regulations are enforceable.

Table 3-3. Maximum Permissible Sound Levels from Limited Sources by Receiving Land Use

Zoning Category of Receiving Land Use	Sound Level Limit (dBA) – At Boundary of Receiving Property
Resident District	
Daytime – 7 a.m. to 10 p.m.	60
Nighttime – 10 p.m. to 7 a.m.	50
Commercial District (at all times)	65
Industrial District (at all times)	75

Source: Cedar Rapids, Iowa, Code of Ordinances, Chapter 56, Motor Vehicle Noise and Noise Limits from Certain Sound Sources

The proposed location for the wind turbine is within a large grassy area on the College campus. The closest facilities to the site are the college buildings directly to the west. The closest off-campus buildings are the residential areas (homes and apartments) to the north. There is a commercial land use area to the east, residential areas to the southeast, and additional campus facilities to the south and southwest. However, these areas are farther from the proposed wind turbine site than the campus buildings and residential areas to the west and north, respectively. If the City's noise standards are met at the closer areas, they would be met at the more distant properties.

Considering the sound level limits in Table 3-3, those set for residential districts would clearly apply to the off-campus areas to the north. Application of sound limits to the campus facilities, however, is not as clear cut. According to the Cedar Rapids Comprehensive Plan (Cedar Rapids 1999), schools fit into an "Institutional/Public" land use category and are appropriate to be located within other land use categories. The implication is that although there is no "Institutional/Public" land use category in Table 3-3, it may be appropriate to apply the sound limit for the predominant surrounding land use, which is residential in this case. The evaluation in this EA assumes, as a matter of conservatism, that the daytime sound limit for residential areas of 60 dBA is applicable to the school facilities and, because the nearest school facilities do not include buildings where people would sleep, the lower nighttime sound limit does not apply. Figure 3-2 identifies the school facilities closest to the proposed wind turbine site, and there are no dormitories on the College campus (KCC 2011).

Existing Conditions

The College commissioned an ambient noise survey to measure baseline sound conditions in the area of the proposed wind turbine and to evaluate the impacts of the wind turbine's operation. This section includes a summary of the applicable findings; the survey report is included in Appendix C. To determine baseline conditions, three sound monitoring sites were selected (Figure 3-2) as representative of the residential receptor areas that would be the closest to the wind turbine.

Sound-measuring equipment was operated concurrently at the three sites to measure 24-hour sound levels from late afternoon on December 9, 2010, to late afternoon on December 10, 2010. There were equipment problems at two of the monitoring locations and, as a result, the intended 24 hours of monitoring data were not collected at those locations. The sound-measuring equipment at location #3 (outside the Kirkwood Kids Daycare facility) experienced a battery problem and shut down after collecting about 5 hours of data, ending at 10:18 p.m. At location #1 (outside a residence in the Kirkwood Estates trailer park), the equipment recorded 18 hours of usable data before experiencing a localized noise anomaly, which corrupted the remaining data after 11:30 a.m. No problems were experienced at location #2

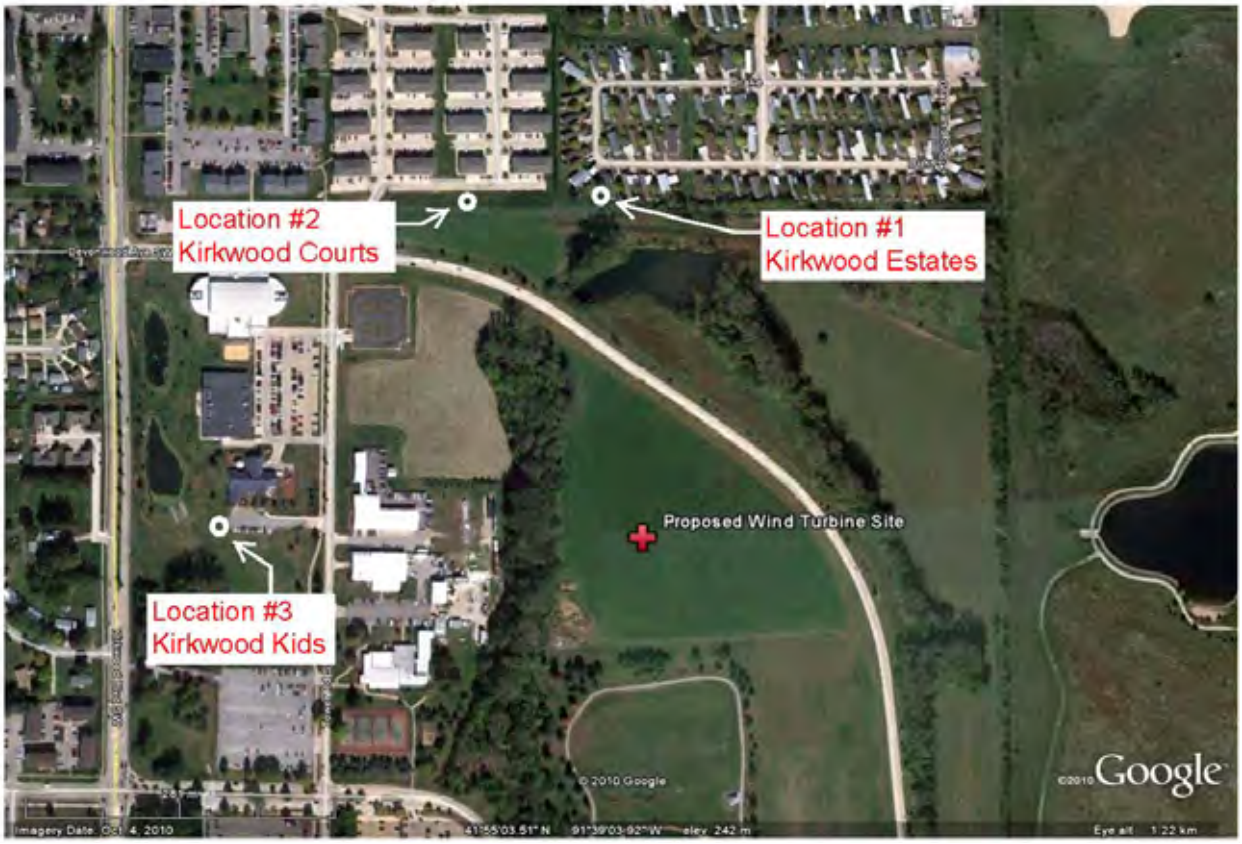

Figure 3-2. Monitoring Sites for Measuring Baseline Sound Conditions

(outside the Kirkwood Courts apartment complex) and a full 24 hours of data were obtained. Table 3-4 provides a summary of the baseline sound monitoring results. Values shown in the table were taken or derived from the raw data collected during the monitoring effort (McCaslin 2010). The survey report in Appendix C provides additional information on the ambient noise monitoring effort, including graphs of measured sound levels over the entire monitoring period at each location.

Table 3-4. Summary of Baseline Sound Monitoring Results (in dBA)

Monitoring Location	Distance to Turbine Site (feet)	Hours of Data	L_{eq}	L_{min}	L_{max}	L_{50}	L_{90}
#1	1,000	18	69.3 (61.0)[a]	47.5	98.7	56.3	53.2
#2	1,100	24	63.1	47.2	84.5	57.9	54.1
#3	1,300	5	61.2	53.4	77.1	57.9	55.4

a. The value in parentheses represents the L_{eq} at location #1 without the two highest measurements of 98.7 and 86.7 dBA. The next highest measured value was 75.8 dBA. The two high values are outliers compared to the almost 1,100 data points collected and are not representative of ambient noise conditions. Leaving them in the equivalent sound level calculation results in an unrealistically high number.

L_{eq} = Equivalent A-weighted sound level over the given time interval. This is a single number that, if continuous during a specific period, would contain the same total energy as the actual time-varying sound. The L_{eq} is the energy-averaged sound level over the applicable time interval.

L_{min} = Minimum sound level (in dBA).

L_{max} = Maximum sound level (in dBA).

L_{50} = The sound level (in dBA) that is exceeded 50 percent of the time, frequently used as a measure of the median sound level.

L_{90} = The sound level (in dBA) that is exceeded 90 percent of the time, frequently used as a measure of ambient sound levels.

Although location #1 had the highest measured sound levels, unusually high sound levels were limited to only two measurements (a sound measurement was collected every minute of the monitoring period). As noted in the footnote to Table 3-4, it is reasonable to discard those two measurements as outliers in the calculation of the equivalent sound level. It was not necessary to remove those values from the calculation of L_{50} and L_{90}, as these designations are not affected by the magnitude of the outliers.

3.3.3.2 Direct and Indirect Impacts

Sound Levels Associated with the Proposed Wind Turbine Project

Noise produced during Wind Turbine Project construction (estimate to last about 2 months) would be a result of heavy equipment operating at the site. Sound levels from typical construction equipment (for example, bulldozers, rollers, or other heavy equipment with diesel engines and limited movement) are generally in the 80 to 90 dBA range at a distance of 50 feet (EPA 1974). Assuming two of the noisiest pieces of equipment were operating at the same time and that sound intensity decreases over distance as a result of geometric spreading of the sound levels (resulting in a decrease of about 6 decibels per doubling of the distance from the source), it is estimated that sound levels (occurring only during the daytime) would exceed the EPA guideline for a residential DNL of 55 dBA (EPA 1974) at locations within about 2,200 feet. Construction sound levels are compared with EPA guidelines because the City's noise ordinance (Table 3-3) is not applicable to construction activities. The private residences to the north, northwest, and west of the proposed wind turbine site are within this distance. Sound attenuation factors such as air absorption and ground effects from terrain and vegetation would decrease sound levels at those residences. Noise levels experienced at the residences would be similar to those of a normal office and from conversations (Table 3-2). In addition, the sounds would be relatively short term and would occur only during the daytime when they would be less likely to interfere with sound-sensitive activities such as sleeping. Thus, construction of the wind turbine would have minor noise impacts on nearby residents.

Noise produced during decommissioning of the wind turbine would be expected to be similar to, if not less than, that generated during construction. That is, with appropriate control of nighttime activities, noise impacts would be minor.

Operating wind turbines generate two types of sound: mechanical sound from components such as gearboxes, generators, yaw drives, and cooling fans, and aerodynamic sound from the flow of air over and past the rotor blades. Modern wind turbine design has greatly reduced mechanical sound and it generally can be ignored in comparison to aerodynamic sound, which is often described as a "swishing" or "whooshing" sound (BLM 2005b). The Clipper Liberty 2.5 MW CW99 has a hub height of 80 meters (262 feet), and rotor diameter of 99 meters (325 feet), and has several characteristics that reduce aerodynamic sound levels in comparison to older wind turbine designs. It is an upwind turbine, meaning the turbine faces into the wind and the wind encounters the rotor blades before the tower and the nacelle, making for quieter operations than a downwind turbine. It has relatively low rotational speeds and pitch control on the rotors, both of which reduce sound levels. The Clipper 2.5 MW wind turbine is also a variable speed design, which is quieter than a fixed speed turbine because it can operate at slower speeds in low winds, resulting in a quieter operation in low winds (BLM 2005a).

As described in Appendix C, the Clipper Liberty 2.5 MW CW99 wind turbine has a maximum sound power level of 107 decibels. This sound level is characterized as being plus or minus 2 decibels, which is typical of these reported values for wind turbines and is indicative of the accuracy of the measuring technique. The maximum sound level occurs at a wind speed of 18 miles per hour. The Clipper 2.5 MW wind turbine has a cut-in wind speed of about 8.9 miles per hour and a cut-out wind speed of 56 miles per hour. The wind turbine makes less noise at wind speeds lower than 18 miles per hour, and the noise levels do not increase at the higher wind speeds. The maximum sound level was used throughout this evaluation for the sake of conservatism. It should be noted that the College is also considering a General Electric 2.5-

megawatt wind turbine for the Wind Turbine Project. The General Electric wind turbine has a maximum sound power level of 105 dBA (GE 2009), very similar to the Clipper wind turbine after adjustments are made for the A-weighted scale.

WindPro, a standard sound propagation model, was used to estimate the distance at which specified sound levels would occur, and to calculate sound levels at nearby residential areas that would result from operation of the wind turbine at a wind speed of 18 miles per hour (Figure 3-3). The small circles (identified with letters A through F) in Figure 3-3 are the representative locations of nearby residential areas for which sound levels were calculated.

Figure 3-3. Predicted Noise Map with Rings Labeled (in dBA) [for the Clipper Liberty 2.5 MW CW99 Wind Turbine at Maximum Sound Levels]

Sound levels of 50 dBA [equivalent to quiet speech (Table 3-2)] or higher, would occur within 800 feet of the proposed wind turbine, and sound levels would diminish to 40 dBA or less by 2,300 feet (Figure 3-3). This is consistent with other wind turbines, the sound from which generally is between 40 to 50 dBA at 1,000 to 2,000 feet (Colby et al. 2009).

Predicted sound levels at nearby residences range from about 43 to 47 dBA, which is less than the applicable nighttime regulatory standard of 50 dBA specified in the Cedar Rapids Code of Ordinances (Table 3-5). Thus, operation of the wind turbine would comply with the local noise ordinance for residential areas.

Within the campus, a few of the buildings directly to the west of the proposed wind turbine site would experience sound levels of 50 to 55 dBA (Figure 3-3). This is less than the most conservative daytime standard of 60 dBA in the City codes (nighttime standards would not apply to these buildings as they are

not residential facilities). Thus, college activities at these and at more distant facilities would not be adversely affected by noise generated by the wind turbine.

Table 3-5. Predicted and Existing Wind Turbine Sound Levels at Nearby Residences

Location	Distance to Wind Turbine Site (feet)	Predicted Sound Level of Wind Turbine (dBA)	Existing Sound Levels at Nearest Monitoring Site (dBA)	
			Minimum (L_{min})	Ambient (L_{90})
A	1,040	47.2	47.5	53.2
B	1,080	46.9	47.2	54.1
C	2,220	40.2	47.2	54.1
D	1,670	43.0	53.4	55.4
E	1,690	43.0	53.4	55.4
F	1,680	42.9	53.4	55.4
Applicable Standard		**50**		

Note: In the sound assessment of Appendix C, locations A through F are shown as large areas representing housing areas or apartment complexes. In this table and in Figure 3-3, the locations are shown as individual receptor locations that are based on the coordinates identified in Appendix C that correspond to the apparent worst-case locations that were evaluated in areas A through F. In Appendix C, the areas associated with the letters are identified as follows:

A. Kirkwood Estates (trailer park)
B. Kirkwood Courts (apartments)
C. Apartments
D. Single Family Homes
E. Apartments
F. Multi-family Homes

Compliance with local noise standards would ensure that individuals would not be harmed by sound levels generated by the proposed wind turbine, and that routine sound-sensitive activities would not be hindered. However, it is recognized that some individuals are more sensitive to sounds than others, so DOE also compared sound levels at residential areas from the proposed wind turbine with ambient sound conditions in the area. As shown in Table 3-5, predicted sound levels from the wind turbine would be below the sound level recorded 90 percent of the time (L_{90}, which is frequently used as a measure of ambient sound levels) at the monitoring sites nearest to those residential areas. Thus, noise generated by the wind turbine, even at the loudest operating condition, would generally be below ambient sound levels in nearby residential areas and would be inaudible to individuals in those areas, even when outdoors. It can also be seen in Table 3-5 that the predicted wind turbine sound level would be at least 6 decibels lower than the comparable ambient sound level. Because decibels are based on a logarithmic scale, combining sounds with this great a difference adds very little (1 decibel or less) to the higher value (that is, the ambient noise levels). However, DOE recognizes that the monitoring effort to characterize existing sound levels was of limited duration and that different, slightly lower sound levels may occur at times. DOE also recognizes that wind turbine sounds can be relatively constant for long periods, during which ambient sound levels can fluctuate substantially and might drop below those of the wind turbine. Under those conditions, individuals outdoors would be able to hear the wind turbine. Further, some individuals are sensitive to the differences between the constant sound of a wind turbine and fluctuating sounds from other sources, even when the ambient and wind turbine sound levels are similar, and can distinguish wind turbine sounds from other sources. In summary, sounds that would be produced by the wind turbine would meet local standards, generally would be below ambient sound levels in the area, would not adversely affect sound sensitive activities in the nearest residences, and would not adversely affect residents other than, possibly, those most sensitive to the sounds of a wind turbine.

Low-Frequency Sounds

Wind turbines produce a broadband sound; that is, the sound occurs over a wide range of frequencies, including low frequencies. This EA briefly addresses low-frequency sounds because groups and individuals claim that such sounds cause numerous maladies in some people close to operating turbines.

The information on low frequency sounds is not presented in separate "affected environment" and "impacts" topics because it is a side issue with no impacts to the environment, but with recognized opposing viewpoints.

Low-frequency sounds are in the range of 20 to 100 hertz and infrasonic sound (or infrasound) is low-frequency sound of less than 20 hertz. Compared to higher frequency sound, low-frequency sound propagates over longer distances, is transmitted through buildings more readily, and can excite structural vibrations (for example, rattling windows or doors). The threshold of perception, in decibels, also increases as the frequency decreases. For example, in the frequency range where humans hear best (in the low kilohertz), the threshold of hearing is at about 0 decibel, but at a frequency of only 10 hertz, the threshold of hearing is at about 100 decibels (Rogers 2006).

Older designs of wind turbines, particularly those in which the blades were on the downwind side of the turbine tower, produced more low-frequency sound as a result of the blades passing through more turbulent air from the tower blocking wind flow. Modern, upwind turbines produce a broadband sound emission that includes low-frequency sounds, but not at levels that are audible once the receptor is away from the wind turbine. A primary cause for low-frequency sounds in modern turbines is the blade passing through the change in airflow at the front of the tower, which can be aggravated by unusually turbulent wind conditions. The University of Massachusetts at Amherst reported on broadband noise measurements made at four different wind turbines ranging in size from 450 kilowatts to 2 megawatts (Rogers 2006). The results indicated that at distances of no more than 387 feet from the turbines, all infrasound levels were below human perception levels. The proposed wind turbine at the College, at 2.5 megawatts, is larger than those evaluated in the University of Massachusetts study and, as a result, the distance at which all infrasound would be inaudible might extend farther than 387 feet. However, considering the infrasound audibility limit in the study increased from 328 for a 1.3-megawatt turbine to 387 feet for a 2.0-megawatt turbine, infrasound from the 2.5-megawatt turbine would not be expected to be at human perception levels beyond about 450 feet.

The University of Massachusetts at Amherst report further states that there is "no reliable evidence that infrasound below the hearing threshold produces physiological or psychological effects" (Rogers 2006). This lack of effects at levels below the hearing threshold was supported by a scientific advisory panel composed of medical doctors, audiologists, and acoustic professionals established by the American and Canadian Wind Energy Associations to review wind turbine sound and health effects (Colby et al. 2009). It was also supported by the findings from Canadian and Australian government reviews of available scientific literature (CMOH 2010; Australia NHMRC 2010).

Conclusion

DOE recognizes there are sound issues associated with the operation of wind turbines. Modeling and data collected for the Wind Turbine Project indicate expected wind turbine sounds would meet applicable City of Cedar Rapids' standards; generally would be less than ambient conditions; and would not be audible to most individuals. The predicted sound levels would be consistent with the residential and educational uses of the area, achieving EPA's recommendation of DNL levels of 55 dBA or less outdoors. With a normal 15-dBA reduction in sound level between indoors and outdoors (with partially open windows), predicted sound levels would easily be below the recommended level of 45 dBA indoors and even at the closest residences would be at or near an indoor nighttime noise level of about 30 dBA, which is a sound level generally recommended for sleep and consistent with World Health Organization guidelines (WHO 1999). For example, the wind turbine would generate sound levels of about 45 dBA at the closest residences (Table 3-5); with the 15-dBA reduction in sound level going from outdoors to indoors, indoor sounds from the wind turbine would be about 30 dBA. Noise generated from the wind turbine would result in no or minor adverse impacts.

3.3.4 CULTURAL RESOURCES AND HISTORIC PRESERVATION

3.3.4.1 Affected Environment

Regulatory Background

Cultural resources are archaeological sites, historical structures and objects, and traditional cultural properties. Historic properties are cultural resources that are listed in or eligible for listing in the National Register of Historic Places (NRHP) because they are significant and retain integrity (36 CFR 60.4). Section 106 of the *National Historic Preservation Act* (16 U.S.C. 470 *et seq.*) requires that Federal agencies take into account the effects of their actions on historic properties. Section 101(b)(4) of NEPA requires Federal agencies to coordinate and plan their actions to identify any unique historic or cultural characteristics of the geographic area (40 CFR 1508.27) of the proposed Wind Turbine Project and act accordingly. The first step of the process is for an agency to determine whether an action is an undertaking [36 CFR 800.3(a)]. The proposed Wind Turbine Project is an "undertaking" because it is "a project, activity, or program funding in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval" [36 CFR 800.16(y)].

The regulations at 36 CFR Part 800, "Protection of Historic Properties" describe the process for compliance with Section 106, including defining the area of potential effect (APE), steps to identify resources, evaluate effects, and consultation with interested parties including the SHPO and other concerned parties. The regulations state, "If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties are present, the agency official has no further obligations under Section 106, or this part" [36 CFR 800.3(a)(1)]. By definition, an "effect" is an "alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register" [36 CFR 800.16(i)].

The following section describes the existing historic and cultural resource conditions in the area of the proposed Wind Turbine Project site. The APE considered for evaluation of direct impacts to cultural resources during construction of the wind turbine consists of a 250-foot radius around the proposed turbine location and associated access road and buried utility lines (Figure 2-4), which is the area that could be disturbed by construction activities. The APE is a 4.5-acre parcel entirely within previously disturbed and maintained grass fields. In addition, a 1-mile radius APE was considered to evaluate indirect impacts such as visual and noise intrusion on nearby historic properties (Figure 2-2).

According to regulations on the protection of historic properties [36 CFR 800.5(a)(2)(v)], an adverse effect can include "introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features." A project can have adverse visual effects by involving either a negative aesthetic or obstructive effect on historic properties. An obstructive effect is one that diminishes the historic property's integrity by blocking the property from view or by blocking the view from the property.

Status of Consultations

On August 2, 2010, a request was sent to the University of Iowa, Office of the State Archaeologist requesting a site records search within the APEs for direct and indirect effects. That record search indicated that no historic properties or archaeological sites were located within the APE for direct effects. However, the review did indicate the presence of three properties within 1 mile of the turbine site, consisting of two historic farms and a prehistoric scatter (Appendix B). The sites were either ineligible for listing on the NRHP or were not evaluated (Cedar Rapids 2010b). The State Archaeologist recommended

that the Iowa SHPO be contacted for additional input regarding cultural resource management associated with the proposed Wind Turbine Project.

On August 9, 2010, a request for SHPO Comment on the Wind Turbine Project was transmitted to the Iowa SHPO for input regarding archaeological sites within 1 mile of the proposed site. The Iowa SHPO responded by letter dated August 24, 2010 (Appendix B), and provided an opinion that the proposed Wind Turbine Project location was not eligible for inclusion on the NRHP and that no historic properties would be adversely affected by the Wind Turbine Project.

As part of scoping, a letter requesting input on the proposed Wind Turbine Project was sent to the Sac and Fox Tribe of the Mississippi in Iowa located in Tama, Iowa, approximately 50 miles west of the proposed site. To date, no comments have been received from the tribe.

Data Review and Evaluation

DOE conducted a separate review of the Iowa SHPO historic preservation database for the presence of previously identified cultural resources in or near the Wind Turbine Project area. The review identified approximately 40 sites listed on the National Register of Historic Places in the Cedar Rapids vicinity, consisting of historic homes, buildings, bridges, farms, archaeological sites, and historic districts. The review confirmed that none of the NRHP-listed properties are within 1 mile of the proposed Wind Turbine Project site. The majority of the historic properties are located closer to the downtown area of Cedar Rapids, more than 3 miles north of the Wind Turbine Project site.

3.3.4.2 Direct and Indirect Impacts

Construction

Because the site of the proposed Wind Turbine Project is relatively close to Prairie Creek (1.5 miles) and the Cedar River (2 miles), it is likely that American Indians used the area to some extent before the arrival of Europeans. However, the site is a 4.5-acre parcel consisting of previously disturbed, maintained grass fields. Site records indicate the absence of archaeological sites within the direct APE, and the presence of unknown archaeological sites is unlikely. If the College encounters archaeological resources during construction, ground-disturbing activities would immediately cease, and the College would contact the Iowa SHPO for resolution and further instruction regarding additional studies and/or potential avoidance, minimization, or mitigation measures in accordance with the NHPA.

Operations

Once in operation, the proposed Wind Turbine Project would be a vertical visual presence in the community (see visual simulations in Appendix D). The turbine would be visible from multiple locations surrounding the site. Other than possible indirect visual impacts to the two historic farm properties, no other impacts would occur. NRHP-listed historic buildings and other structures in Cedar Rapids are several miles away; therefore, DOE concluded that adverse visual impacts on these properties would be unlikely.

There are other tall structures visible in the area including two communications towers, two water towers, several cellular towers, billboards, and overhead utility towers within a mile of the proposed wind turbine site (H.R. Green 2010). Therefore, the proposed wind turbine would not represent a substantially different visual presence and would not further alter the historic context of or view from any historic properties.

As described in Section 3.3.3.2, sound generated by the turbine would decrease to ambient levels within 1,000 to 2,000 feet of the turbine and generally would not be detectable beyond those distances. Because all historic properties are located farther from the turbine, there would be no adverse auditory impacts to historic properties from the Wind Turbine Project.

Although there are some historic and cultural resources in the vicinity, the operation of the wind turbine would not cause an adverse effect to historic or archaeological resources in the Cedar Rapids area.

3.3.5 BIOLOGICAL RESOURCES

3.3.5.1 Affected Environment

The College is located between the Cedar and Iowa rivers in the eastern tallgrass prairie region of Iowa. The wind turbines would be installed on a maintained grass field. The site is surrounded by other maintained fields, college facilities and parking lots, and small stands of trees. Developed areas of Cedar Rapids are north of the campus. In all other directions, the college is surrounded by cultivated fields and low-density development.

Because the Wind Turbine Project site is in the middle of a college campus and periodically mowed, the only native wildlife commonly found are grassland and urban species. As described in Section 3.3.5.2, habitat loss and other direct impacts to biological resources during construction of the wind turbine and associated infrastructure would be minimal, and this section therefore focuses on birds and bats, which could be harmed during operation of the turbine, and other Federally and State-protected species.

The *Migratory Bird Treaty Act* (16 U.S.C. 703-7012; MBTA) implements four international conventions that provide for international protection of migratory birds. MBTA prohibits taking, killing, possessing, transporting, and importing migratory birds, their eggs, parts and nests, except when specifically authorized by the U.S. Department of the Interior. While MBTA has no provision for allowing unauthorized take, USFWS recognizes that some migratory birds may be harmed or killed during activities such as wind turbine operations even if all reasonable measures to avoid a take have been implemented.

The most abundant bird species along the two breeding bird survey routes conducted closest to the Wind Turbine Project site (Alice and Cedar Valley routes) are the red-winged blackbird (*Agelaius phoeniceus),* house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), western meadowlark (*Sturnella neglecta*), dickcissel (*Spiza Americana*), ring-necked pheasant (*Phasianus colchicus*), horned lark (*Eremophila alpestris*), American robin (*Turdus migratorius),* common grackle (*Quiscalus quiscula*), song sparrow (*Melospiza melodia*), and mourning dove (*Zenaida macroura*) (Sauer et al. 2008). Many of these same species, plus Canada geese (*Branta canadensis*), rock pigeons (*Columbia livia*), dark-eyed juncos (*Junco hyemalis*), American crows (*Corvus brachyrhynchos*), mallards (*Anas platyrhynchos*), and northern cardinals (*Cardinalis cardinalis*) were commonly detected during Christmas bird counts in the Cedar Rapids area (National Audubon Society 2010). The bird surveys were conducted in areas with more agriculture and less urban development than the area surrounding the Wind Turbine Project site, and, therefore, the composition of the avian community within and near the Wind Turbine Project site might be somewhat different.

The Cedar and Iowa rivers are important flyways for birds migrating to and from the prairie pothole region of the north-central United States. The Cedar River is about 2 miles north of the Wind Turbine Project site, and the Iowa River is about 13 miles south of the site. Much of the section of the Iowa River south and southwest of the site has been identified by the Iowa Department of Natural Resources as a Bird Conservation Area (DNR 2010b) and by the National Audubon Society (2010) as an Important Bird Area. The Audubon Society has also identified portions of the Cedar River 12 to 16 miles northwest of the Wind Turbine Project site as Important Bird Areas.

Of the nine bat species that occur in Iowa, the five species that most commonly occur in the Cedar Rapids area are the little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), Eastern red bat

(*Lasiurus borealis*), hoary bat, and silver haired bat (*Lasionycteris noctivagans*). Other bats that might occur in the area include the northern bat (*Myotis septentrionalis*), evening bat (*Nycticeius humeralis*), and tri-colored bat (Perimyotis subflavus). The Indiana bat (*Myotis soladis*), a State- and Federally listed endangered species, is not known to occur in Linn County (DNR 2010c, 2010d, USFWS 2007a, 2007b); however, the USFWS has stated that this species may migrate through the Wind Turbine Project area (Nelson 2010).

There are two Federally-listed threatened or endangered species that occur in Linn County. The western prairie fringed orchid grows in wet prairies and sedge meadows, and the prairie bush clover grows in dry to mesic prairies with gravely soil (USFWS 2007a).

There are 2 amphibians, 2 birds, 8 fish, 7 freshwater mussels, 6 butterflies, 1 mammal, 47 plants, 4 reptiles, and 1 snail classified as endangered, threatened, or of special concern by the State of Iowa that might occur in Linn County (DNR 2010d). None of these species is found in upland maintained grass fields such as the location where the College proposes to install a wind turbine. Of the two bird species, Henslow sparrows (*Ammodramus henslowii*) prefers tall dense prairie grasslands; whereas, bald eagles (*Haliaeetus leucocephalus)* are found near water such as rivers, reservoirs, and lakes and nest in large trees, especially along riparian areas. The nearest habitat for bald eagles is about 2 miles north of the Wind Turbine Project site along the Cedar River.

3.3.5.2 Direct and Indirect Impacts

Preparation of the access road and staging area, construction of the foundation and wind turbine, and installation of the buried electrical cable would disturb up to 2 acres of mowed fields from which native trees and shrubs have been removed. Those areas have limited value for native plants and animals, and construction of the wind turbine and installation of associated infrastructure would, therefore, have negligible impacts on biological resources.

Migratory Birds and Bald Eagles

To minimize harm to birds and bats during operation of the wind turbine, ISEO through the College would ensure the proposed Wind Turbine Project would conform to the applicable site development and turbine design and operation recommendations in the *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003) and to the *Wind Energy and Wildlife Resource Management* recommendations provided by the Iowa DNR (Howell 2010; DNR 2011). For example, the proposed Wind Turbine Project consists of a single wind turbine to be located in an area already disturbed and urbanized; thus, the Wind Turbine Project would not further fragment wildlife habitat in the area. Only 2 acres or less of land would be disturbed and disturbed areas not required for operation of the turbine would be restored to their original conditions after construction was completed. The Wind Turbine Project site is not close to any known bird migration pathways or areas where birds are highly concentrated, areas or features in the landscape known to attract raptors, or important habitat for bats. It is also distant from any “areas of concern for wind farm sitings” identified by the Iowa DNR (DNR 2011). The proposed turbine tower is a monopole; no external features such as ladders or guy wires would be attached to the turbine, and all electrical cables would be buried. Finally, the College would conform to the interim guidelines by using one daytime white and nighttime red flashing hazard light the minimum amount of FAA-required pilot warning and obstruction avoidance lighting.

Nationally, wind turbines are responsible for 0.01to 0.02 percent of all avian fatalities due to human structures, averaging 0 to 3 birds killed per turbine per year (Erickson et al., 2002). Mortality rates at wind turbines in the Midwest, particularly those in open areas such as agricultural areas, are similar, generally averaging 1 to 2 birds killed per turbine per year (Erickson et al., 2002 and 2008). Because the Wind Turbine Project site is over 2 miles from the Cedar River and distant from identified Important Bird Areas

and other areas where large numbers of birds might migrate or congregate, DOE anticipates that a similar small number of birds would be killed as a result of the proposed Wind Turbine Project.

Bald eagles are not anticipated to be affected by the proposed Wind Turbine Project. The nearest habitat for bald eagles is over 2 miles away along the Cedar River.

Bats

The estimated average rate of bat fatalities at wind energy projects in the Midwest is between 0.1 and 8 bats per turbine per year (Arnett et al. 2008). Given the similarity of the proposed Wind Turbine Project site to other Midwest sites with minimal suitable bat habitat, bat fatalities for the Wind Turbine Project are likely to be at the lower end of this range.

Threatened and Endangered Species

There is no habitat within the Wind Turbine Project area for the two Federally-classified threatened plant species that occur in Linn County. DOE, therefore, concluded the proposed Wind Turbine Project would not affect those listed species. The USFWS has concurred with this determination (Nelson 2010).

Linn County is outside of the known summer and winter range of the Indiana bat (DNR 2010b, 2010c). The nearest known hibernacula to the Wind Turbine Project site are in Dubuque County to the northeast, and the nearest summer records are from Iowa County to the southwest (USFWS 2007b). The stands of trees to the east and west of the Wind Turbine Project site are not likely suitable roosting or foraging habitat because they are isolated from larger riparian-forested areas of the type where Indiana bats are typically known to roost and forage. Because the proposed Wind Turbine Project involves a single wind turbine in an area where Indiana bats are not known to occur; where there is no nearby summer roosting habitat, foraging habitat, or hibernacula; and where Indiana bats might only occasionally migrate, DOE concludes that the proposed Wind Turbine Project would not adversely affect this species.

There is no habitat within or near the site of the proposed Wind Turbine Project for any species classified as endangered, threatened, or of special concern by the State of Iowa; therefore, DOE concludes that the proposed Wind Turbine Project would not affect any of those species.

3.3.6 WATER RESOURCES – SURFACE WATER

3.3.6.1 Affected Environment

Surface Drainage

The College Wind Turbine Project site is within the drainage area of the Cedar River and, specifically, within the Lower Cedar Watershed as designated by the EPA and the U.S. Geological Survey (EPA 2010a). From the proposed project site, the Cedar River (at its closest) is about 2 miles to the northeast after it flows through the downtown area of Cedar Rapids. As shown in Figure 3-4, Prairie Creek, a tributary to Cedar River, is slightly closer to the project site, at about 1.5 miles to the north. Cedar River and Prairie Creek are the primary surface waters in the area of the proposed project.

A ridge of high ground runs through the main portion of the college campus such that ground to north, including where the wind turbine would be located, drains toward the north and land to the south drains to the south. The grassy area where the turbine would be sited has a slight downward slope (about 4 percent) to the north. There are small, wooded swales to both the west and the east that include drainage channels carrying runoff northward to where they converge at a small pond located about 700 feet directly north of the proposed wind turbine site. The outlet channel from the small pond flows to the north and west, under Kirkwood Boulevard, under U.S. Highway 30, then north through Prairie Creek Park (Figure 3-4) and

into Prairie Creek. From that point, the creek travels another 1.5 miles to the northeast, where it drains into Cedar River.

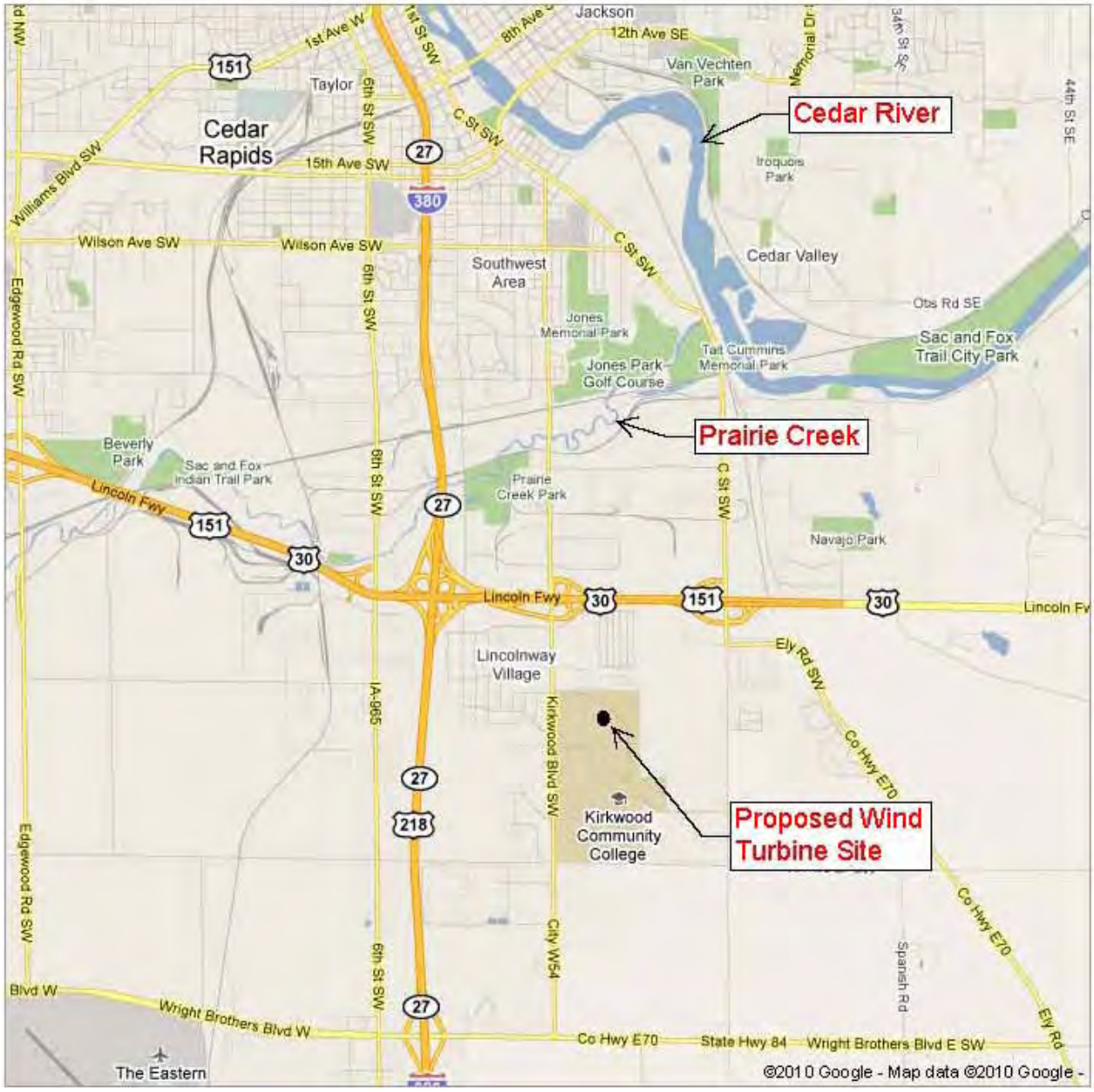

Figure 3-4. Surface Waters in the Vicinity of the Proposed Wind Turbine Site

Water Quality

The Iowa Water Quality Standards [Iowa Administrative Code, Environmental Protection (567), Chapter 61] designate waters of the State for specific uses. All perennial rivers and streams are designated for specific uses in addition to being protected for general use, which includes "livestock and wildlife watering, aquatic life, non-contact recreation, crop irrigation, and industrial, domestic, and other incidental water withdrawal uses." In addition to these general uses, Cedar River in the Wind Turbine Project area is designated as a Class A1 and Class B (WW-1) water (DNR 2010e), where the first designates its use for primary (prolonged and direct) contact recreation and the second for a warm water

habitat suitable for a variety of native fish and invertebrate species, including game fish. Prairie Creek, in the general area where it joins the Cedar River, is designated a Class A1 and Class B (WW-2) water (DNR 2010e). These designations indicate the same uses as the Cedar River except that the Class B (WW-2) indicates the water has limited potential for the maintenance of game fish populations. Specific, in-stream water quality criteria have been established for each of these classifications and the quality of these waters is gauged against the applicable water quality standards.

Section 305(b) of the *Clean Water Act* requires States to develop and periodically update an inventory of the water quality of all water bodies in the state. For each water body or applicable segment of stream, these inventories identify whether the water quality supports the applicable designated uses. Section 303(d) of the *Clean Water Act* requires States to develop and periodically update an inventory of water bodies that do not meet water quality standards. According to the Section 303(d) information reported by the State in 2008, the Cedar River is identified as an impaired water over its entire length in Linn County (DNR 2010f). The impairment over this long segment of the river is a result of water samples showing bacteria levels higher than allowed for primary contact recreational use (that is, per its Class A1 designation). The portion of the Cedar River downstream of U.S. Highway 30 (about 5 miles east of the Wind Turbine Project site) is also identified as an impaired water for not meeting all water quality standards for a warm water fishery [that is, per its Class B(WW-1) designation]. In this case the impairment has been made evident by a decline in mussel species and the potential causes include flow alteration, habitat modification, nutrients, and/or siltation. Other water quality standards applicable to a water with Class A1 and Class B (WW-1) designations are met for the Cedar River in Linn County. The State's Section 303(d) information lists Prairie Creek as having insufficient information to assess whether its designated uses are met (DNR 2010g).

Floodplains and Wetlands

The rivers and creeks in the Cedar Rapids area are occasionally subjected to flooding from periods of unusually high precipitation runoff or snow melts. However, according to the applicable flood insurance rate map published by the Federal Emergency Management Agency, neither the 100-year nor 500-year flood zones extend into the College campus area where the wind turbine would be located (FEMA 2010). The closest flood zone, or floodplain, to the proposed turbine site is about 0.6 mile to the northwest. This flood zone is on the west side of Kirkwood Boulevard and is associated with the same drainage channel that carries runoff from the Wind Turbine Project site to Prairie Creek. This narrow flood zone, centered on contributing drainage channels, extends to the north (downstream) to Prairie Creek, but extends up the channel to the east no farther than Kirkwood Boulevard.

DOE used the "Wetlands Online Mapper" tool available on the USFWS National Wetlands Inventory website (http://www.fws.gov/wetlands/Data/Mapper.html) to identify wetlands that might occur within and near the proposed turbine location. Figure 3-5, which was generated using that tool, shows five distinct wetlands areas of three different types near the proposed wind turbine site. The codes (for example, PUBHh) in the figure provide additional information on the types of wetlands as follows:

Figure 3-5. Map of Wetlands within the General Area of the Wind Turbine Project

1. Freshwater Emergent – PEMFh – Palustrine wetlands (wetlands that are non-tidal, not part of a large lake, and are characterized by the presence of vegetation) with emergent vegetation and is semi-permanently flooded as a result of being in a diked or impounded area.

2. Freshwater Forested/Shrub – PSS1A – Palustrine wetlands with scrub or shrub vegetation characterized as broad-leaved deciduous and is in a temporarily flooded area.

3. Freshwater Pond

   – PUBHh – Palustrine wetlands pond associated with a permanently flooded area as a result of being diked or impounded and having an unconsolidated bottom.

   – PUBGh – Palustrine wetlands pond with an unconsolidated bottom that is intermittently exposed and is in a diked or impounded area.

Both ponds to the north and east of the turbine location are manmade impoundments. The wetlands area with emergent vegetation is on the edge of the smaller pond and is likely flooded on occasions as a result of the pond increasing in size at times of heavy runoff. The two wetlands areas with trees and shrubs are associated with low spots or runoff channels.

The College also performed a preliminary wetlands identification effort (Appendix F). In addition to the potential wetlands areas identified above, the College identified an area of about 4.5 acres within the wooded area directly to the west of the proposed wind turbine site as wetlands. This wooded area runs along a small stream channel, and in the smaller, upper portion of Figure 3-5, is shown as the dark strip that separates the grassy, open area where the wind turbine would be located from the nearest College buildings farther to the west. The College identified these wetlands with a code of "PEMA," characterizing it as palustrine wetlands with emergent vegetation and subjected to temporary flooding.

3.3.6.2 Direct and Indirect Impacts

Neither construction, operation, nor decommissioning of the wind turbine would involve discharges that could contaminate surface water, and it is anticipated there would be no reduction in surface water quality or availability as a result of the Wind Turbine Project. However, there are issues of potential concern to surface waters that would have to be considered during implementation of the proposed project.

During construction, there would be an increased potential for storm water runoff to carry loosened soil from the site. Because the Wind Turbine Project would involve disturbing more than 1 acre of land (up to 2 acres of land disturbance is estimated), the construction action would have to be covered by a storm water discharge permit (DNR 2007). Per State regulations, the college intends to submit a Notice of Intent to the Iowa Department of Natural Resources prior to starting construction. This Notice would be for storm water discharges under a General Permit No. 2 for construction activities as part of the National Pollutant Discharge Elimination System Program. Under the General Permit, the College would be required to develop and implement a storm water pollution prevention plan for the construction site. This plan would describe the measures to be taken to reduce the pollutants in storm water discharge and the practices to be implemented to control erosion. Fuels and other petroleum products in construction equipment would be present at the site during construction; management of these materials and actions to minimize the potential for any releases would be addressed in the pollution prevention plan. As part of the Notice of Intent, the College would be required to certify that the plan was in place and ready to be implemented. Finally, terms of the General Permit include compliance with effluent standards or prohibitions established under Section 307(a) of the *Clean Water Act* for toxic pollutants and a "Duty to Mitigate" that requires "all reasonable steps to minimize or prevent any discharge in violation of this

permit which has a reasonable likelihood of adversely affecting human health or the environment" (DNR 2007). The nature of the site (mild slope with grassy vegetation) coupled with the permitting and planning requirements for construction activities should minimize the potential for surface water issues during construction.

Runoff from the constructed wind turbine foundation, compacted temporary staging area, and access road could have increased runoff compared to surrounding vegetated areas. However, the affected areas are relatively small and have a shallow slope; thus, the potential for runoff is low. The only hazardous materials to be used during operations are the lubricants in the turbine machinery and possibly other lubricants and cleaning materials required during maintenance. Decommissioning would be very similar to construction, in that fuels and other petroleum productions would be present in equipment and the same precautions would be taken to ensure there were no releases of hazardous materials. Once the wind turbine materials were removed, the area would be recontoured and revegetated, which would minimize storm water runoff.

The wind turbine foundation would be located away from identified wetlands (Figure 3-5) as would the temporary staging area and the access road, both of which would be near the wind turbine location and extend no farther than the existing road to the northeast. However, as shown in Figure 2-4 (Section 2 above), the buried electrical line that would extend northwest from the wind turbine to the existing overhead transmission lines would pass very close to wetlands associated with the small pond. The College obtained a determination from the Rock Island District (Illinois) USACE stating that the wind turbine location did not require a Section 404 (of the *Clean Water Act*) permit for discharge of dredged or fill materials in waters of the United States (including wetlands) (USACE 2010). The determination also addressed the access road, which, at the time, was not identified by a specific location, by stating "If this road will impact wetlands, a permit may be required. If it will not impact wetlands, then no permit will be required." Although the short access road is well removed from wetlands areas, the same requirement would be applicable to the buried electrical line. At the present, the College intends to route the electrical line under the road and under the small creek or drainage channel by using directional drilling. If this approach is used, no impact to wetlands would be expected; the creek is very small and pushing a drill underneath it is not expected to affect its flow. If some other approach were used that involved installation of the electrical line from the top down, then there would likely be some "dredging or filling" of the drainage channel involved, even if minor. This would trigger the need for a Section 404 permit, but the affected area would be so small that it probably could be covered under a nationwide permit.

The proposed Wind Turbine Project, as currently planned by the Kirkland Community College, would have no adverse effects on wetlands. Should plans during construction change such that wetlands could be affected, Kirkland may be required to pursue a permit with USACE. Such a permit would help ensure the potential for adverse impacts to wetlands was minimized and, possibly, would include requirements for affected wetlands areas to be restored or replaced.

3.3.7 HUMAN HEALTH AND SAFETY

3.3.7.1 Affected Environment

Occupational health and safety is concerned with occupational and worker hazards during routine construction and operations. The U.S. Department of Labor, Bureau of Statistics maintains information on workplace injuries, illnesses, and fatalities. These statistics consider the potential for total recordable cases; days away from work, days of restricted work activity or job transfer; and worker fatalities in the work environment. The incidence rates (cases per 100 full-time workers for nonfatality statistics and cases per 100,000 full-time workers for fatality statistics) the Bureau of Labor Statistics maintains are calculated separately for different industries based on the reported health and safety cases for that

particular industry. A full-time worker is assumed to work 2,000 hours per year. The health and safety incident categories are defined as follows:

- Total recordable cases – The total number of work-related deaths, illnesses, or injuries that result in the loss of consciousness, days away from work, restricted work activity or job transfer, or required medical treatment beyond first aid.

- Days away from work, or days of restricted work activity or job transfer – Cases that involve days away from work, or days of restricted activity or job transfer, or both.

- Worker fatality – Cases that involve the death of a worker.

In order to minimize the effect of industrial health and safety hazards, industries must comply with all applicable regulations that relate to industrial health and safety, including Occupational Safety and Health Administration requirements to have a health and safety plan in place before starting work.

3.3.7.2 Direct and Indirect Impacts

To understand the potential risks to workers, DOE used applicable data from the Bureau of Labor Statistics to estimate the number of injuries and fatalities that might occur during the Wind Turbine Project. For construction activities, DOE used the Bureau of Labor Statistics incidence rates from the category "heavy and civil engineering construction" for 2009 as a reasonable approximation for the work associated with constructing a foundation and putting up the tower for the wind turbine. The total recordable cases incidence rate for the year was 3.8 injuries per 100 full-time employees (each working 2,000 hours during the year), and the days away from work, days of restricted work activity or job transfer incidence rate was 2.2 injuries per 100 full-time employees (BLS 2010a). For evaluation purposes, DOE estimates that there would be 20 construction workers at the site at any given time during construction, which would take about 2 months. This is a conservatively high estimate of the labor required to construct the wind turbine. For example, the University of Delaware's Website (http://www.ceoe.udel.edu/Lewes Turbine/index.shtml) provides photographs of its 2-megawatt wind turbine being constructed and installed in a period of about one and one-half months. Assuming nine 40-hour weeks for 20 workers, DOE estimates there would likely be no total recordable cases (calculated at 0.14 case) and no days away from work (calculated at 0.08 day) during construction. Standard best management practices for the construction industry would be implemented to reduce risks to workers. This would include complying with Occupational Safety and Health Agency regulation at 29 CFR Part 1926, "Safety and Health Regulations for Construction."

The fatality incidence rate for private industry construction activities in 2009 (preliminary data) was 9.7 fatalities per 100,000 full-time employees (BLS 2010b). Assuming nine 40-hour weeks for 20 workers, a fatality during construction would be very unlikely because the calculated number of fatalities is about 0.00035 (or conversely, 1 chance in 2,900).

It is estimated that there would be two maintenance events each year and each would involve two workers for two days. That is, each event would require a total of 32 hours of labor, so there would be 64 hours of labor per year. To evaluate worker risks for these activities, DOE used the Bureau of Labor Statistics incidence rates from the category "other services, repair and maintenance" for 2009. The total recordable cases incidence rate was 3.8 injuries per 100 full-time employees, and the days away from work, days of restricted work activity or job transfer incidence rate was 1.8 injuries per 100 full-time employees (BLS 2010a). Assuming a 20-year working life for the wind turbine and 64-hours of labor per year, DOE estimates that there likely would be no total recordable cases (calculated at 0.024 case) and no days away from work (calculated at 0.012 day) during wind turbine operations. Other than the great heights

involved, there would be no unusual or potentially unacceptable hazards or risks to workers, who would be trained to operate under a safety program and procedures, which would account for the working heights involved.

The fatality incidence rate for wind turbine maintenance activities is assumed to fit into the category of "industrial machinery, maintenance and repairs workers, general." The reported fatality incidence rate for this category was 12.1 fatalities per 100,000 full-time employees (BLS 2010b) for 2009. Assuming a 20-year working life for the wind turbine and 64-hours of labor per year, a fatality during wind turbine operation would be very unlikely because the calculated number of fatalities is about 0.00008. There would be increased risks involved in the performance of these maintenance activities "at elevation." This increase, however, would likely increase the incidence rate by a few percentage points, which would still result in very low impact values.

Decommissioning would involve tasks similar to construction. Assuming decommissioning required the same size workforce, lasted for the same duration, and that incidence rates, some 20 years in the future, would be the same as at present, it can be concluded there would likely be no recordable incidents, no days away from work, and no fatalities during decommissioning.

There have been recorded incidents of wind turbines collapsing or throwing blades during operation. Video and photograph records of such events can be found on various Internet web sites (for example YouTube). One cause of such an event would be electrical or mechanical failures that allowed the rotor to gain too much speed during high winds. As would be expected, it is not practical to design either the electronics or the structure of a wind turbine to accommodate every rotor velocity. Accordingly, wind turbines are designed for a maximum rotor speed and include controls and brakes to prevent the maximum speed from being exceeded. Utility-scale wind turbines are now better designed, certified to meet international engineering standards, and, as applicable, include ratings for withstanding hurricane force winds and other criteria.

Here, in addition to safeguards included in the design of the wind turbine, the location of the proposed wind turbine would minimize the potential for public safety issues. The wind turbine would be positioned farther than its full tower height (that is, farther than 262 feet) from the nearest public road, which is the Kirkwood North Loop Road, and only the closest segment of this road to the northeast would be within the distance represented by the tower and an extended blade (that is, within 427 feet). There would no college or other buildings within the larger, 427-foot distance from the proposed wind turbine site. In the highly unlikely event of a catastrophic failure and collapse of the wind turbine, it is very unlikely that any member of the public would be in danger. In addition, the area around the turbine would be fenced and the campus security would regularly patrol the area near the turbine.

Video and photograph records of wind turbine fires can also be found on various Internet websites. The wind turbine nacelle houses powered electronic equipment, so there is both an energy source and some amount of combustible material, thus fires, although very rare, could occur. A unique concern with a wind turbine fire is that there is no effective method of extinguishing the fire from the ground. A response would be limited to maintaining a safe area around the turbine and responding to spot fires that might result from falling sparks or debris (NYSERDA 2005). Wind turbine components are required to undergo applicable certifications by groups such as the International Electrotechnical Commission and the National Fire Protection Association to reduce the potential for any electrical malfunctions, including fires. Further, the separation, or set back, of the wind turbine from any residence or building would minimize the danger to human health or safety should a fire ever occur.

Wind turbine blades also have the potential to accumulate and throw (or shed) ice under specific weather conditions. The stated isolation of the wind turbine would also prevent this phenomenon from being a

hazard to the public. The Clipper Liberty 2.5 MW CW99 and other modern turbines are designed to monitor ice buildup and shut down if buildup is sufficient to slow the turbine's rotation. Thus, ice that accumulates on the blades or other parts of the turbine would fall directly below the turbine into the field and would not be a hazard to the public.

3.3.8 TRANSPORTATION

3.3.8.1 Affected Environment

Primary access into the College area is via Interstate 380, which runs north-to-south through Cedar Rapids, and U.S. Highway 30 (also known as the Lincoln Freeway), which runs east-to-west (Figure 3-6). Both Interstate 380 and Highway 30 are classified as principal arterials by the Iowa Department of Transportation (IDOT 2004) and intersect about 1 mile to the northwest of the College. Roads of this classification are considered high traffic volume corridors that generally serve major centers of activity and urban areas. Other roads of note providing access to the

Figure 3-6. Road Map of Kirkwood Community College Area showing Iowa Department of Transportation Functional Classifications

college campus include Kirkwood Boulevard, running north-to-south on the west side of the college, and 76th Avenue Drive SW, running east-to-west through the southern portion of the campus. Kirkwood Boulevard is classified as a minor arterial and 76th Avenue Drive SW is classified as a collector. The minor arterial classification is for routes connecting to principal arterials and providing access to smaller developed areas. Collectors provide service to important community locations not served by higher-classification roads and that collect traffic from lower-classification roads for channeling to higher-classification roads. Kirkwood North Loop Road, which would provide access from Kirkwood Boulevard to the proposed project site, is classified as a local road.

As noted in Section 3.3.1, the Eastern Iowa Airport is just more than 3 miles southwest of the proposed project site. This is a commercial service airport with two runways, serving about 1 million enplaning and deplaning passengers per year (EIA 2010).

3.3.8.2 Direct and Indirect Impacts

Construction of the wind turbine would involve increased vehicular traffic, including heavy equipment, in the area of the College campus and specifically on Kirkwood Boulevard and Kirkwood North Loop Road. However, with only a single wind turbine involved, construction would be of relatively short duration (about 2 months) and the workforce small (about 20 workers at any given time). Possibly of more concern would be the traffic associated with delivery of the wind turbine components, not because of the volume of traffic but because of the size of the loads. The turbine blades, tower, and other large parts would be transported to the site in several large pieces for onsite assembly. This would be accomplished in several oversized loads, and performed by experienced haulers with appropriate State and local hauling permits. Having the principal arterials Interstate 380 and Highway 30 near the college campus should make it relatively easy to get the oversize loads to the Wind Turbine Project site. Therefore, transportation of the turbine blades and other large components to the project site would be limited to minor and temporary impacts on traffic in the Cedar Rapids area.

Once the wind turbine is constructed, it would present a possible concern to air traffic due to its total height of 427 feet to the tip of a vertical blade. As described in Section 3.3.1.2, the College has already addressed this issue and has received notification from the FAA that the proposed wind turbine would not be a hazard to air navigation (Appendix B).

Decommissioning of the wind turbine would require equipment similar to that present during construction and would be expected to result in similar minor and temporary transportation impacts. Depending on the condition of the removed wind turbine components, there could be actions taken at the site to cut up items to make them easier to remove from the area, which would even further reduce the minor potential for transportation concerns.

3.3.9 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Executive Order 12898 (February 11, 1994) directs Federal agencies to identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In 2009, the aggregate percent of all racial minorities (Black, American Indian or Alaskan Native, Asian, Native Hawaiian or other Native Islander, or persons of two or more races) was 10 percent in Linn County (USCB 2010a) and about 10 percent in Iowa (USCB 2010a). Persons of Hispanic or Latino origin made up about 2.5 percent of the population in Linn County (USCB 2010b), and about 4.5 percent of the population in Iowa (USCB 2010a). The proposed Wind Turbine Project site is in Cedar Rapids and had a 2006 population that was 92-percent white. About 3.0 percent of the Cedar Rapids population is of Hispanic or Latino origin (USCB 2010c). Hispanics may be of any race, so are included in applicable race categories. Neither racial

minority nor ethnic minority persons would experience adverse socioeconomic impacts from the proposed Wind Turbine Project.

Direct and Indirect Impacts

No potential for adverse impacts to human health or environmental effects have been identified as part of the proposed project. Therefore, there would be no disproportionately high and adverse socioeconomics- or environmental justice-related impacts on minority populations and low-income populations.

The construction of the proposed Wind Turbine Project is expected to generate a short-term and small increase in employment due to temporary construction related jobs for the wind turbine. A local engineering firm would be responsible for the design work, specification, and supervision work. The College would solicit bids for the turbine, including from a turbine vendor based in Cedar Rapids. The College would use its existing personnel and might hire a small number of contractors for the foundation and installation work. The equipment vendor would perform final checks and bring the turbine into operation. Therefore, new permanent direct or indirect jobs would be unlikely.

Operation of the wind turbine would be unlikely to create direct jobs, but it could help to preserve jobs or community resources.

3.3.10 AIR QUALITY

3.3.10.1 Affected Environment

The affected air environment can be characterized in terms of concentrations of the criteria pollutants carbon monoxide, sulfur dioxide, particulate matter, nitrogen dioxide, ozone, and lead. The EPA has established National Ambient Air Quality Standards for these pollutants. There are two standards for particulate matter: one for particulates with an aerodynamic diameter less than or equal to a nominal 10 micrometers and one for particulates with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers. According to the EPA's online air quality maps and monitoring data (http://epa.gov/oar/data/) Linn County is in attainment for all pollutants listed above.

The EPA has found that the "aggregate group of the well-mixed greenhouse gases (GHG)" constitutes an air pollutant that contributes to climate change. Carbon dioxide is a GHG, and the College Wind Turbine Project would have an indirect impact on reducing carbon dioxide emissions from fossil fuel sources.

Electricity for the College is currently supplied by the Alliant Energy Corporation. Fuel sources for Alliant Energy's power plants include coal (61 percent), natural gas (31 percent), oil (6.3 percent), wind (1.2 percent), and hydro (0.6 percent) (Alliant 2009). Therefore, the College's primary source of electricity currently is fossil fuels.

3.3.10.2 Direct and Indirect Impacts

The proposed Wind Turbine Project would be an emissions-free energy generation project that would not degrade air quality. Aside from temporary dust generated during construction and decommissioning, which would be minimized to the extent practicable (for example, by keeping gravel on roads and watering dry unpaved roads), this Wind Turbine Project would not result in any adverse impacts to air quality. The proposed project would not require any air permits.

Carbon dioxide is a GHG that contributes to climate change, which in turn causes harm to many physical and biological systems. The proposed Wind Turbine Project would reduce the College's carbon footprint by reducing reliance on fossil fuels. It is assumed if this wind energy project was not built, the College

would continue to receive the vast majority of the electricity it uses from fossil-fuel sources. At an estimated 30-percent capacity factor, the annual energy capture associated with the installation of a 2.5-megawatt wind turbine would be approximately 6,570 megawatt-hours per year. For the Iowa area and its predominant use of fossil-fuel in the generation of electricity, it has been calculated that about 1,822 pounds of carbon dioxide is emitted to the atmosphere for each megawatt-hour of electricity produced (EPA 2010b). Considering these figures, the proposed Wind Turbine Project would reduce the reliance on fossil fuel generated electricity and reduce the College's carbon footprint by about 11,970,000 pounds, or almost 6,000 tons of carbon dioxide per year.

3.3.11 INFRASTRUCTURE AND ENERGY

Discussions in this section are limited to the electrical energy associated with the College Wind Turbine Project. The Wind Turbine Project would not impact other utilities or utility services of the community. Water would be required during construction for activities such as soil compaction and dust suppression; however, this would not be expected to impact water supplies or the water distribution system. The Wind Turbine Project would not involve routine production of sanitary sewage or other wastewater, and other than the waste debris generated during construction (which would go to the local landfill), there would be no routine production of solid waste. Fabrication of the wind turbine components would involve the unavoidable commitment of various materials, but these materials represent a small fraction of those available in the world marketplace.

3.3.11.1 Affected Environment

Electricity at the College and the proposed Wind Turbine Project site is provided by Alliant Energy Corporation through its subsidiary Interstate Power and Light (IUB 2010). Alliant Energy provides electricity to more than 1 million customers in its three-state (Iowa, Minnesota, and Wisconsin) utility service area (Alliant 2010a). It operates 30 power plants across the upper Midwest with a total output capacity of over 5,000 megawatts (Alliant 2010b) and reports selling 32.9 million megawatt-hours of electricity in 2007 (Alliant 2010c). Assuming the electricity sold in 2007 was used evenly throughout the 8,760 hours in a year, this represents an average electrical load of about 3,760 megawatts, and Alliant Energy reported a peak electrical load of 5,750 megawatts (Alliant 2010c).

Alliant Energy's electricity generating capacity relies on several different energy sources, but the predominant sources are coal, providing 61 percent of the capacity, and natural gas, at 31 percent of the capacity. The remaining generating capacity includes 6.3 percent from oil, 1.2 percent from wind, and 0.6 percent from hydro (Alliant 2009).

At the state level, State of Iowa's capacity for generating electricity is 1.4 percent of the nation's capacity, with a summer production capacity of 14,580 megawatts (DOE 2010). Actual electricity production in August of 2010 was 5.35 million megawatt-hours (DOE 2010). Assuming this was produced evenly over a 24-hour day for 31 days in the month, this equates to an average production rate of about 7,190 megawatts. Peak production during the month was likely much higher than the 7,190-megawatt average.

3.3.11.2 Direct and Indirect Impacts

The proposed Wind Turbine Project would involve a peak electrical power production capability of 2.5 megawatts. Portions of this power not used by the College would be sent to the electrical grid. The wind turbine itself has minor electrical demands, such as the motors to control the pitch of the blades and to keep the face of the turbine into the wind. Over time, these electrical demands would be very small in comparison with the power production, and the power production would be a very small component of

the loads at the regional and state levels. The Wind Turbine Project would have a very minor positive impact on the electricity generating capacity of the region.

3.4 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments of resources are actions of a proposed Wind Turbine Project that would result in the loss of resources, whether those are natural or cultural, that consequently could not be recovered or replaced promptly in the original or current condition. The proposed project would result in no irreversible or irretrievable commitments of resources during the construction of operational phase. The proposed Wind Turbine Project property has been previously developed and environmental resources have already been impacted. Reuse of the property for the Wind Turbine Project would result in a temporary, but not irreversible use of that property for other projects. The amount of new construction materials required for the proposed project would be minimal relative to the availability of those materials or the raw materials could be replenished. There would be a negligible irretrievable commitment of manufacturing resources. Long-term or permanent use of other resources, such as landfill space or the use of transportation corridors would be negligible. Minimal consumption of raw materials or resources would be required for operation.

The expenditure of Recovery Act funding from DOE would also be irreversible.

3.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts associated with the proposed Wind Turbine Project include:

- Long-term loss of approximately 165 square feet of vegetation resulting from the construction of the tower foundation;
- Death or injury of about one to three, and possibly more, birds and bats per year struck or otherwise harmed by the spinning turbine blades;
- A minimal increase in noise during construction;
- Introduction of an additional vertical element into the existing viewshed;
- Minimal shadow flicker impacts for local residences and roadways; and
- A risk of tower collapse within 427 feet of the turbine tower.

The impacts from construction noise would be temporary; whereas, the other unavoidable adverse impacts could occur throughout the operational life of the wind turbine. Overall, impacts of the proposed Wind Turbine Project on the environment and human health would be minimal.

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

Short-term use of the environment, as the term is used in this document, is that used during the life of the Wind Turbine Project, whereas long-term productivity refers to the period of time after the Wind Turbine Project has been decommissioned, the equipment removed, and the land reclaimed and stabilized. The short-term use of the Wind Turbine Project area for the proposed project would not affect the long-term productivity of the area. When operation of the turbine was no longer practicable, the turbine, tower, and foundation would be removed and the site reclaimed and revegetated to resemble the pre-disturbance conditions (vacant grassy field), and the site would be available for other uses.

4. CUMULATIVE IMPACTS

4.1 Introduction

The Council on Environmental Quality regulations stipulate that the cumulative impacts analysis within an EA consider whether the potential environmental impacts resulting from the "incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions." Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). Because the impacts of the proposed Wind Turbine Project generally would be minor and localized, DOE focused its evaluation of cumulative impacts of the proposed Wind Turbine Project and reasonably foreseeable future actions within the City of Cedar Rapids.

4.2 Reasonably Foreseeable Actions

The Cedar River Flood Risk Management Project is the largest project in the area that would be contemporaneous with the College Wind Turbine Project. The project is expected to cost just under $100 million (2010 dollars) and will primarily affect the area along the Cedar River with the exception of borrowing activities near the airport, which is approximately 3.3 miles from the Wind Turbine Project site. Other projects that will be contemporaneous are numerous road improvement projects for Cedar Rapids. No other wind power projects of similar size were identified in the area. However, Iowa has an ongoing wind farm initiative that includes approximately 35 wind farms statewide. The nearest wind farms are approximately 70 miles north of the Wind Turbine Project in Bremer County or 80 miles west in Marshall County.

4.3 Summary of Cumulative Impacts

4.3.1 CUMULATIVE GREENHOUSE GAS IMPACTS

While the scientific understanding of climate change continues to evolve, the Intergovernmental Panel on Climate Change Fourth Assessment Report has stated that warming of the earth's climate is unequivocal, and that warming is very likely attributable to increases in atmospheric GHGs caused by human activities (anthropogenic) (IPCC 2007). The Panel's Fourth Assessment Report indicates that changes in many physical and biological systems, such as increases in global temperatures, more frequent heat waves, rising sea levels, coastal flooding, loss of wildlife habitat, spread of infectious disease, and other potential environmental impacts are linked to changes in the climate system, and that some changes may be irreversible (IPCC 2007).

The release of anthropogenic GHGs and their potential contribution to global warming are inherently cumulative phenomena. It is assumed that the proposed Wind Turbine Project would displace fossil fuel electricity currently used by the College, resulting in a net decrease in emissions of approximately 6,000 tons of carbon dioxide equivalents for each year of operation. The proposed Wind Turbine Project in combination with the above-listed Wind Turbine Projects and plans for additional turbines in Iowa by 2025 would neither measurably reduce the concentration of GHGs in the atmosphere nor reduce the annual rate of GHG emissions. Rather, they would marginally decrease the rate at which GHG emissions are increasing every year and contribute to efforts ongoing globally to reduce GHGs and slow climate change.

4.3.2 VISUAL RESOURCES

The proposed Wind Turbine Project would affect the viewshed in the Wind Turbine Project area. The wind turbine would be a dominant vertical component in the landscape due to its height. Although there are several wind projects in the region surrounding the Wind Turbine Project, none of them are located within the likely viewshed of the proposed Wind Turbine Project. The closest communications towers are on the College campus and stand approximately 400 feet tall. These communications towers would partially be in the viewshed of the proposed Wind Turbine Project and therefore, there would be a small cumulative visual impact.

4.3.3 BIOLOGICAL RESOURCES

Operation of the single wind turbine would result in a very small incremental increase in the number of birds and bats killed by wind turbines in Iowa and the surrounding region. Because existing wind energy projects in Iowa are scattered throughout the State (DNR 2011) the Wind Turbine Project, in combination with these other wind energy projects, would not result in a concentration of bird or bat mortalities in the Linn County area.

4.3.4 NOISE

The reasonable foreseeable actions do not include any that are expected to change the local ambient noise patterns, which are partially driven by traffic. The noise impact from the wind turbine is expected to be small compared with the existing ambient noise (see Section 3.3.3.2 of this EA).

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APPENDIX A

Environmental Assessment Scoping

Company	Title	Department	Last	First	Agency	Address Line 1	Address Line 2	City	email	Phone	State	Zip Code	Phone
U.S. Fish and Wildlife Service	Field Supervisor	USFWS Rock Island Field Office	Nelson	Richard		1511 47th Avenue		Moline			IL	61265	
U.S. Army Corps of Engineers	Chief, Enforcement Section	Regulatory Branch	Jones	Donna		Clock Tower Building	Post Office Box 2004	Rock Island			IL	61204-2004	
U.S. Army Corps of Engineers	POC for this action	Regulatory Branch	Frolich	Albert		Clock Tower Building	Post Office Box 2004	Rock Island			IL	61204-2004	309-794-5659
Iowa Department of Natural Resources		Water Resources Section	Schwake	Chris		Wallace Office Building	502 E 9th St.	Des Moines			IA	50319-0034	
Iowa Department of Natural Resources		Conservation and Recreation Division					502 E 9th St.	Des Moines			IA	50319-0034	
Federal Aviation Administration	POC for this action	Federal Aviation Adminstration	Blaich	Michael		Air Traffic Airspace Branch, ASW-520	2601 Meacham Blvd	Fort Worth			TX	76137-0520	
Federal Aviation Administration		Obstruction Evaluation Service	Edgett-Baron	Sheri		Air Traffic Airspace Branch, ASW-520	2601 Meacham Blvd	Fort Worth			TX	76137-0520	
State Historical Society of Iowa		Architectural Historian	Ammerman	Jeremy		600 East Locust Street		Des Moines			IA	50319-0290	515-281-5111
Office of the State Archaeologist						700 Clinton St. Bldg		Iowa City			IA	52242-1030	319-384-0732
U.S. Environmental Protection Agency	NEPA Coordination Team Leader	EPA Region 7	Cothern	Joe			901 North Fifth Street	Kansas City			KA	66101	913-551-7148
U.S. Department of the Interior, Regional Office	Regional Environmental Officer		Stewart	Robert		P.O. Box 25007 (D-108)	Denver Federal Center	Denver			CO	80225-0007	303-445-2500
U.S. Department of the Interior, Bureau of Indian Affairs			Keller	Marvin		2051 Mercator Drive	Room 247	Reston			VA	20191	703-390-6325
Iowa Department of Natural Resources	Director		Leopold	Richard		Henry A. Wallace Building	502 East Ninth Street	Des Moines			IA	50319-0034	515-281-5385
Office of the Governor	Governor of Iowa		Culver	Chet		State Capital	1007 East Grand Avenue	Des Moines			IA	50319	515-281-5221
Federal Emergency Management Agency	Deputy Regional Environmental Officer		Sessa	Ken		DHS/FEMA Region VII	9221 Ward parkway, Suite 300	Kansas City			KA	64114	816-283-7960
Sac & Fox Tribe of the Mississippi in Iowa	Tribal Council Chief		Wanatee	Gailey		349 Meskwaki Rd		Tama			IA	52399	
Sac & Fox Tribe of the Mississippi in Iowa	Chairman		Pushetonequa	Adrian		349 Meskwaki Road		Tama			IA	52339-9629	641-484-4678
Kirkwood Community College	Executive Director Facilities	Kirkwood Wind Turbine Project	Kaldenberg	Thomas		6301 Kirkwood Blvd. SW		Cedar Rapids			IA	52404	319-398-5569
Kirkwood Community College	Director, Public Information		Carpenter	Steve		6301 Kirkwood Blvd. SW		Cedar Rapids			IA	52404	319-398-4939
Howard R. Green Company	Project Scientist		McCaslin	Ted		2550 University Ave W, STE 400N		St. Paul			MN	55114	651-659-7708
Howard R. Green Company			Fisher	Mike		2550 University Ave W, STE 400N		St. Paul			MN	55114	319-841-4354
National Audubon Society	Vice President		Wallis	Phil		1201 Pawlings Road		Audubon			PA	19403	
National Audubon Society	General Counsel		Scott	Michelle		225 Varick Street, 7th floor		New York			NY	10014	
National Audubon Society	Important Bird Area Coordinator and Staff Biologist		Van Fleet	Kim		100 Wildwood Way		Harrisburg			PA	17110	
Meyer Glitzenstein & Crystal			Glitzenstein	Eric		1601 Connecticut Ave., N.W.	Suite 700	Washington			DC	20009-1056	
Meyer Glitzenstein & Crystal			Eubanks	William		1601 Connecticut Ave., N.W.	Suite 701	Washington			DC	20009-1057	
Kirkwood Estates Trailer Park	Manager					615 Miller Avenue Drive SW		Cedar Rapids			IA	52404	
Kirkwood Courts Apartments	Manager					205 Kirkwood Ct. SW		Cedar Rapids			IA	52404	
Campus View Apartments	Manager					205 Kirkwood Ct. SW		Cedar Rapids			IA	52404	
Eagle's Pointe at Kirkwood	Manager					5502 Kirkwood Blvd SW		Cedar Rapids			IA	52404	
Kirkwood Kids Child Development Center		Kirkwood Community College				6301 Kirkwood Blvd. SW		Cedar Rapids			IA	52404	
City of Cedar Rapids	Mayor		Corbett	Ron		321 30th Street SE		Cedar Rapids			IA	52404	319-286-5051
City of Cedar Rapids	Public Works Director/City Engineer		Elgin	David		Public Works Building	1201 6th St SW	Cedar Rapids			IA	52404	319-286-5802

Fields of Opportunities

STATE OF IOWA

CHESTER J. CULVER, GOVERNOR
PATTY JUDGE, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
PATRICIA L. BODDY, INTERIM DIRECTOR

October 25, 2010

Ms. Melissa Rossiter
NEPA Document Manager
Department of Energy
1617 Cole Boulevard
Golden, CO 80401

Subject: Kirkwood Community College's Proposed Wind Turbine Project

Dear Ms. Rossiter:

This letter is in response to your October 13, 2010 letter concerning the proposed wind turbine at Kirkwood Community College in Cedar Rapids, Iowa. A letter dated July 16, 2010, from the Iowa Department of Natural Resources Conservation and Recreation Division, was sent to Mr. Ted McCaslin of Howard R. Green Company discussing this project. I've attached a copy of that letter.

Waters of the United States (includes wetlands) should not be disturbed if a less environmentally damaging alternative exists. Unavoidable adverse impacts should be minimized to the extent practicable. Any remaining adverse impacts should be compensated for through restoration, enhancement, creation and/or preservation activities. We would ask that Best Management Practices be used to control erosion and protect water quality near the project.

Any proposed placement of dredged or fill material into waters of the United States (including jurisdictional wetlands) requires Department of the Army authorization. When detailed plans are available, please complete and submit the joint application form to the Rock Island District Corps of Engineers (1 copy) and Iowa Department of Natural Resources (2 copies) for processing. The application form may be obtained at http://www.iowadnr.gov/other/files/jointpermit.pdf .

If you have any questions, please call me at 515-281-6615.

Sincerely,

Christine M. Schwake

Christine Schwake
Environmental Specialist

Attachment

502 EAST 9th STREET / DES MOINES, IOWA 50319-0034
PHONE 515-281-5918 FAX 515-281-8895 www.iowadnr.gov

Fields of Opportunities

STATE OF IOWA

CHESTER J. CULVER, GOVERNOR
PATTY JUDGE, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
RICHARD A. LEOPOLD, DIRECTOR

July 16, 2010

Mr. Ted McCaslin
Howard R. Green Company
Court International Building
2550 University Ave. West
Suite 400N
St. Paul, MN 55114

RE: Environmental Review for Natural Resources
Wind Turbine Kirkwood Community College
Linn County
Section 15, Township 82N, Range 7W

Dear Mr. McCaslin:

Thank you for inviting Department comment on the impact of this project. Although the Department does not regulate wind farms, if relatively frequent bird and bat mortality is discovered at the turbine site, please contact the Department for further consultation as it is in the developer's interest to avoid potential conflict with federal and state-listed threatened and endangered species. The college should consider conducting spring and fall bird and bat mortality surveys. This work could be done by students as a learning experience and will add to the information concerning wildlife migration in Iowa. Information titled *Wind Energy and Wildlife Resource Management in Iowa: Avoiding Potential Conflicts* is here as an attachment and is available from the Department website at:

http://www.iowadnr.gov/wildlife/diversity/files/wind_wildliferecs.pdf

The Department, together with the U.S. Fish and Wildlife Service, recommends that tubular turbine supports rather than lattice supports are used to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching and nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with recommended bird deterrent devices (Avian Power Line Interaction Committee 1994).

This letter is a record of review for protected species, rare natural communities, state lands and waters in the project area, including review by personnel representing state parks, preserves, recreation areas, fisheries and wildlife but does not include comment from the Environmental Services Division of this Department. This letter does not constitute a permit. Other permits may be required from the Department or other state or federal agencies before work begins on this project.

Any construction activity that bares the soil of an area greater than or equal to one acre including clearing, grading or excavation may require a storm water discharge permit from the Department. Construction activities may include the temporary or permanent storage of dredge material. For more information regarding this matter, please contact Ruth Rosdail at (515) 281-6782.

The Department administers regulations that pertain to fugitive dust IAW Iowa Administrative Code 567-23.3(2)"c." All persons shall take reasonable precautions to prevent the discharge of visible emissions of

fugitive dusts beyond the lot line of property during construction, alteration, repairing or demolishing of buildings, bridges or other vertical structures or haul roads. All questions regarding fugitive dust regulations should be directed to Jim McGraw at (515) 242-5167.

If you have questions about this letter or require further information, please contact me at (515) 281-8524.

Sincerely,

Original signed by

Daryl Howell
Environmental Specialist
Conservation and Recreation Division

FILE COPY Kelly Poole
Tracking Number 5048

Enclosures

Suggested References

Anderson, R., M. Morrison, K. Sinclair, D. Strickland, H. Davis, and W. Kendall. 1999. Studying wind energy/bird interactions: a guidance document. Metrics and methods for determining or monitoring potential impacts on birds at existing and proposed wind energy sites. Avian Subcommittee, National Wind Coordinating Committee, Washington, DC. 87 pp.

Jain, A.A. 2005. Bird and bat behavior and mortality at a northern Iowa windfarm. M.S. Thesis, Iowa State Univ., Ames. 108pp.

A - 3 email - 102010-Iowa State Archeologist - update to this maybe coming.txt
From: "Rossiter, Melissa" <melissa.rossiter@go.doe.gov>
To: "Richard Holder" <rholder@jason.com>
Subject: FW: EA -- Kirkwood Community College wind turbine project, Linn Co., IA
Date: Wednesday, October 20, 2010 7:58 AM

FYI

Melissa H. Rossiter
Telephone 720.356.1566
Blackberry 720.291.1602
melissa.rossiter@go.doe.gov

-----Original Message-----
From: Doershuk, John F [mailto:john-doershuk@uiowa.edu]
Sent: Wednesday, October 20, 2010 9:51 AM
To: Rossiter, Melissa
Subject: EA -- Kirkwood Community College wind turbine project, Linn Co., IA

Mellissa:

My office is in receipt of the postcard notification re input on the Kirkwood Community College wind turbine project, Linn Co., IA. Please send me the area of potential effect for the project and I will check our recorded for 1) known archaeological resources that might be affected and 2) the potential for the project area to contain currently unrecorded archaeological resources of significance. Receipt of project map data as an e-mail attachment preferred.

Thank you,

John F. Doershuk, Ph.D.

State Archaeologist

Proposed Wind Turbine
Kirkwood Community College, Cedar Rapids, Iowa
Public Information Meeting
December 7, 2010

Purpose of the Public Information Meeting:
The purpose of this meeting is to discuss Kirkwood Community College's proposal to construct a wind turbine on the College's main campus in Cedar Rapids, Iowa.

Computer generated rendition of proposed location, looking south.

Proposed Project:
Kirkwood Community College, with funding support from the Department of Energy and the Iowa Office of Energy Independence, is proposing to install a 2.5 megawatt wind turbine on the College's main campus in Cedar Rapids, Iowa. The proposed wind turbine would supply power directly to Alliant Energy's distribution system. The turbine would serve as the focal point for workforce development and continuing education programs that would foster employment and technical expertise in Iowa's evolving green economy. The proposed wind turbine would also be accessible as a tool for renewable energy-based educational programs that currently exist and are being developed at other Iowa community colleges.

Proposed Wind Turbine:
The proposed wind turbine would be located near Kirkwood Community College's baseball complex on central campus in Cedar Rapids, Iowa. The wind turbine would be American made with a hub mechanism approximately 260 feet (80 meters) tall and rotors (the turbine's blades) approximately 160 feet (50 meters) long. With a rotor turning directly above the hub the turbine would be a total of approximately 430 feet (130 meters) tall.

Funding Sources:
Kirkwood has received an Iowa Office of Energy Independence State Energy Program grant of $1,050,000 to help fund the project. Kirkwood has also applied for funding assistance from the Iowa Energy Center Alternative Energy Revolving Loan Program.

Environmental Studies & Agency Coordination:
The Department of Energy, the federal agency responsible for funding the State Energy Program, is currently conducting an Environmental Assessment (EA) study for the proposed project. The EA will evaluate how the proposed wind turbine would impact the natural and human environment within the project study area. As part of the EA, a detailed noise analysis and shadow flicker study are being conducted to understand how the proposed turbine would affect the area around the proposed location.

Preliminary coordination has occurred with some federal and state agencies including the Federal Aviation Administration, U.S. Fish and Wildlife, Army Corps of Engineers, Iowa Department of Natural Resources, and State Historical Society of Iowa.

Computer generated rendition of proposed location, looking north.

For More Information Please Contact:
Mr. Thomas Kaldenberg
Executive Director of Facilities
Kirkwood Community College
6301 Kirkwood Blvd SW, Cedar Rapids, IA 52406
Telephone: (319) 398-5569
Email: thomas.kaldenberg@kirkwood.edu

LOCATION MAP

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

N

0 1,000
Feet

Proposed Turbine Location

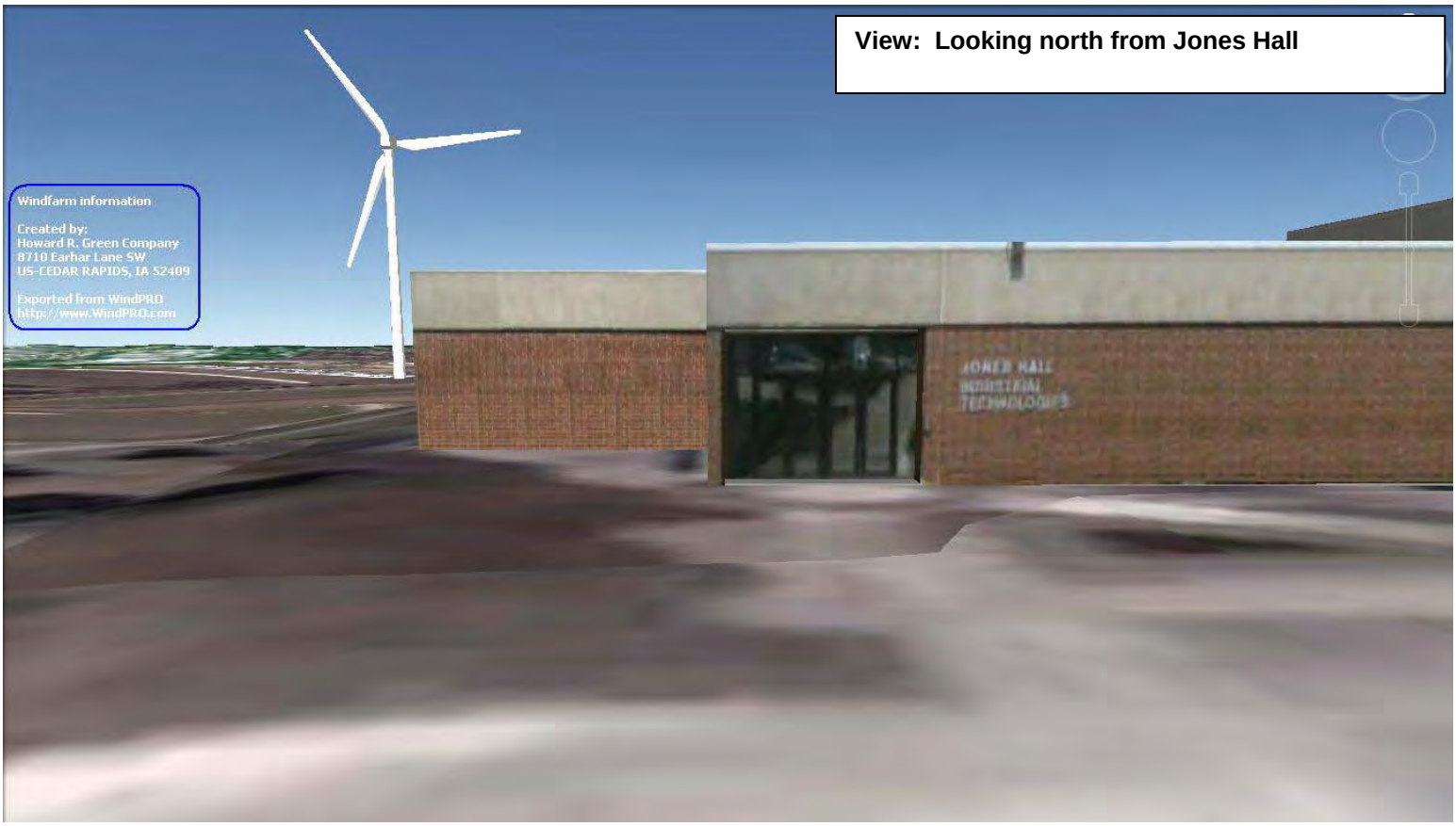
Howard R. Green Company

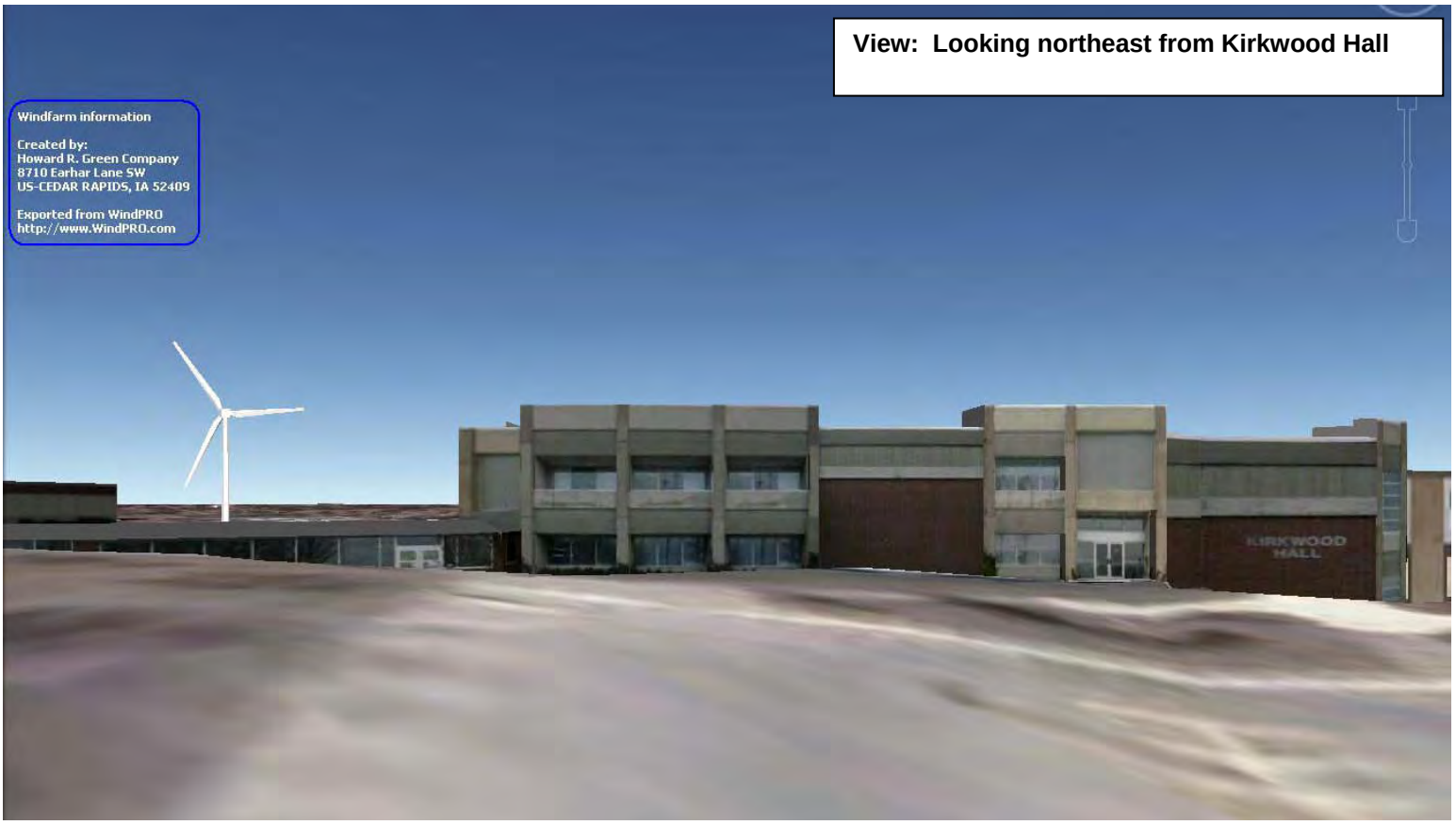
POSSIBLE VISUAL APPEARANCE

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

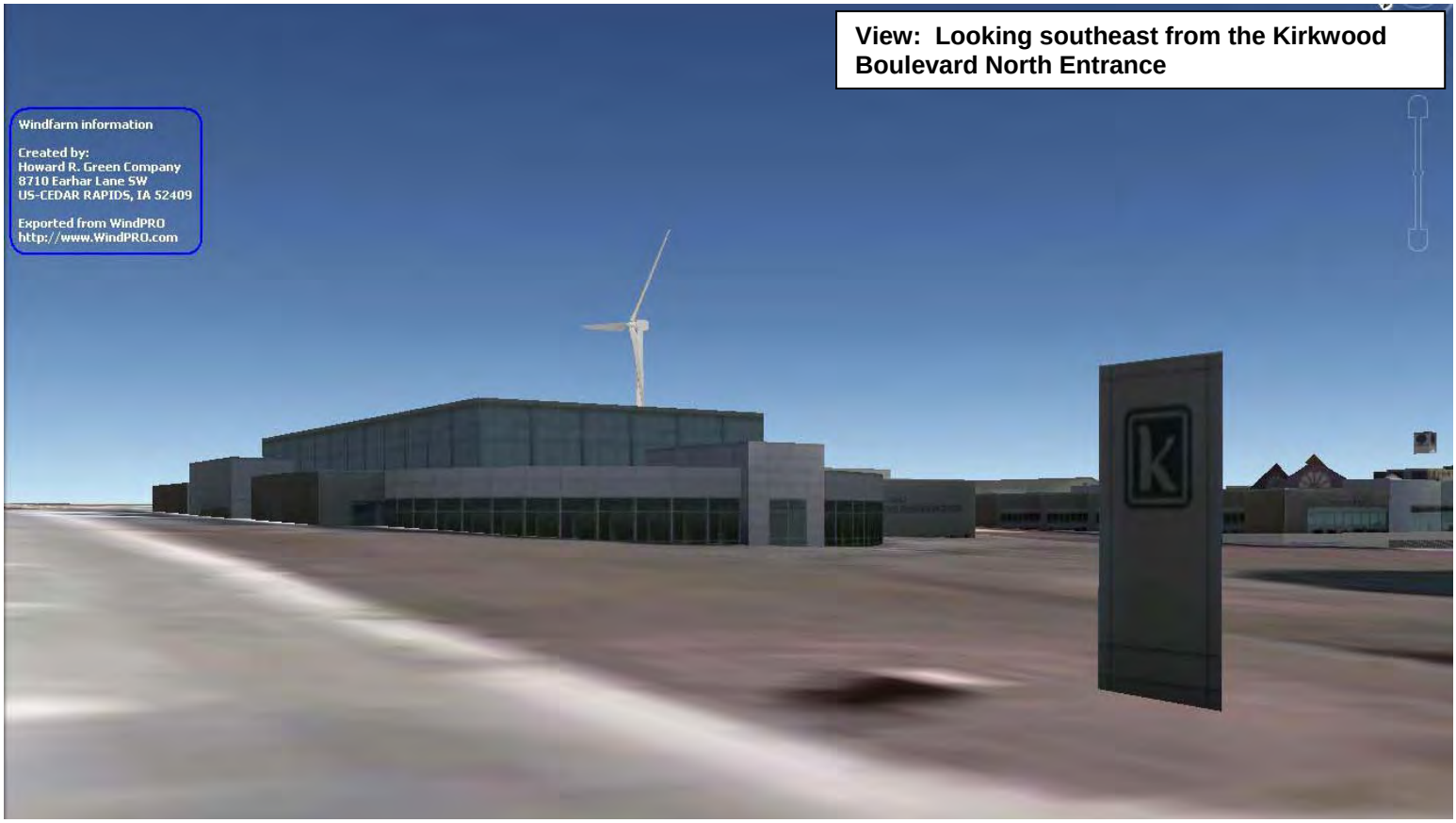
Computer Generated Images
WindPRO Software

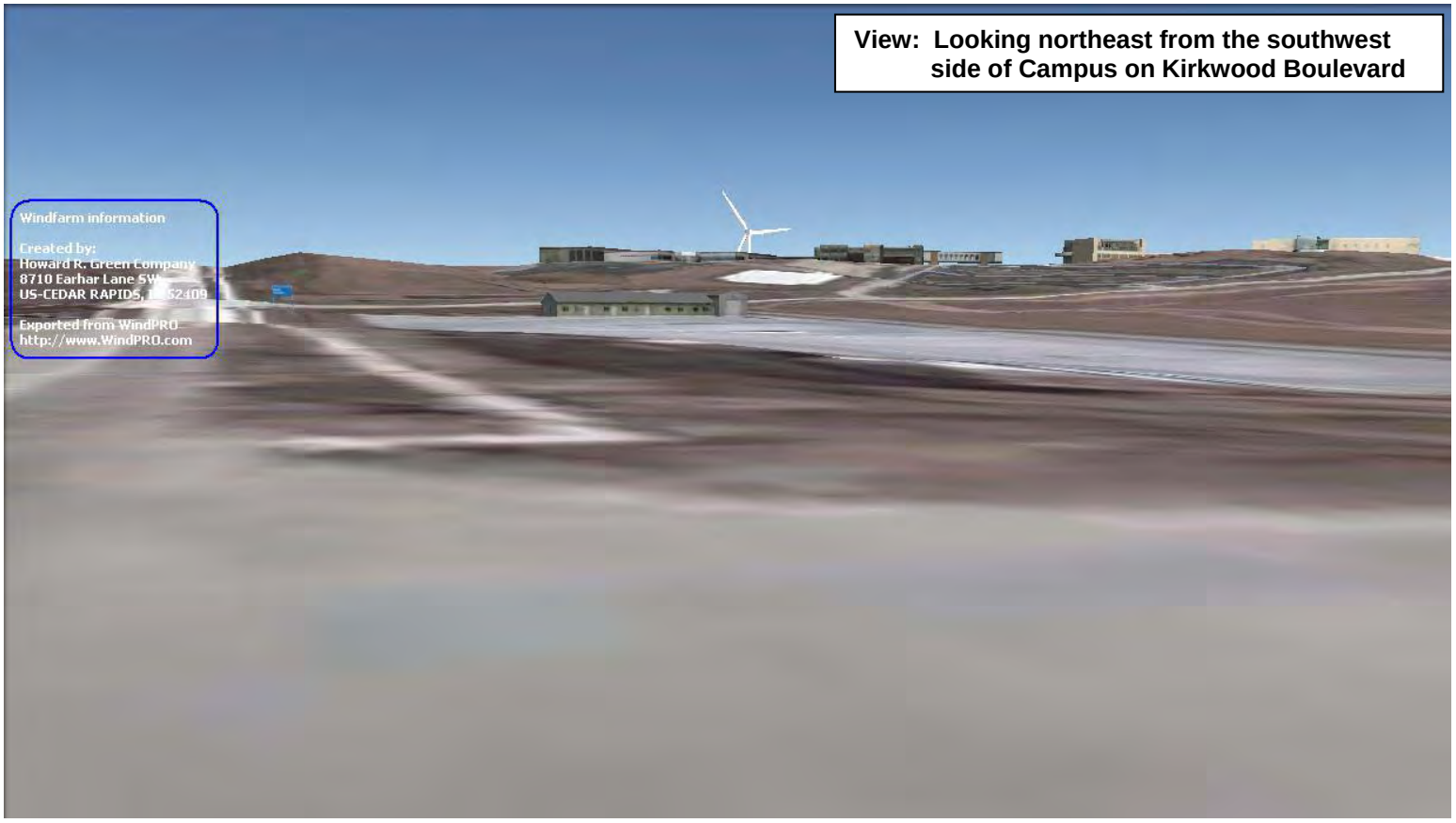
Howard R. Green Company





POSSIBLE VISUAL APPEARANCE **Proposed Wind Facility** **Kirkwood Community College** **Cedar Rapids, Iowa**	**Computer Generated Images** **WindPRO Software** Howard R. Green Company





POSSIBLE VISUAL APPEARANCE

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Computer Generated Images
WindPRO Software

Howard R. Green Company

POSSIBLE VISUAL APPEARANCE

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Computer Generated Images
Google Earth Software

Howard R. Green Company

WELCOME

to the

Kirkwood Community College
Proposed Wind Turbine

Public Information Meeting

December 7, 2010
Kirkwood Community College
Jones Hall, Room 108
4:00 PM to 6:00 PM

COMMENTS

Your comments are important to us.

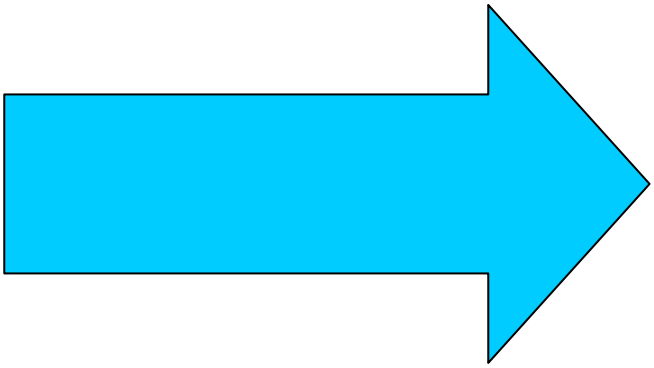
Please fill out the form and drop it in the comment box.

Thank you for Participating!

Proposed Wind Turbine
Public Information Meeting

December 7, 2010
4:00 PM to 6:00 PM

Room 108

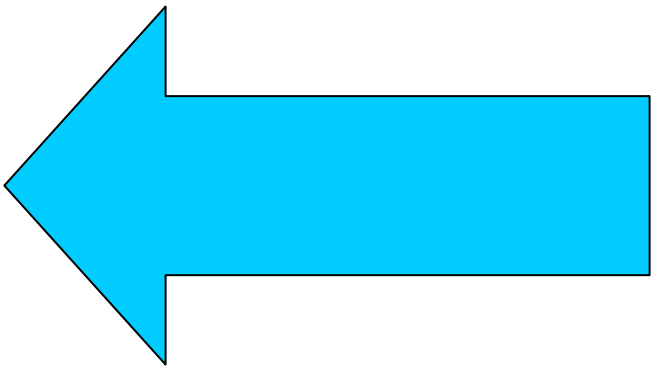


Kirkwood Community College
Cedar Rapids, Iowa

Proposed Wind Turbine
Public Information Meeting

December 7, 2010
4:00 PM to 6:00 PM

Room 108



Kirkwood Community College
Cedar Rapids, Iowa

Proposed Wind Turbine
Public Information Meeting

December 7, 2010
4:00 PM to 6:00 PM

Jones Hall

ROOM 108

Kirkwood Community College
Cedar Rapids, Iowa

Proposed Wind Turbine
Kirkwood Community College, Cedar Rapids, Iowa
Public Information Meeting
December 7, 2010

SIGN IN FORM

First Name:______________________________Last Name:_____________________________________
Mailing Address:____
City, State, Zip:____
Phone Number:____

First Name:______________________________Last Name:_____________________________________
Mailing Address:____
City, State, Zip:____
Phone Number:____

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Phone Number:____

First Name:______________________________Last Name:_____________________________________
Mailing Address:____
City, State, Zip:____
Phone Number:____

CITIZEN COMMENTS

Proposed Wind Turbine
Kirkwood Community College, Cedar Rapids, Iowa
Public Information Meeting
December 7, 2010

Comments:

Please provide your comments by **December 14, 2010.**

☐ I do ☐ Do not desire a response.

Please Print:

Name:

Address:

Phone:

Email:

THANK YOU FOR PARTICIPATING

Your comments are important to the success of this project. We will give careful consideration to all of the comments and information received as we continue with project development.

Mailing Instructions:

- Fold the form into thirds
- Tape the form shut so the address shows
- Stamp and mail the form

Fold Second

Howard R. Green Company
Attn: Stacy Woodson
P.O. Box 9009
Cedar Rapids, IA 52409-9009

Fold First

Proposed Wind Turbine
Kirkwood Community College, Cedar Rapids, Iowa
Public Information Meeting
December 7, 2010

Name: _____

Property Address: _____

Notes: _____

Name: _____

Property Address: _____

Notes: _____

Howard R. Green Company

Meeting Notes

Subject:	Public Information Meeting
Project:	Kirkwood Community College Proposed Wind Turbine
Project Number:	10100015.01
Meeting Date:	4:00 – 6:00 PM, Tuesday, December 7, 2010
Meeting Location:	Kirkwood Community College, Jones Hall, Room 108
Notes by:	Mike Fisher, Ted McCaslin, Stacy Woodson

Attendees:

Kirkwood Community College
Dr. Mick Starcevich
Tom Kaldenberg
Iowa Office of Energy Independence
Jordan Vaughan
Howard R. Green Company
Mike Fisher
Ted McCaslin
Stacy Woodson
Public (see attached sign in sheet)
Leo Tonyan, 7212 Rolling Ridge Dr. SW, Cedar Rapids
Jim Off, 1223 40th St. Court NW, Cedar Rapids
Christopher Brandt, 5943 Murfield Dr. SW #4, Cedar Rapids
Jorge Lopez, Kirkwood Community College
Sandy Bell, 5665 Cornell St. SW, Cedar Rapids

Notice of Meeting:

Meeting notification letters were mailed to approximately 1,700 residents around Kirkwood Community College. A public notice announcing the date, time, and location of the meeting was published in the Cedar Rapids Gazette on November 26-28, 2010. Email notification of the meeting was sent on November 30, 2010 to local, state, and federal agencies with special interest in the proposed project (i.e. Cedar Rapids Planning Department, Iowa Office of Energy Independence, and U.S. Department of Energy). See attached meeting notification correspondence.

Howard R. Green Company

Meeting Notes

Meeting Exhibits & Displays:

- Handout - Summary of Proposed Project
- Location Map of Proposed Wind Turbine
- Computer Generated Images - Possible Visual Appearances
    - Looking northeast from Community Training & Response Center Building
    - Looking northwest from Kirkwood Facilities Building
    - Looking north from Jones Hall
    - Looking northeast from Kirkwood Hall
    - Looking southeast from Kirkwood Blvd. north entrance
    - Looking northeast from the southwest side of campus on Kirkwood Blvd.
    - Looking east from Kirkwood Blvd. at the main entrance.
    - Looking southeast from Kirkwood Blvd. & US 30 exit north of campus

Summary of the Meeting:

The purpose of the meeting was to introduce the public to Kirkwood Community College's proposal to construct a 2.5 megawatt wind turbine on campus. The meeting was held in Room 108 of Jones Hall on Kirkwood's Campus.

The meeting began at 4:00 PM. Five people signed in. Of the five, two were Kirkwood Community College instructors that teach in Jones Hall. Some of the general questions that were asked by the attendees included:

- Where the proposed turbine would be located?
- When the proposed turbine would be constructed?
- How much noise the turbine would generate?
- What environmental studies are being done to protect species?
- Who is funding the project?
- Where will the generated power go?

Prior to the meeting Tom Kaldenberg received a few phone calls from the public asking questions about the location, cost of the proposed project, and if nearby residents energy costs or taxes would go down with the installation of the proposed project.

The meeting concluded at 6:00 PM. No written comments were received at the meeting.

Proposed Wind Turbine
Kirkwood Community College, Cedar Rapids, Iowa
Public Information Meeting
December 7, 2010

SIGN IN FORM

First Name: Leo Last Name: Tonyan
Mailing Address: 7212 Rolling Ridge Dr SW
City, State, Zip: Cedar Rapids IA 52404
Phone Number: 319-804-3003

First Name: Jim Last Name: Off
Mailing Address: 1223 40th St Court
City, State, Zip: Cedar Rapids IA 52405
Phone Number: 319 398 5650

First Name: Christopher Last Name: Brandt
Mailing Address: 5943 Mount Pisgah Dr SW #4
City, State, Zip: Cedar Rapids IA
Phone Number: 319. 841. 2218

First Name: Jorge E Last Name: Lopez
Mailing Address: Kirkwood Community College
City, State, Zip:
Phone Number: 398-5426

First Name: Sandy Last Name: Bell
Mailing Address: 5665 Council St SW
City, State, Zip: CR
Phone Number: 365-6107

First Name: Last Name:
Mailing Address:
City, State, Zip:
Phone Number:

First Name: Last Name:
Mailing Address:
City, State, Zip:
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First Name: Last Name:
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First Name: Last Name:
Mailing Address:
City, State, Zip:
Phone Number:

First Name: Last Name:
Mailing Address:
City, State, Zip:
Phone Number:

Howard R. Green Company

November 19, 2010

Re: Public Information Meeting - Kirkwood Community College Proposed Wind Turbine

Dear Current Resident:

On behalf of Kirkwood Community College, you are invited to attend a Public Information Meeting on:

Tuesday, December 7, 2010, between 4:00 and 6:00 PM
at Kirkwood Community College, Jones Hall, Room 108

The purpose of this meeting is to discuss Kirkwood Community College's proposal to construct a wind turbine on the College's main campus. No formal presentation will be made at the meeting. Staff from Kirkwood and HR Green will be available during this time to answer questions regarding the proposal.

Kirkwood Community College is working with the Department of Energy and the Iowa Office of Energy Independence on a proposal to install a 2.5 megawatt wind turbine on the College's main campus in Cedar Rapids, Iowa. The proposed wind turbine would supply power directly to Alliant Energy's distribution system. The turbine would serve as the focal point for workforce development and continuing education programs that would foster employment and technical expertise in Iowa's evolving green economy. The proposed wind turbine would also be accessible as a tool for renewable energy-based educational programs that currently exist and are being developed at other Iowa community colleges.

For more information regarding the proposal, please contact:

Mr. Thomas Kaldenberg, Executive Director of Facilities
Kirkwood Community College
6301 Kirkwood Blvd SW, Cedar Rapids, IA 52406
Telephone: (319) 398-5569
Email: thomas.kaldenberg@kirkwood.edu

Sincerely,

HOWARD R. GREEN COMPANY

Michael G. Fisher
Vice President

Public Notice:

Kirkwood Community College will hold a Public Information Meeting to discuss the proposal of constructing a 2.5 megawatt wind turbine on the College's main campus. The meeting will take place on:

Tuesday, December 7, 2010, 4:00 to 6:00 PM
Kirkwood Community College, Jones Hall, Room 108

Staff will be available to answer questions. No formal presentation will be made. For more information regarding the proposed project contact: Mr. Thomas Kaldenberg, Executive Director of Facilities, Kirkwood Community College, 6301 Kirkwood Blvd SW, Cedar Rapids, IA 52406, (319) 398-5569, thomas.kaldenberg@kirkwood.edu.

THE ACES ON BRIDGE®

Bobby Wolff

"A man must be a little mad if he does not want to be even more stupid."

— Michel de Montaigne

. . . . . .

On this deal from the first session of last year's Blue Ribbon Pairs, South, with eight tricks in his hand facing an opening bid, decided to eschew a scientific approach. It is better to play the direct four-no-trump response as asking for aces, but North and South were at least on the same wavelength. After discovering that his partner held the relevant key-cards, South took a shot at seven spades.

At first things were going smoothly, but then came a hitch. Nikolay Demirev (West) rejected the traditional (but perhaps overrated) lead of a trump in favor of the club king. That appears to be a catastrophic decision when you look at all four hands, as declarer can now ruff two clubs in dummy.

South took trick one with dummy's ace, cashed the top hearts, discarding a diamond, crossed to the diamond ace and ruffed a club. He now played the diamond queen, ruffing it in hand, and ruffed his last club.

He only had to get back to hand to draw trumps to land his ambitious contract, and we can see that a diamond ruff is the way to do it. However, there was a problem, because on the second round of diamonds West had followed with the king!

That brilliant falsecard induced declarer to return to hand by ruffing a heart, which West was able to overruff. How much more satisfying than to lead a trump and defeat the contract in more pedestrian fashion.

NORTH 11-26-A
♠ 9 3
♥ A K 8 5 2
♦ Q J 9 8 4
♣ A

WEST
♠ J 8 4
♥ 7 6
♦ K 10 6
♣ K Q 6 3 2

EAST
♠ 5
♥ Q J 10 4 3
♦ 7 3 2
♣ 10 9 8 7

SOUTH
♠ A K Q 10 7 6 2
♥ 9
♦ A 5
♣ J 5 4

Vulnerable: Both
Dealer: North

The bidding:

South	West	North	East
		1 ♥	Pass
4 NT	Pass	5 ♣*	Pass
5 NT	Pass	6 ♥	Pass
7 ♠	All pass		

*Zero or three key-cards, counting the trump king as an ace

Opening lead: Club king

BID WITH THE ACES 11-26-B

South holds:
♠ J 8 4
♥ 7 6
♦ K 10 6
♣ K Q 6 3 2

South	West	North	East
	1 ♦	1 ♥	Pass
1 NT	Pass	2 ♣	Pass
?			

ANSWER: Your no-trump response suggested 8-12 points, so you are at the lower end of your range. But your trump support is outstanding. Not only might you make game, but you may not have much defense against a spade or diamond contract. I would raise to three clubs now, which does not promise the earth. (The "impossible" bid of two spades, or a cuebid of two hearts, would show a stronger hand.)

—

For details of Bobby Wolff's autobiography, "The Lone Wolff," contact kay15072@aol.com. If you would like to contact Bobby Wolff, e-mail him at bobbywolff@mindspring.com.

autos 150

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08 Ford Fusion SE, loaded, 20K $12,995
08 Mazda 6i, loaded, 39k $12,995
08 Honda Civic EX sedan, loaded, 40K $12,995
05 Mini Cooper loaded, navigation system, red $12,995
04 Honda Accord EX, V6, loaded, leather 70K $10,995
03 Volvo S-80 T6, loaded, leather, sunroof, 70K $10,995
07 Honda Accord, coupe, loaded, 50K $10,995
06 Mazda 6s, V6, loaded, 41K $10,995
07 Pontiac Vibe, loaded, 60K, great MPG $9,995
06 Ford Fusion SE, V6, loaded, 60K $9,995
08 Ford Focus SE, loaded, 40K $9,995
05 Nissan Altima SE, loaded, sunroof $9,995
06 Nissan Altima 2.5S, loaded, great MPG $9,995
04 Pontiac Grand Prix GTP, loaded, sunroof, new tires $9,850
06Ford Taurus SEL, loaded

vans 152

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06 Ford Escape XLT, loaded, 60K $10,995
05 Ford Escape XLT, AWD, V6, loaded, sunroof.....$10,500
06 Mercury Mariner Premier, loaded, leather $9,995
03 Mazda Tribute ES, loaded, sunroof, 80K $7,995
AUTOLAND 365-7891
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CADILLAC 2000 Escalade, Black 130k mi., Bose sound system. $6,500 or best offer. 319-521-5931

CHEVY 2001 Tahoe LT w/ autoride suspension. Fully loaded, 151k miles, 4WD, Black exterior, Grey interior, CD/DVD, dual airbags, leather, power everything, air, sun roof, tow package. Excellent condition, $8900. (319)360-2959

CHEVY 2000 Silverado, 4WD Z71 LT, Heated Leather, Topper, 147k Miles, $7950 (319)899-1054 dougkelley70@gmail.com

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CHEVY 1999 Tahoe LT, only 94k mi., leather heated seats, rear air controls, tow package, new tires, Chrome Eagle Alloy Rims, Great Shape! All the 4-wheel Drive Power You Need for Winter. $7500/obo. 533-5521

CHEVY 1998 Tahoe 4x4, over $4,000 of upgrades, includes KC day lights, upgraded stereo system, running boards, brush guard, lots of extras. $3,850. 319-360-9345 or 563-249-4335.

CHEVY 1996 Suburban LT, 2WD, leather, tow package, rear heat/air, running boards, 3rd seat, near new tires, extremely well maintained, 205k mi. $3900/OBO. 319-851-5474

CHEVY 1990 C1500 V-8 automatic, air, great winter driver, $1,450. 319-393-6315

CHEVY 1989 Silverado. Half-Ton, 4wd, power steering, brakes, automatic, new motor, new paint, $2000. 319-936-1217

FORD 2006 F-350 short bed dually, 42,500 miles, 6L diesel engine, 4x4, XLT Lariat, white in color, excellent condition. Must sell. $29,500 or best offer. 608-632-2669.

02 Ford F-150 Lariat Crew 6995
06 Hyundai Sonata 62k.....6995
79 Pontiac Firebird.....6995
05 Chevy Uplander.....5995
98 Jeep Wrangler 4x4 75k.....5995
95 Jeep Cherokee 4x4 Plow.....5995
05 Pontiac Grand Prix.....5295
00 Mitsubishi Eclipse 115k.....3995
98 Dodge Durango 4x4.....3995
99 Volvo V70 4x4 Wagon.....3995
90 Dodge 350 Dump Truck.....3995
03 Buick Century 130K.....3295
97 Chevy Blazer 4x4.....2995
99 GMC Safari 4x4.....2295
97 Olds Bravada.....1995
99 Buick Century.....1995
97 Chevy Venture.....1895
96 Pontiac Grand Am.....1695

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319-438-1917

FORD 1998 F-150, 4x4, X-Cab, excellent condition, $4800. 319-431-7269.

FORD 1996 RANGER PICKUP 4 cylinder, runs but needs work. Make an offer. 319-393-0708, 319-899-7907.

GMC 2008 Sierra 1500 4x4 X-cab SLE, 11,000 miles, 5.3 auto, highly optioned & accessories, $28,995. 319-849-2940.

GMC 2005 1/2 ton reg. cab, 8' box, V8 automatic, 4x4, 61k, $12,300. $1000's below book. 319-329-2986. Nice truck.

GMC 1988 K3500, automatic, 4WD, 454 V-8, 3 year old 7 1/2 ft. Hiniker snowplow. Body rusty but ready to push snow. $2750.00 (319)321-0555 pbryant@southslope.net

parts & supplies 161

BRIDGESTONE Blizzak 235-60R-18 Snow Tires (4 tires), barely used. $200.00 (319)360-3944

CHEVY TRUCK PARTS - 66-98 motors, body parts, tranny, rear end. $5-500. 319-981-3210

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vehicles, parts wanted 162

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motorcycles, ATVs 166

2002 Kasea Sense, Hawkeye yellow with trunk, $799. Don's Honda, 537 Hwy 1 W., Iowa City, 319-338-1077 www.donshonda.com

2007 VFR800, 25th anniversary edition, 500 miles, fuel-injection V-Four engine. Don's Honda, 537 Hwy 1 W., Iowa City, 319-338-1077 www.donshonda.com

2 Yamaha Grizzly ATV's. 2007, 125cc, automatic,$2,600. 2006, 80cc, $ 2,400. both in excellent condition, Camafiouge, both very few hours. 319-378-3148

RVs, camping equipment 170

DAMON 2005 Challenger, 371, Class A motor home. 37', 22k mi., 2 slides, non smoker, very clean. Sell below book. $50,000. Swisher Bank (319) 857-4131

FOREST-RIVER 2005 Cardinal 5th wheel Camper, 33'L, 29' living space, 2 slides, king size bed, rear kitchen, loaded! $26,500/ or best offer. Call 319-350-2880.

GULFSTREAM, 2004, Yellowstone, 5th wheel Y30FSK XL edition, 30' with 3 slides and hitch. $22,500. 319-432-2726

Ketelsen RV
319-377-8244 ketelsenrv.com

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lost and found 206

LOST: Cat, large male orange tabby, very friendly, no collar, but has micro chip. Last seen November 10, in Mt Vernon. REWARD. Please call 895-8017

LOST: Large red dog, "Red" & Black & tan German Shepherd, "Tank", both neutered, in Palo area. Reward. 319-432-5708.

notices 208

GENERAL Contractor, Walsh II, is soliciting local Iowa Subcontractors for bids on the Iowa Corrections Institution for Women Building Package Project in Mitchellville. This $45mm project includes construction of 4 new buildings and the renovation and expansion of 1 existing building. Targeted Small Business are encouraged to bid. Bids will be received until 5pm 12/8 via fax at 312-563-5466. For more information and to obtain drawings please contact Michael Pearson at 312-563-5400 or mpearson@walshgroup.com

GENERAL Contractor, Walsh II, is soliciting local Iowa Subcontractors for bids on the Iowa Corrections Institution for Women Additional Site Preparation Project in Mitchellville. This $3.9mm project includes Site grading, site electrical work, site utilities and a new geothermal well field. Targeted Small Business are encouraged to bid. Bids will be received until 5pm 12/6 via fax at 312-563-5466. For more information and to obtain drawings please contact Michael Pearson at 312-563-5400 or mpearson@walshgroup.com

PUBLIC NOTICE:
Kirkwood Community College will hold a Public Information Meeting to discuss the proposal of constructing a 2.5 megawatt wind turbine on the College's main campus. The meeting will take place on: Tuesday, Dec. 7, 2010, 4:00 to 6:00 PM Kirkwood Community College, Jones Hall, Room 108.
Staff will be available to answer questions. No formal presentation will be made. For more information regarding the proposed project contact: Mr. Thomas Kaldenberg, Executive Director of Facilities, Kirkwood Community College, 6301 Kirkwood Blvd SW, Cedar Rapids, IA 52406, (319)398-5569 thomas.kaldenberg@kirkwood.edu

personals 212

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announcements

lost and found 206

FOUND: Female black & white border collie mix, very friendly, found in Lisbon / Mt Vernon area. 319-721-4663

LOST: Cat, large male orange tabby, very friendly, no collar, but has micro chip. Last seen November 10, in Mt Vernon. REWARD. Please call 895-8017

LOST: Large red dog, "Red" & Black & tan German Shepherd, "Tank", both neutered, in Palo area. Reward. 319-432-5708.

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Horoscopes

Check the day's rating: 10 is the easiest day, 0 the most challenging.

November 27

Sagittarius (Nov. 22-Dec. 21): (8) Take time today for charitable activity. It could be as simple as dropping off items at the thrift store, or mailing a letter. Maintain a thankful perspective.

Capricorn (Dec. 22-Jan. 19): (8) Now you're ready to take on something different. Plan your budget carefully to avoid overlooking a significant obligation. Then move forward confidently.

Aquarius (Jan. 20-Feb. 18): (7) Prepare early for today's activities. That way you can relax and enjoy the afternoon without worry while surrounded by special people. Savor the conversation.

Pisces (Feb. 19-March 20): (6) With a little effort, you get everyone involved today. You're out the door, ready to run circles around obstacles. Bring a cell phone and arrange where to meet up.

Aries (March 21-April 19): (8) The atmosphere relaxes now, as each person finds their own entertainment for the day. You might even have time to watch a romantic movie. Enjoy the rest.

Taurus (April 20-May 20): (8) Career associates have brilliant imaginations about how to proceed. There's great chatter before everyone settles down to get the work done.

Gemini (May 21-June 21): (5) Make the most of today's potential. Use your imagination to get others moving. Motivation can be tricky, but you can handle it. Their energy brings it alive.

Cancer (June 22-July 22): (5) Try to do everything you need to accomplish today without spending. You'd be surprised how many things on the list respond to simple elbow grease.

Leo (July 23-Aug. 22): (5) You get a surprise call from someone completely off your radar. Catching up allows you to recall times past and renew your faith in the durability of friendship.

Virgo (Aug. 23-Sept. 22): (6) You get busy early and check off minor tasks. Then it's easier to get with everyone else's program. Stick to your list if shopping, or pay a premium.

Libra (Sept. 23-Oct. 22): (8) Take time out to create something beautiful. You don't have to spend much. In fact, you may not even need to leave home. Just grant yourself freedom to explore.

Scorpio (Oct. 23-Nov. 21): (7) Your personal energy is on track at the desired pace to achieve a major goal. Give yourself time in the morning to get rolling, then don't stop.

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pets

dogs 385

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CHIHUAHUA Puppies, MALES, shots, dewormed, paper trained and puppy kit, $150. CASH. 319-474-2211.

DACHSHUND born 8/19/10, black and tan female, black and tan male, red and tan male neutured, $110. 641-660-1378

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DASCHUND PUPPIES, 2 females, $150/ea. 1 male, $200. 10 weeks old, ready to go, shots & wormed. 563-608-0989.

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GOLDEN-RETIEVERS, AKC, both parents on 20 acres. Was $600/ea., Now $300/ea. (563) 381-2908

GREAT Dane AKC, black w/white markings 2 females 4 months old. european bloodlines $350 (319)213-3647 krisif99@gmail.com

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LAB-MIX puppies, 12 weeks old, $40/ea. (319) 213-6040.

LAB PUPPIES, AKC, Black females, family raised, 11 weeks old, current on shots, $150. 319-551-8173.

LABS, AKC, chocolate & black, shots & wormed, will be ready 12/6, will hold for Christmas. $200-$225. 319-430-0419.

LABS AKC Fox Red, Adult male & female, excellent pedigree & breeders $150.00/ea (319)573-1456

LABS - Yellow 10 wks. old, shots, wormed, mother on site. 5 females, 1 male, $100/ea. 319-480-2233.

dogs 385

YORKIE pups, registered, vet checked, great nonshedding pets! $475 and up. 319-310-8683. www.knappcreek.com

YORKSHIRE terrier puppies AKC. 1 male, $275, 1 female, $375. Shots, wormed, must go to good home. Cash 319-646-1130

cats 386

KITTENS: 14 weeks old. FREE! Shots & wormed. Litter trained 319-360-5511

KITTENS, Home raised, med hair, 8 weeks old, litter trained, 3 females, 1 white & gray stripe, 1 black & white, 1 black, $20 each. 1 white male, $50. 319-438-1319, 319-210-5223

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pets, other 387

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CHEVY 1989 Silverado. Half-Ton, 4wd, power steering, brakes, automatic, new motor, new paint, $2000. 319-936-1217

DODGE 2004 Ram Crew Cab, 4x4.....$13,495
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JEEP 2007 Liberty, 4x4, 22k miles, power windows & locks.$17,850 AB AUTO, 2710 150th Ave. Manchester • 319-310-3020

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vehicles, parts wanted 162

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motorcycles, ATVs 166

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RVs, camping equipment 170

FOREST-RIVER 2005 Cardinal 5th wheel Camper, 33'L, 29' living space, 2 slides, king size bed, rear kitchen, loaded! $26,500/or best offer. Call 319-350-2880.

GULFSTREAM, 2004, Yellowstone, 5th wheel Y30FSK XL edition, 30' with 3 slides and hitch. $22,500. 319-432-2726

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MAXLITE 2005 ML25RS, front 3 bed bunk house, rear hard side slide out with queen bed, bought new in 2007, many extras, hitch & sway bar. Reduced to $11,500. 319-541-0503.

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boats 172

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seatasea.com 365-6066

89 SeaNymph 17, 80hp $5750
93 Fischer 17, 115hp $6995
08 Ranger 619, 225-kicker .....Call
09 Lund SSV14, trailer $3595
90 Cobalt 252, 454 .....$15,950
95 Maxum 1800, I/O $4500
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KENNEDY MARINE
4625 6th St SW, Cedar Rapids IA
319.366.2896, kennedymarine.com
NOTE: New Winter Hours!
Tues -Fri 8/5, Sat till noon.

snowmobiles 174

SKI-DOO/CAN-AM
$150,000 in clothing
10 - 800Etec
Garys, Independence.
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All makes & models.
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2008 Yamaha Nytro, 1049cc,brand new. .....Sale $9128
Iowa City Motorsports 155 Escort Ln, Iowa City 319-351-5900
iowacitymotorsports.com

YOUTH Snowmobile Safety Class Sponsored by The Frozen Few Snowmobile Club. Dec. 2nd & 3rd, 5-9pm. For more info contact Al at 319-362-2173

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GENERAL Contractor, Walsh II, is soliciting local Iowa Subcontractors for bids on the Iowa Corrections Institution for Women Additional Site Preparation Project in Mitchellville. This $3.9mm project includes Site grading, site electrical work, site utilities and a new geothermal well field. Targeted Small Business are encouraged to bid. Bids will be received until 5pm 12/6 via fax at 312-563-5466. For more information and to obtain drawings please contact Michael Pearson at 312-563-5400 or mpearson@walshgroup.com

GENERAL Contractor, Walsh II, is soliciting local Iowa Subcontractors for bids on the Iowa Corrections Institution for Women Building Package Project in Mitchellville. This $45mm project includes construction of 4 new buildings and the renovation and expansion of 1 existing building. Targeted Small Business are encouraged to bid. Bids will be received until 5pm 12/8 via fax at 312-563-5466. For more information and to obtain drawings please contact Michael Pearson at 312-563-5400 or mpearson@walshgroup.com

PUBLIC NOTICE:
Kirkwood Community College will hold a Public Information Meeting to discuss the proposal of constructing a 2.5 megawatt wind turbine on the College's main campus. The meeting will take place on: Tuesday, Dec. 7, 2010, 4:00 to 6:00 PM Kirkwood Community College, Jones Hall, Room 108.
Staff will be available to answer questions. No formal presentation will be made. For more information regarding the proposed project contact: Mr. Thomas Kaldenberg, Executive Director of Facilities, Kirkwood Community College, 6301 Kirkwood Blvd SW, Cedar Rapids, IA 52406, (319)398-5569 thomas.kaldenberg@kirkwood.edu

personals 212

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services

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Woodson, Stacy

From: Woodson, Stacy
Sent: Tuesday, November 30, 2010 1:09 PM
To: 'Melissa.rossiter@go.doe.gov'; 'Chris.paulsen@go.doe.gov'; 'Henry.fowler@go.doe.gov'; 'Jamie.cornell@go.doe.gov'; 'Paritosh.kasotia@iowa.gov'; 'Kevin.eppens@iowa.gov'; 'rholder@jason.com'; 'B.Larson@cedar-rapids.org'; 'kirsten.running-marquardt@legis.state.ia.us'; 'wally.horn@legis.state.ia.us'; 'linda.langston@linncounty.org'
Cc: 'Tkalden@kirkwood.edu'; Fisher, Mike; McCaslin, Ted
Subject: Kirkwood Wind Turbine - Public Information Meeting
Attachments: Public_Notice_for_Media.pdf

This is a reminder that the public information meeting for the proposed wind turbine at Kirkwood Community College is on Tuesday, December 7 from 4 to 6 PM. The meeting is on Kirkwood's Campus in Jones Hall, Room 108. The attached notice was published in the Cedar Rapids Gazette Nov. 26-28. Please let me know if you have questions regarding the upcoming public meeting.

Thank you,

Stacy E. Woodson, P.E.
Group Leader/Project Manager
Howard R. Green Company
progress.innovation.expertise

8710 Earhart Lane SW
Cedar Rapids, IA 52404
Direct: 319-841-4390
Fax: 319-841-4012
Visit: www.hrgreen.com for recent news.

APPENDIX B

Consultation Letters

Federal Aviation Administration

« OE / AAA

ALL of My Cases (Off Airport)

All Cases	Filter by Case Status	Cases Requiring Action
Show All Cases (4)	Draft (0) | Accepted (4) | Work in Progress (0) Determined (0) | Circularized (0) | Terminated (0)	7460-2 Required (0) | Add Letter (0)

Records 1 to 4 of 4 Page 1 of 1

Project Name	Structure Name	ASN	Status	Date Accepted	Date Determined	City	State
KIRKW-000144233-10	Site 2	2010-WTE-6054-OE	Accepted	04/15/2010		Cedar Rapids	IA
KIRKW-000144233-10	Site 3	2010-WTE-6055-OE	Accepted	04/15/2010		Cedar Rapids	IA
KIRKW-000144233-10	Site 4	2010-WTE-6052-OE	Accepted	04/15/2010		Cedar Rapids	IA
KIRKW-000144233-10	Site 1	2010-WTE-6053-OE	Accepted	04/15/2010		Cedar Rapids	IA

Rows per Page: 20

Records 1 to 4 of 4 **Page:** 1 Page 1 of 1

Draft: Cases that have been saved by the user but have not been submitted to the FAA.
Accepted: Cases that have been submitted to the FAA.
Add Letter: Cases that have been reviewed by the FAA and require additional information from the user.
Work in Progress: Cases that are being evaluated by the FAA.
Determined: Cases that have a completed aeronautical study and an FAA determination.
Terminated: Cases that are no longer valid.
Please allow the FAA a minimum of 30 days to complete a study.
Click here to contact the appropriate representative.

Federal Aviation Administration

« OE/AAA

Notice of Proposed Construction or Alteration - Off Airport

Project Name: KIRKW-000144233-10 **Sponsor:** Kirkwood Community College

Details for Case : Site 1

Show Project Summary

Case Status

ASN:	2010-WTE-6053-OE	**Date Accepted:**	04/15/2010
Status:	Accepted	**Date Determined:**	
		Letters:	None
		Documents:	04/15/2010 Site_1_Maps.pdf

Construction / Alteration Information

Notice Of:	Construction
Duration:	Permanent
if Temporary :	Months: Days:
Work Schedule - Start:	09/01/2010
Work Schedule - End:	05/31/2011
State Filing:	Not filed with State

Structure Summary

Structure Type:	Wind Turbine
Structure Name:	Site 1
FCC Number:	
Prior ASN:	

Structure Details

Latitude:	41° 54' 52.56'' N
Longitude:	91° 38' 58.37'' W
Horizontal Datum:	NAD83
Site Elevation (SE):	821 (nearest foot)
Structure Height (AGL):	377 (nearest foot)
Requested Marking/Lighting:	White-medium intensity
Other :	
Recommended Marking/Lighting:	
Current Marking/Lighting:	None
Other :	
Nearest City:	Cedar Rapids
Nearest State:	Iowa
Description of Location:	Kirkwood Community College main campus in Cedar Rapids, Iowa. Section 15, Township 82N, Range 7W.
Description of Proposal:	Construct four 1.5 MW (or greater) wind turbines at the Cedar Rapids, Iowa campus. No buildings or overhead transmission lines are included in the proposed proejct at this time.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Federal Aviation Administration

« OE/AAA

Notice of Proposed Construction or Alteration - Off Airport

Project Name: KIRKW-000144233-10 **Sponsor:** Kirkwood Community College

Details for Case : Site 2

Show Project Summary

Case Status

ASN:	2010-WTE-6054-OE	**Date Accepted:**	04/15/2010
Status:	Accepted	**Date Determined:**	
		Letters:	None
		Documents:	04/15/2010 Site_2_Maps.pdf

Construction / Alteration Information

Notice Of:	Construction
Duration:	Permanent
if Temporary :	Months: Days:
Work Schedule - Start:	09/01/2010
Work Schedule - End:	05/31/2011
State Filing:	Not filed with State

Structure Summary

Structure Type:	Wind Turbine
Structure Name:	Site 2
FCC Number:	
Prior ASN:	

Structure Details

Latitude:	41° 54' 22.25'' N
Longitude:	91° 38' 25.23'' W
Horizontal Datum:	NAD83
Site Elevation (SE):	825 (nearest foot)
Structure Height (AGL):	377 (nearest foot)
Requested Marking/Lighting:	White-medium intensity
Other :	
Recommended Marking/Lighting:	
Current Marking/Lighting:	
Other :	
Nearest City:	Cedar Rapids
Nearest State:	Iowa
Description of Location:	Kirkwood Community College main campus in Cedar Rapids, Iowa. Section 15, Township 82N, Range 7W.
Description of Proposal:	Construct four 1.5 MW (or greater) wind turbines at the Cedar Rapids, Iowa campus. No buildings or overhead transmission lines are included in the proposed proejct at this time.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Federal Aviation Administration

« OE/AAA

Notice of Proposed Construction or Alteration - Off Airport

Project Name: KIRKW-000144233-10 **Sponsor:** Kirkwood Community College

Details for Case : Site 3

Show Project Summary

Case Status

ASN:	2010-WTE-6055-OE	**Date Accepted:**	04/15/2010
Status:	Accepted	**Date Determined:**	
		Letters:	None
		Documents:	04/15/2010 Site_3_Maps.pdf

Construction / Alteration Information

Notice Of:	Construction
Duration:	Permanent
if Temporary :	Months: Days:
Work Schedule - Start:	09/01/2010
Work Schedule - End:	05/31/2011
State Filing:	Not filed with State

Structure Summary

Structure Type:	Wind Turbine
Structure Name:	Site 3
FCC Number:	
Prior ASN:	

Structure Details

Latitude:	41° 54' 29.29'' N
Longitude:	91° 38' 34.42'' W
Horizontal Datum:	NAD83
Site Elevation (SE):	825 (nearest foot)
Structure Height (AGL):	377 (nearest foot)
Requested Marking/Lighting:	White-medium intensity
Other :	
Recommended Marking/Lighting:	
Current Marking/Lighting:	
Other :	
Nearest City:	Cedar Rapids
Nearest State:	Iowa
Description of Location:	Kirkwood Community College main campus in Cedar Rapids, Iowa. Section 15, Township 82N, Range 7W.
Description of Proposal:	Construct four 1.5 MW (or greater) wind turbines at the Cedar Rapids, Iowa campus. No buildings or overhead transmission lines are included in the proposed proejct at this time.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Federal Aviation Administration

« OE/AAA

Notice of Proposed Construction or Alteration - Off Airport

Project Name: KIRKW-000144233-10 **Sponsor:** Kirkwood Community College

Details for Case : Site 4

Show Project Summary

Case Status

ASN: 2010-WTE-6052-OE
Status: Accepted
Date Accepted: 04/15/2010
Date Determined:
Letters: None
Documents: 04/15/2010 Site_4_Maps.pdf

Construction / Alteration Information

Notice Of: Construction
Duration: Permanent
if Temporary : Months: Days:
Work Schedule - Start: 09/01/2010
Work Schedule - End: 05/31/2011
State Filing: Not filed with State

Structure Summary

Structure Type: Wind Turbine
Structure Name: Site 4
FCC Number:
Prior ASN:

Structure Details

Latitude: 41° 54' 59.51" N
Longitude: 91° 39' 3.19" W
Horizontal Datum: NAD83
Site Elevation (SE): 810 (nearest foot)
Structure Height (AGL): 427 (nearest foot)
Requested Marking/Lighting: White-medium intensity
Other :
Recommended Marking/Lighting:
Current Marking/Lighting:
Other :
Nearest City: Cedar Rapids
Nearest State: Iowa
Description of Location: Kirkwood Community College main campus in Cedar Rapids, Iowa. Section 15, Township 82N, Range 7W.
Description of Proposal: Construct four 1.5 MW (or greater) wind turbines at the Cedar Rapids, Iowa campus. No buildings or overhead transmission lines are included in the proposed proejct at this time.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Federal Aviation Administration

« OE / AAA

Project Submission Success
Project Name: KIRKW-000144233-10

Project **KIRKW-000144233-10** has been submitted successfully to the FAA.

Please return to the system at a later date for status updates.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2010-WTE-6052-OE

Issued Date: 04/20/2010

Thomas Kaldenberg
Kirkwood Community College
6301 Kirkwood Boulevard SW
Cedar Rapids, IA 52404

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine Site 4
Location:	Cedar Rapids, IA
Latitude:	41-54-59.51N NAD 83
Longitude:	91-39-03.19W
Heights:	427 feet above ground level (AGL) 1237 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the structure would not be a hazard to air navigation provided the following condition(s) is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual),&12.

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.

This determination expires on 04/20/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is subject to review if an interested party files a petition that is received by the FAA on or before May 20, 2010. In the event a petition for review is filed, it must contain a full statement of the basis upon which it is made and be submitted in triplicate to the Manager, Airspace and Rules Division - Room 423, Federal Aviation Administration, 800 Independence Ave., Washington, D.C. 20591.

This determination becomes final on May 30, 2010 unless a petition is timely filed. In which case, this determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review. For any questions regarding your petition, please contact Office of Airspace and Rules via telephone -- 202-267-8783 - or facsimile 202-267-9328.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

This aeronautical study considered and analyzed the impact on existing and proposed arrival, departure, and en route procedures for aircraft operating under both visual flight rules and instrument flight rules; the impact on all existing and planned public-use airports, military airports and aeronautical facilities; and the cumulative impact resulting from the studied structure when combined with the impact of other existing or proposed structures. The study disclosed that the described structure would have no substantial adverse effect on air navigation.

An account of the study findings, aeronautical objections received by the FAA during the study (if any), and the basis for the FAA's decision in this matter can be found on the following page(s).

If we can be of further assistance, please contact Michael Blaich, at (404) 305-7081. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2010-WTE-6052-OE.

Signature Control No: 700482-124986380 (DNH -WT)
Sheri Edgett-Baron
Acting Manager, Obstruction Evaluation Service

Attachment(s)

Additional Information
Map(s)

Additional information for ASN 2010-WTE-6052-OE

The proposed construction would be located approximately 3.33 nautical miles (NM) northeast of the Eastern Iowa Airport (CID). It would exceed the Obstruction Standards of Title 14, Code of Federal Regulations (14 CFR), Part 77 as follows:

Section 77.23(a)(2) by 144 feet - a height that exceeds 283 feet above ground level within 3.33 NM as applied to CID.

The proposal was not circularized for public comment because current FAA obstruction evaluation policy exempts from circularization those proposals that exceed the above cited obstruction standard. This is provided the proposal does not lie within an airport traffic pattern. This policy does not affect the public's right to petition for review determinations regarding structures, which exceed the subject obstruction standards.

AERONAUTICAL STUDY FOR POSSIBLE INSTRUMENT FLIGHT RULES (IFR) EFFECT DISCLOSED THE FOLLOWING:

> The proposed structure would have no effect on any existing or proposed IFR arrival/departure routes, operations, or procedures.

> The proposed structure would have no effect on any existing or proposed IFR en route routes, operations, or procedures.

> The proposed structure would have no effect on any existing or proposed IFR minimum flight altitudes.

AERONAUTICAL STUDY FOR POSSIBLE VISUAL FLIGHT RULES (VFR) EFFECT DISCLOSED THE FOLLOWING:

> The proposed structure would have no effect on any existing or proposed VFR arrival or departure routes, operations or procedures.

> The proposed structure would not conflict with airspace required to conduct normal VFR traffic pattern operations at any known public use or military airports.

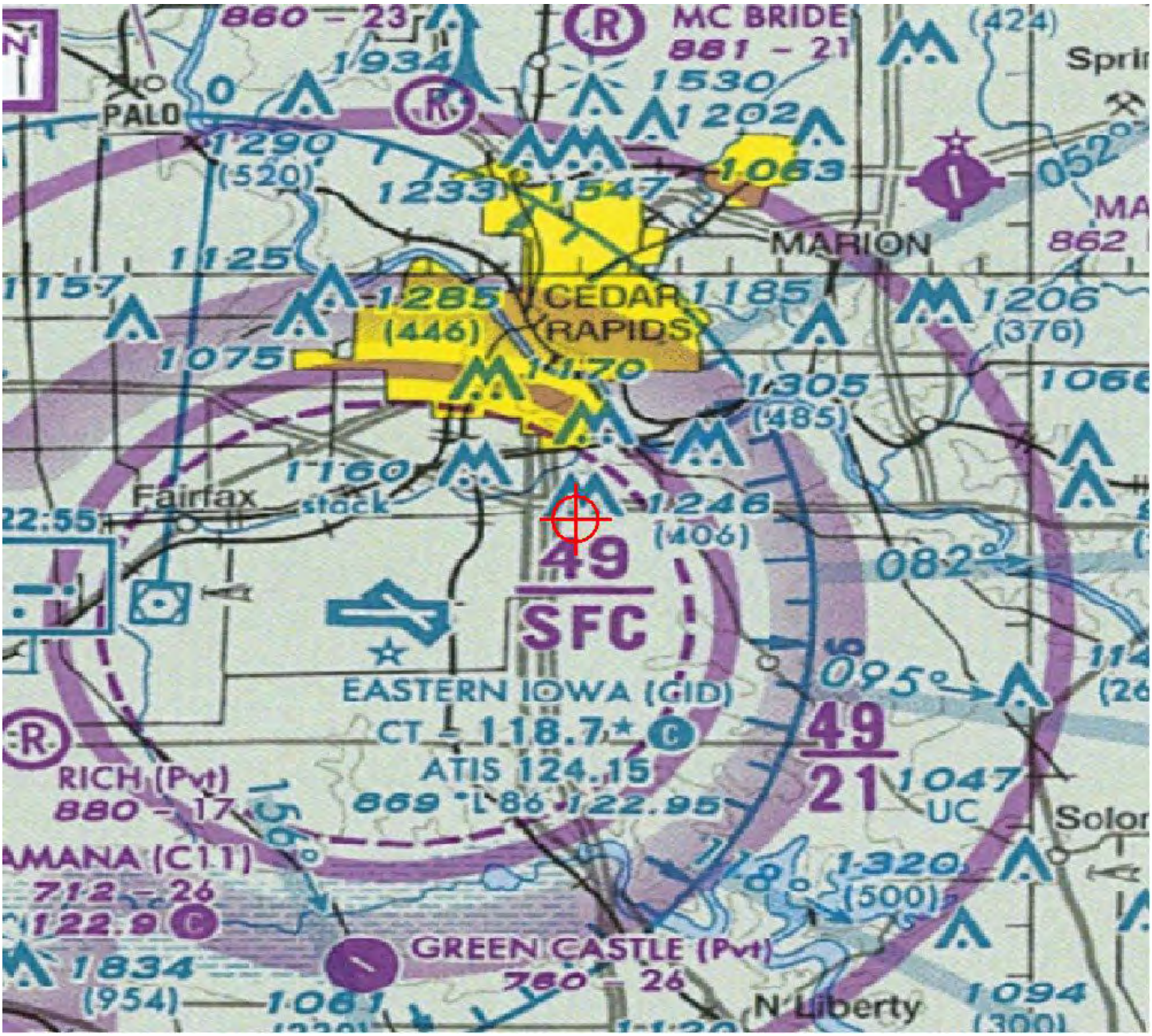
> The proposed structure would not penetrate those altitudes normally considered available to airmen for VFR en route flight.

> The proposed structure will be appropriately obstruction marked and lighted to make it more conspicuous to airmen flying in VFR weather conditions at night.

The cumulative impact of the proposed structure, when combined with other existing structures is not considered significant. Study did not disclose any adverse effect on existing or proposed public-use or military airports or navigational facilities. Nor would the proposal affect the capacity of any known existing or planned public-use or military airport.

Therefore, it is determined that the proposed construction would not have a substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on any air navigation facility and would not be a hazard to air navigation.

Sectional Map for ASN 2010-WTE-6052-OE



THE UNIVERSITY OF IOWA

REQUEST FOR IOWA SITE FILE SEARCH
Please note: A fee is assessed for this service.

Name: Ted McCaslin

Company/Agency: Howard R. Green Company

Address: 2550 University Ave W, STE 400N, St. Paul, MN 55114

Phone Number: 651-659-7708 FAX Number (business number only):651-644-9446

Email tmccaslin@hrgreen.com

I am: _____ Listed on the Iowa SHPO Archaeological Consultants List

_____ Certified by the Society of Professional Archaeologists

_____ On Registry of Professional Archaeologists

_____ Other qualifications (**specify**):

Purchase Order No. (if any): 10100015

Provide Information for this search by: ____ Fax _____Mail _X__Email

Agencies Sponsoring or Funding Project: Iowa Office of Energy Independence

Is this search for Section 106/NEPA Compliance? _X__Yes _____No

Area of Search County: Linn

Township: 82N Range: 7 Section: 15 Quarter Section(s) SW

Township:_____Range:_____Section:_____ Quarter Section(s)_____

USGS Quadrangle Map(s) Name (Please attach with project outlined): Cedar Rapids South

[search will be conducted for sites within one mile of project area] See attached Shapefiles

Maps may be downloaded and printed at **http://cairo.gis.iastate.edu/new_site/** (please use 1:24000 quads)

Repository for Project Documentation:_____

FOR OSA USE ONLY (below line)

ISF Search No._____ Date Received _____

Search Conducted by:_____ Date Completed:_____

Material Sent: _____Site Location Maps _____Site form copies (pgs)

_____Other _____Letter

Method Sent: _____Phone_____Fax_____Mail_____Email
(minutes) (pages) (ounces)

Office of the State Archaeologist 700 Clinton St. Bldg. Iowa City, Iowa 52242-1030 319/384-0732 FAX 319/384-0768
E-mail: OSA@uiowa.edu

THE UNIVERSITY OF IOWA

Friday, August 06, 2010

Ted McCaslin
Howard R. Green Company
2550 University Ave W, STE 400N
St. Paul MN 55114-

Ref: LN Linn **Iowa Site File Search No.** 2010157

Dear Ted:

I have conducted a search of the Iowa Site File for archaeological sites recorded within a one-mile radius of the project area described in your request for search on 8/2/2010 This area is within 82N-7W Sec.15 .
Our records indicate that no archaeological site has been reported to the OSA within or very near the project location . Three other sites were recorded within one mile of that location at the time of the records search. Other archaeological sites may be present at or near the project location but have not been discovered or reported to the OSA. Included along with this letter is a map of the survey and site file search location information and previously surveyed areas.

If you have not already done so, you may wish to consult with the State Historic Preservation Office (SHPO) to determine whether an archaeological survey may be needed. In the event that previously unidentified archaeological resources are discovered during ground disturbing activities on projects complying with Section 106 of the National Historic Preservation Act or other applicable federal and state laws, construction work should cease in the area of the resource and in the surrounding area where further subsurface remains can reasonably be expected to occur. The responsible federal or state agency and State Historic Preservation Office should be immediately notified and consulted about the discovery.

If during the course of construction or earthmoving signs of a human burial are encountered, those activities should be stopped at once and the Office of the State Archaeologist should be contacted immediately. Human burials may potentially include bone, ashes, or subterranean structures with or without overlying mound structures. All human burials in the state of Iowa are legally protected under Chapters 263B, 566, and 716 of the Iowa Code.

Should you need more information about a particular site, you may write to me including the appropriate site number in your request. Since every county has a different series of site numbers, be sure to include the full trinomial site designation in your request. This designation takes the form of 13XY### where XY is the county abbreviation and ### is the order in which site reports are received for a given county.

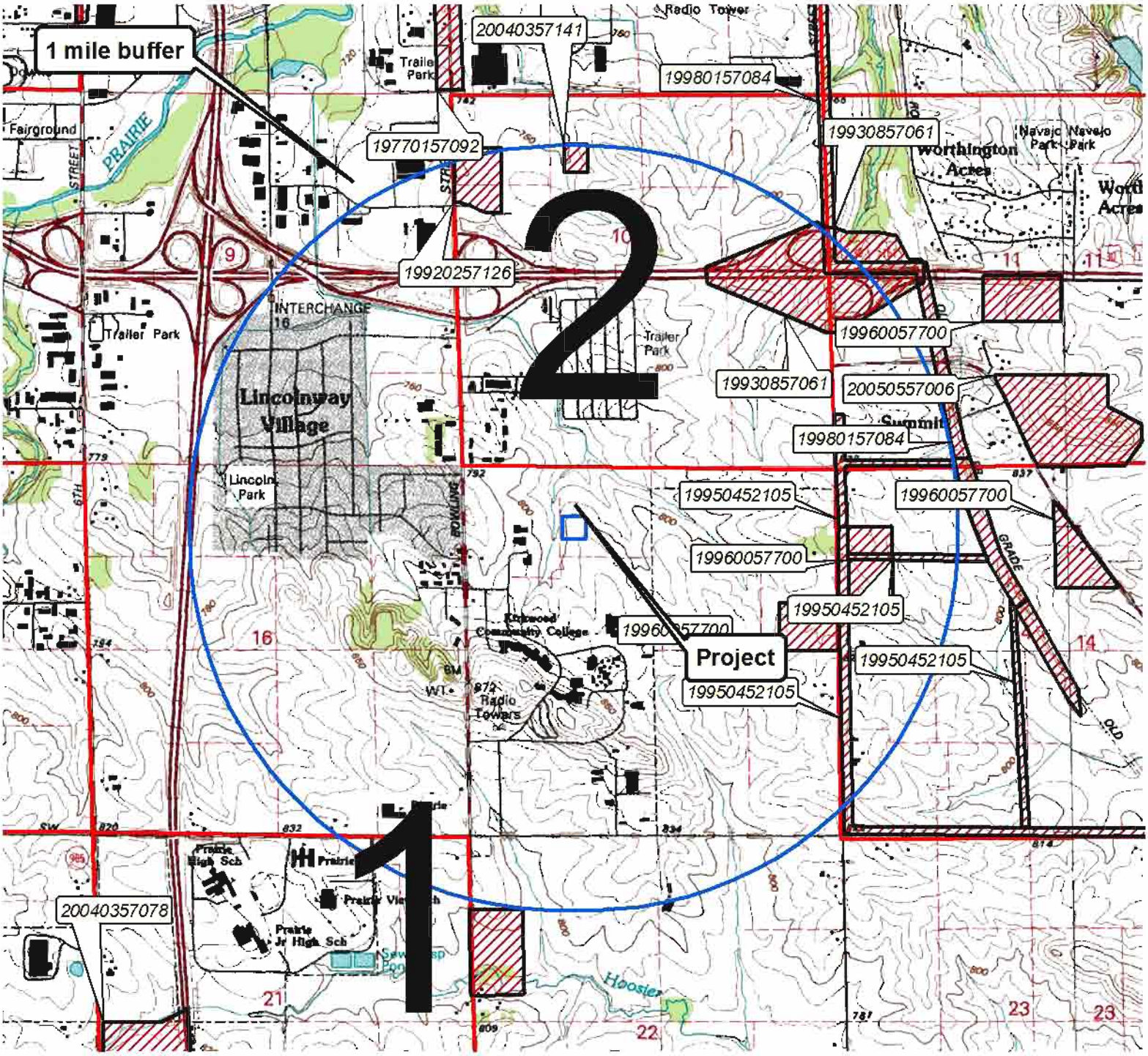
The information in this letter is intended to assist you in fulfilling any local, state, or federal laws and regulations related to archaeological sites concerning historic preservation such as Section 106 of the National Historic Preservation Act and to assist avoidance of any burial sites potentially located within the subject area. Prior to any federal undertaking, all archaeological sites should be evaluated for their National Register eligibility. Federal undertakings include but are not limited to projects receiving any federal financial support, technical assistance, licenses, or permits received by private landowners or federal, state, or local governments. The State Historical Preservation Office (SHPO) would need to be contacted for details about the final determination of significance for any site to be affected by a federal undertaking.
This letter is not meant to confirm or deny that any applicable requirements have been met.

Sincerely,

Colleen Eck
Site Records Manager
enclosure

SITE	Cultural Affiliation	Site Type	AREA	DTYPE
13LN634	Historic Euro-American	Historic farm/residence	2827.161	circle
13LN816	Prehistoric	Prehistoric scatter	314.129	dot
13LN817	Historic Euro-American	Historic farm/residence	489.761	polygon

Dtype definitions	
Polygon:	Boundaries and location known
Triangle:	Location and boundaries not certain
Inverted Triangle:	Location known, boundaries unknown
Dot: (10 m radius)	Location known, area < 20 m in any direction
Circle:	Location and site area known, exact boundaries not known



OSA Search 2010157
Linn County
Search Date 8/6/2010 CE

N

Precise locations outside of the project area may be withheld pursuant to Iowa Code 305A 10

This map contains confidential site location information Neither the map nor the associated data may be reproduced or distnbuted without the consent of the Office of the State Archaeologist

Data displayed on this map are current as of the date of this search, but are subject to additions and revisions without notice

2 Number of sites per section which occur within 1 mile buffer

Previously surveyed area "intense" labeled with SHPO R&C number

0 0.1250.25 0.5 Miles

0 0.3 0.6 1.2 Kilometers

STATE ARCHAEOLOGIST OF IOWA

Howard R. Green Company

July 1, 2010

Conservation and Recreation Division
Iowa Department of Natural Resources
502 E 9th St.
Des Moines, IA 50319-0034

Re: Environmental Review for Natural Resources

Dear Sir or Madam:

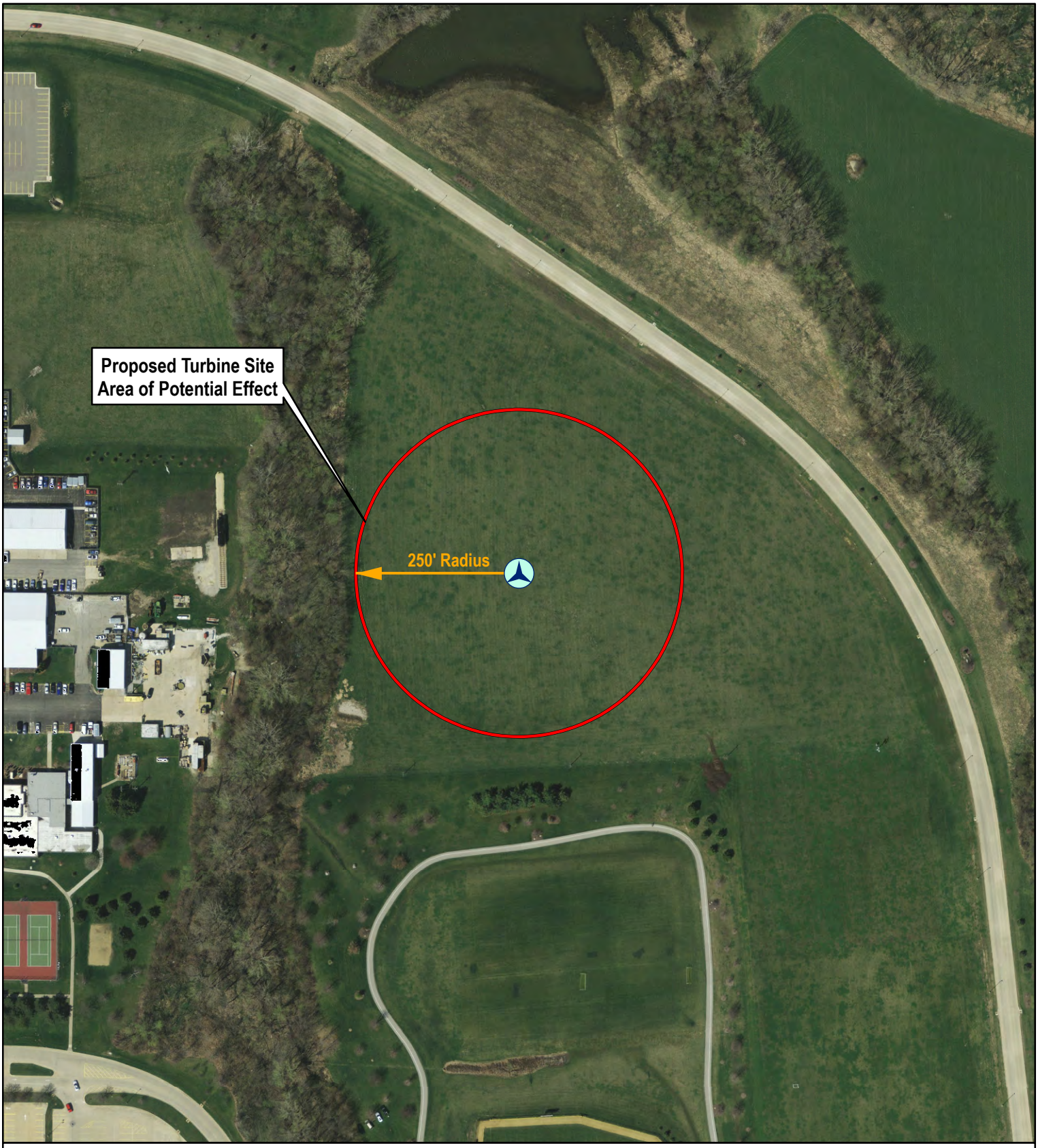
Kirkwood Community College is proposing the construction of wind energy facility. The proposed project consists of the installation of a 2.5 MW wind turbine on the Kirkwood Community College campus in Cedar Rapids Iowa. The project is located in Linn County in Section 15, Township 82N and Range 7W. The location proposed for construction is currently green space. Please see the attached site plan/aerial photograph and the location map. Howard R. Green Company, on behalf of Kirkwood Community College, is requesting an Environmental Review for Natural Resources for this project.

Sincerely,
HOWARD R. GREEN COMPANY

Ted McCaslin
Project Scientist

Enclosures:
Site Plan and Aerial Photo
Location Map

Court International Building | 2550 University Avenue W, Suite 400N | St. Paul, MN 55114
Phone: 651.644.4389 | Fax: 651.644.9446 | www.hrgreen.com



Area of Potential Effect (APE)

Proposed Turbine Location

250' Radius of Project Site

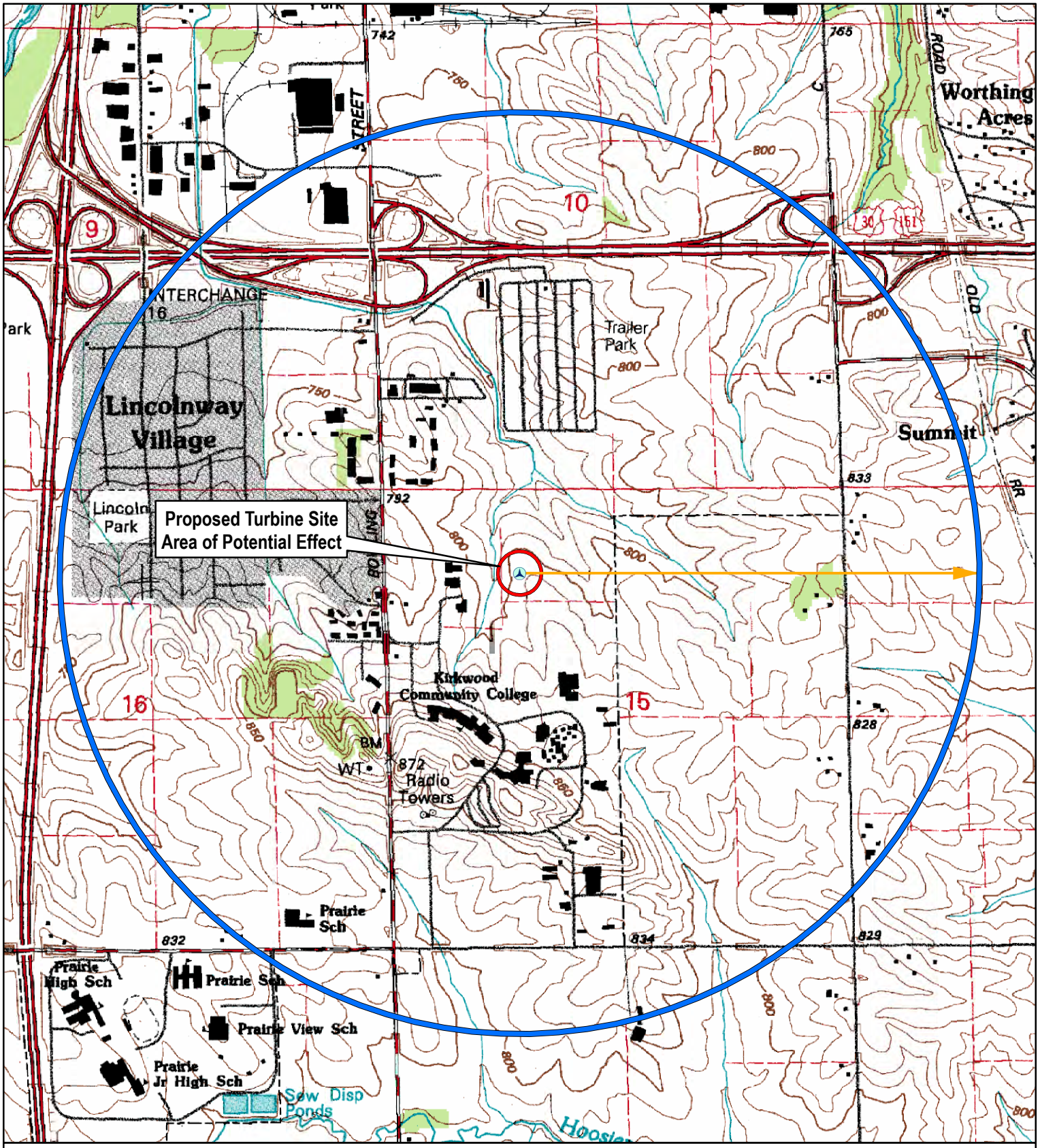
N

SITE PLAN & AERIAL PHOTO

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Source: Linn County GIS
0.5-ft resolution aerrial photo of Linn County, Iowa (2008)

Howard R. Green Company



Area of Potential Effect (APE)

1-Mile Buffer of APE

Proposed Turbine Location

1-Mile Radius of Project Site

N

0 750 1,500

Feet

LOCATION MAP

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company

Source: USDA, NRCS
Digital Raster Graphic Mosaic of Linn County, Iowa
USGS 7.5' Quad Mosaic for Linn County, 2002

JUL 2 3 2010

Fields of Opportunities

STATE OF IOWA

CHESTER J. CULVER, GOVERNOR
PATTY JUDGE, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
RICHARD A. LEOPOLD, DIRECTOR

July 16, 2010

Mr. Ted McCaslin
Howard R. Green Company
Court International Building
2550 University Ave. West
Suite 400N
St. Paul, MN 55114

RE: Environmental Review for Natural Resources
Wind Turbine Kirkwood Community College
Linn County
Section 15, Township 82N, Range 7W

Dear Mr. McCaslin:

Thank you for inviting Department comment on the impact of this project. Although the Department does not regulate wind farms, if relatively frequent bird and bat mortality is discovered at the turbine site, please contact the Department for further consultation as it is in the developer's interest to avoid potential conflict with federal and state-listed threatened and endangered species. The college should consider conducting spring and fall bird and bat mortality surveys. This work could be done by students as a learning experience and will add to the information concerning wildlife migration in Iowa. Information titled *Wind Energy and Wildlife Resource Management in Iowa: Avoiding Potential Conflicts* is here as an attachment and is available from the Department website at:

http://www.iowadnr.gov/wildlife/diversity/files/wind_wildliferecs.pdf

The Department, together with the U.S. Fish and Wildlife Service, recommends that tubular turbine supports rather than lattice supports are used to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching and nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with recommended bird deterrent devices (Avian Power Line Interaction Committee 1994).

This letter is a record of review for protected species, rare natural communities, state lands and waters in the project area, including review by personnel representing state parks, preserves, recreation areas, fisheries and wildlife but does not include comment from the Environmental Services Division of this Department. This letter does not constitute a permit. Other permits may be required from the Department or other state or federal agencies before work begins on this project.

Any construction activity that bares the soil of an area greater than or equal to one acre including clearing, grading or excavation may require a storm water discharge permit from the Department. Construction activities may include the temporary or permanent storage of dredge material. For more information regarding this matter, please contact Ruth Rosdail at (515) 281-6782.

The Department administers regulations that pertain to fugitive dust IAW Iowa Administrative Code 567-23.3(2)"c." All persons shall take reasonable precautions to prevent the discharge of visible emissions of

fugitive dusts beyond the lot line of property during construction, alteration, repairing or demolishing of buildings, bridges or other vertical structures or haul roads. All questions regarding fugitive dust regulations should be directed to Jim McGraw at (515) 242-5167.

If you have questions about this letter or require further information, please contact me at (515) 281-8524.

Sincerely,

Daryl Howell
Environmental Specialist
Conservation and Recreation Division

FILE COPY: Kelly Poole
Tracking Number: 5048

Enclosures

Suggested References

Anderson, R., M. Morrison, K. Sinclair, D. Strickland, H. Davis, and W. Kendall. 1999. Studying wind energy/bird interactions: a guidance document. Metrics and methods for determining or monitoring potential impacts on birds at existing and proposed wind energy sites. Avian Subcommittee, National Wind Coordinating Committee, Washington, DC. 87 pp.

Jain, A.A. 2005. Bird and bat behavior and mortality at a northern Iowa windfarm. M.S. Thesis, Iowa State Univ., Ames. 108pp.

Wind Energy and Wildlife Resource Management in Iowa:
Avoiding Potential Conflicts

Introduction

Iowa is on its way to ranking among the world's leading producers of wind-generated electrical energy. In our efforts to become less dependent upon fossil fuels, nuclear power, hydropower and other sources with frequent environmental concerns, the possibility of this "green" energy has caused much excitement. Many Iowans eagerly await expansion of this low-cost (after initial infrastructure investments) source of electricity as one step towards energy independence.

The Governor, General Assembly, and Department of Natural Resources all consider wind energy development in Iowa a high priority. With much open farmland upon which wind generators might be placed, and in a region of nation realizing relatively high average wind velocities, Iowa seems destined to be a national focal point for wind energy development. Many state and national conservation organizations also support increasing wind energy production.

No energy source has yet been found to be without some degree of environmental costs, however, and wind energy is no exception. It has been demonstrated that if proper siting of wind turbines is not carefully planned, certain locations may result in collisions with, and death of, both wild birds and bats. In one or two noteworthy instances, excessive mortality of hawks, eagles and other birds of prey has resulted in major modifications to both design and placement of wind turbines, or even periodic shut-downs of large facilities. Additional costs involved with such measures can reduce cost-effectiveness of energy production.

Iowa currently exercises minimal regulation on locating wind farms. Nevertheless, some energy companies recognize the benefits of consulting with wildlife resource managers *before* final decisions are made on siting of new facilities. Such actions will result in greater trust and cooperation between energy producers and those charged with protecting our wildlife resources This can lead to an orderly and beneficial development of Iowa's wind energy.

An *ad hoc* Iowa wind energy and wildlife discussion group has met infrequently to review current developments regarding wind energy and wildlife interactions. The group consists of representatives from Iowa DNR's Wildlife Bureau and Energy Section, US Fish & Wildlife Service, several non-governmental conservation organizations, energy companies, the Iowa Renewable Energy Association and other interested parties. The group has no rule-making or regulatory authority; rather it simply works cooperatively to discuss mutual concerns and to learn of the latest developments. A map of sensitive natural resource areas was cooperatively created by the group and is available from Iowa DNR and some other represented organizations, in hopes that it might serve as a helpful reference for wind energy development. The latest version of this map may be viewed at: http://www.iowadnr.com/energy/wind/windwildlife.html .

Wildlife Concerns

Just what are the problems wind turbines might pose to our wildlife and other natural resources? The most obvious is direct collisions of birds and bats with rotating blades. Fortunately for birds, the annual mortality rate at most Midwestern wind farms appears to remain relatively low and probably insignificant. An exception occurs when turbines are placed in or very near major migration corridors and pathways, such as large river valleys and ridgetops or bluffs. Because birds tend to follow or congregate along these natural landscape features during their semi-annual migrations, wind turbines placed near these features have potential for causing significant bird kills in spring and fall. A few examples of such landscapes in Iowa include the Des Moines River, Little Sioux River, Wapsipinicon River, Loess Hills, and Mississippi River blufflands. Still, with Iowa's mostly open landscape, birds generally are widely dispersed throughout much of the year and chance of interaction with turbines is small.

Bats present an entirely different situation. For reasons still mostly unknown, bat collisions and mortality is much higher than for birds at many wind farms. Early efforts are underway to attempt a better understanding of the problem, but little is known at this time. However, bats usually are associated with trees or wooded areas and wetlands, where the insects on which they feed are abundant. Wind turbines placed near woodlands and wetlands thus might reasonably be expected to result in more bat deaths than turbines situated in open farmlands.

An emerging concern for birds is wind turbines placed within or very near large expanses of grassland. In some western states, ground-nesting lesser prairie-chickens have been found to abandon their nesting grounds when wind turbines were erected and operated nearby. It is quite likely that Iowa's greater prairie-chickens, a state endangered species requiring large expanses of unbroken habitat, would exhibit similar behavior. Many other ground-nesting grassland birds have yet to be studied, but some of these species already are in steep decline nationwide and cannot risk another factor that might potentially threaten their survival. A leading cause of much bird decline is related to fragmentation, or "parcelization", of their remaining habitat, breaking it into parcels too small to meet certain birds' survival or reproductive needs. It has been suggested that wind turbines placed in the middle of a large grassland may similarly fragment habitat and greatly reduce its value. This is a question in need of much additional research.

In summary, adverse effects of wind turbines on birds and bats have been documented in some locations, but much remains to be learned. A few energy companies or developers have collaborated with wildlife researchers to conduct some desperately needed studies. They are to be recognized for their commitment to better conservation of all our natural resources. Nevertheless, much more research is needed, especially in comparing "before and after" effects upon wildlife where wind farms are constructed. Information garnered would be invaluable in helping with future wind farm siting decisions.

Wind Turbine Siting Recommendations and Guidelines

Until we more fully understand how wildlife interacts with wind turbines, interim guidelines have been prepared to help wind energy developers and producers do a better job of designing and siting their wind farms. The list of recommendations below will serve as a starting point for

things that *should* be considered when planning wind energy developments. These have been collected from a variety of sources, chief among them the US Fish & Wildlife Service Interim Guidelines for siting and construction of wind energy facilities, and recommendations from the National Wind Coordinating Committee. Keep in mind that this list is a *work in progress*, subject to change as new information is gained.

Siting Recommendations:

- Avoid placing turbines at locations where any species of fish, wildlife or plants protected under the federal Endangered Species Act have been documented. Information may be obtained by contacting the Iowa Department of Natural Resources Endangered Species Coordinator or Wildlife Bureau staff. Any action resulting in losses to federally-listed species could result in substantial fines or other penalties.
- Avoid placing turbines in or near recognized bird concentration areas or migration pathways, including lakes, wetlands, forests, river valleys, ridge tops or bluff tops, large grasslands, known bird roosting areas, public wildlife areas, parks, and areas with frequent incidence of fog mist or low clouds. While there is no firm information on the amount of buffer zone needed between turbines and these habitats, a separation distance of at least one mile might be considered an absolute minimum (more for prairie-chickens—see below).
- Avoid placement of turbines in or near areas where highly "area-sensitive" wildlife species, such as prairie-chickens, are known. Area-sensitive species *require* expansive, unfragmented habitat. For prairie-chickens in particular, a separation distance of at least 5 miles from all known leks (breeding grounds) is *strongly* recommended.
- Avoid placing turbines near documented bat hibernation, breeding or nursery colonies and in migration corridors (see bird recommendation above) or between known colonies and feeding areas.
- Avoid placement of multiple turbines in close proximity to one another or perpendicular to known migration pathways (typically north-south). Widely spaced turbines, in arrays parallel to normal bird migration routes, can reduce collisions.
- Reduce or eliminate availability of carrion within wind farms, to reduce chances of attracting eagles, vultures and other raptors colliding with turbine blades. Neither dead livestock nor wildlife should be left within or near wind farm boundaries.
- Place wind turbines in areas already fully developed for agriculture, especially row-crop farming, where there is minimal extant wildlife habitat—Iowa is especially rich in such lands, and it has been estimated that as much as 80% of Iowa's landscape might be considered suitable for wind energy development with few adverse effects upon wildlife.
- If wildlife habitat losses or fragmentation must be mitigated, develop a plan to create or restore habitat *away* from the wind farm site. This will serve to attract birds, bats and other wildlife away from the development and reduce collisions. Wherever possible, coordinate habitat mitigation sites with other public or private wildlife lands, to connect, enlarge or enhance those areas.
- Certain landscapes, such as the Loess Hills in western Iowa and the "Iowa Great Lakes Region" in northwest Iowa, are known for their beauty, rarity *and* for extensive wildlife breeding and migrating activities. Such landscapes should be avoided entirely both for biological and aesthetic reasons.

- Consider possible *cumulative* regional effects of multiple wind energy projects. While one project alone may result in few concerns for wildlife, multiple projects across one landscape could significantly multiply adverse effects.
- A map of Iowa, denoting areas of particular concern for possible adverse effects by wind turbines upon wildlife and habitat, has been developed and is updated periodically. Wind energy developers and planners are encouraged to refer to this map when considering new sites. Construction within these areas may not necessarily result in wildlife conflicts, and consultation with DNR wildlife biologists can assist developers in finding suitable sites within these potentially sensitive landscapes, or in suggesting plan modifications to minimize adverse effects.

Turbine Design and Operation Recommendations:

- Tubular support towers with pointed tops, rather than lattice supports, greatly reduce opportunities for birds to perch or nest upon the structures. Avoiding placement of permanent external ladders or platforms on tubular towers also reduces nesting and perching.
- Avoid use of guy wires for turbine or meteorological tower supports. Any existing guy wires should be marked with recommended bird deterrent devices (Avian Power Line Interaction Committee 1994).
- Taller turbines, having a top-of-rotor sweep exceeding 199 ft., may require lights for aviation safety. The minimum amount of pilot warning and avoidance lighting necessary should be used, and unless otherwise required by the Federal Aviation Administration, only white strobe lights should be used at night. These should be minimized in number, intensity, and number of flashes per minute. Solid red or pulsating red lights should *not* be used, as they appear to attract more night-migrating birds than do white strobes.
- Electric power lines should be placed underground wherever possible, or should utilize insulated, shielded wire when placed above ground, in order to reduce bird perching and electrocution.
- Where the height of rotor-sweep area produces high wildlife collision risks, tower heights should be adjusted to lower risks.
- If wind turbine facilities absolutely must be located in areas known for high seasonal concentration of birds, it is essential that a bird monitoring program be established, with at least three years of data collected to determine peak use periods. Data may be collected by direct observation, radar, infrared or acoustic methods. When birds are highly concentrated in or near the site, turbines should be shut down until birds have dispersed.
- When older facilities must be upgraded or retrofitted, the guidelines above should be employed as closely as possible.

Ideally, a site study plan and description of turbine structural and lighting design should be submitted to Iowa DNR well in advance of final siting decisions, for review by staff wildlife experts and advisements on acceptability or suggestions for modifications and/or monitoring.

Hiring a reputable environmental consultant with a strong background in bat and bird ecology is strongly recommended. A baseline inventory of wildlife and evaluation of habitat should be considered for every site under serious consideration for windfarm development. Use of National Wind Coordinating Committee study guidelines will allow for comparison with other studies. Special attention should be paid to Spring and Fall migration seasons, reviewing migrational use of the proposed site by raptors, waterfowl, shorebirds, gulls, songbirds and bats. Upon completion and startup of wind energy generation, monitoring wildlife populations and migrations should be conducted for at least 2-3 years.

Related Links

The following websites of other agencies and organizations may be useful in further understanding of potential wind energy and wildlife conflicts, and how to reduce or mitigate threats to wildlife:

http://www.fws.gov/habitatconservation/wind.pdf
http://www.nationalwind.org/publications/siting.htm
http://www.dnr.wi.gov/org/es//science/energy/wind/guidelines.pdf
http://www.aplic.org

For more information, contact Doug Harr, DNR Wildlife Diversity Coordinator, doug.harr@dnr.iowa.gov , or Lee Vannoy, DNR Energy Section, lee.vannoy@dnr.iowa.gov .

Howard R. Green Company

July 2, 2010

Field Supervisor Richard Nelson
USFWS Rock Island Field Office
1511 47th Avenue
Moline, IL 61265

Re: Kirkwood Community College Wind Energy Facility Habitat Assessment

Dear Mr. Nelson:

Kirkwood Community College in Cedar Rapids, Iowa is proposing the construction of a single 2.5 megawatt wind turbine facility on the Kirkwood main campus. Kirkwood is a recipient of State Energy Program (SEP) grant from the Iowa Office of Energy Independence (OEI) and United States Department of Energy (DOE). Partial project funding for the proposed turbine is from this grant. HR Green, on behalf of Kirkwood, is requesting FWS consultation for potential impacts to federally protected species for this project. FWS consultation is required as part of initial NEPA review for this project.

A habitat assessment of the project area and project description is attached. Please call me at 651-659-7708 or email tmccaslin@hrgreen.com if you have questions.

Sincerely,
HOWARD R. GREEN COMPANY

Ted McCaslin
Project Scientist

Enclosures
Kirkwood Wind Energy Facility Habitat Assessment

Court International Building | 2550 University Avenue W, Suite 400N | St. Paul, MN 55114
Phone: 651.644.4389 | Fax: 651.644.9446 | www.hrgreen.com

PROTECTED SPECIES HABITAT SURVEY

KIRKWOOD COMMUNITY COLLEGE
WIND ENERGY FACILITY

Cedar Rapids
Linn County, Iowa

Prepared by:

Howard R. Green Company
Cedar Rapids, Iowa

July 2010

Howard R. Green Company

1.0 Introduction

Kirkwood Community College is proposing the construction of a single 2.5 megawatt wind turbine at its main campus in southern Cedar Rapids. The proposed turbine would have a hub height of 80 meters and three rotors 50 meters in length.

The project area is located Linn County, Iowa in a vacant with maintained grass (See Figures 1 & 2). Adjacent land use includes playing fields, a wooded creek area, campus buildings and vacant maintained campus land. The proposed project includes an area of potential effect of 4.5 acres. It is located in the SW ¼ of the NE ¼ of the NW ¼ of Sec. 15, T82N, R7W. See attached site photos.

The proposed turbine construction will not require the clearing of any trees or structures and no impacts to waters of the United States are anticipated.

The project is located near the Eastern Iowa Airport and the Federal Aviation Administration (FAA) has issued Determination of No Hazard to Air Navigation (Aeronautical Study No. 2010-WTE-6052-OE) for the proposed turbine.

This document is being prepared to provide the U.S. Fish and Wildlife Service (FWS), a general assessment of habitat conditions within the project area and document potential habitat for federally protected species.

2.0 Linn County Listed Species

The FWS Midwest Section 7(a)(2) Technical Assistance Website[1] shows Linn County within the range of two federally threatened species:

Common Name	Scientific Name	Status	Habitat
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Wet prairies and sedge meadows
Prairie bush clover	*Lespedeza leptostachya*	Threatened	Dry to mesic prairies with gravelly soil

Additionally, Linn County is within the range of the protected Bald Eagle *(Haliaeetus leucocephalus* (Bald and Golden Eagle Protection Act).

3.0 Habitat Survey

A habitat survey was conducted by Project Scientist Ted McCaslin of Howard R. Green Company on June 12, 2010 to identify potential habitat for protected species listed in Section 2.0.

[1] http://www.fws.gov/midwest/endangered/section7/s7process/index.html

3.1 Prairie Bush Clover/Western Prairie Fringed Orchid Survey

No prairie remnants were observed within the proposed construction area. The area of potential effect is mowed maintained grassy area comprised of grass and weed species common throughout Iowa. Species observed within the project area include: Kentucky bluegrass (*Poa praetensis*), fescue (*Festuca spp.*), dandelion (*Taraxacum officianale*), white clover (*Trifolium repens*), common plantain (*Plantago major*) and crabgrass (*Digitaria spp.*). The project area appears to be in row crops in a 1960s aerial photograph (See Figure 3).

3.2 Bald Eagle Habitat Survey

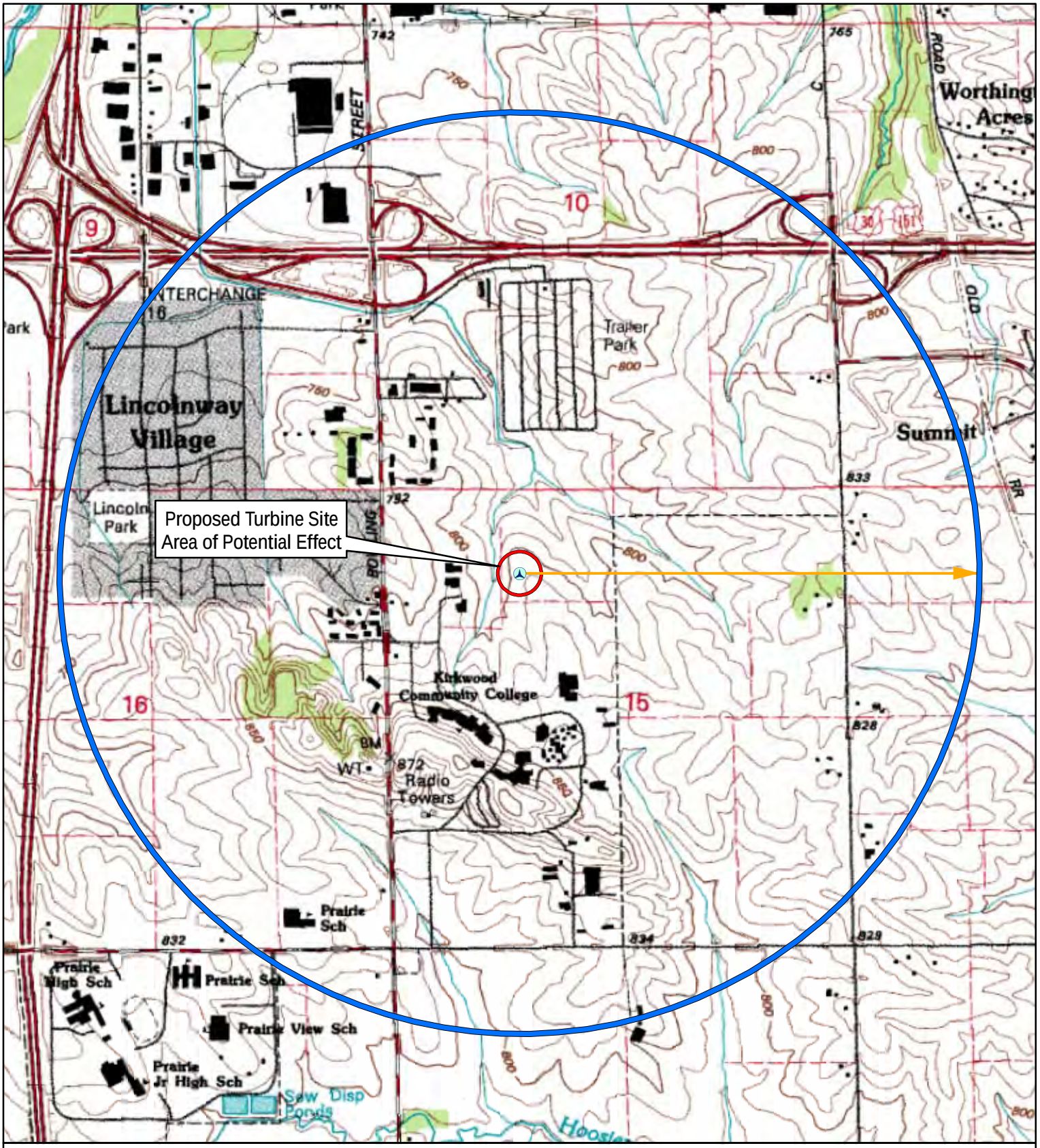
A number of large trees are present immediately west of project area along a small stream. No eagles or eagle nests were observed in the trees. Observed tree species included eastern cottonwood (*Populus deltoides)*, silver maple (*Acer saccharinum*), boxelder (*Acer negundo*), white mulberry (*Morus alba*), black cherry (*Prunus serotina*), and black willow *(Salix nigra*). The approximate age of these trees are between 40-50 years old based on a review of historical aerial photos of the project area and observed tree size and condition (See Figure 3).

No impacts to these trees are proposed for this project.

4.0 Conclusions

The project area is entirely highly disturbed vacant land covered with cultivated and invasive grasses and forbs. No prairie remnants were observed within or near the project area. A forested stream area adjacent to the project area does not appear to be suitable habitat for bald eagle nesting or roosting. No potential habitat for the prairie bush clover, western prairie fringed orchid, or bald eagle appears likely present within the project area.

FIGURES



Area of Potential Effect (APE)

1-Mile Buffer of APE

Proposed Turbine Location

1-Mile Radius of Project Site

N

0 750 1,500

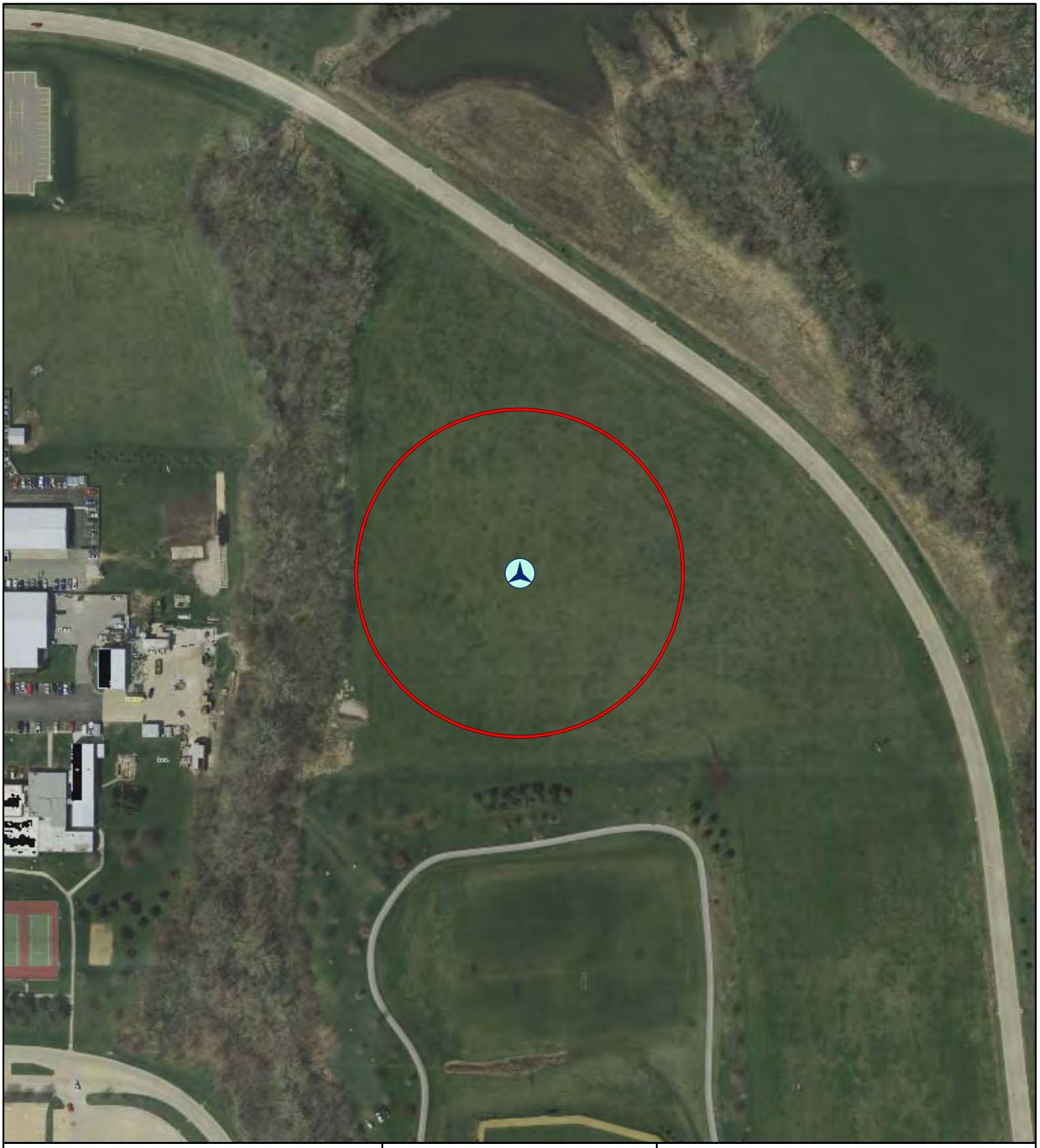
Feet

Source: USDA, NRCS
Digital Raster Graphic Mosaic of Linn County, Iowa
USGS 7.5' Quad Mosaic for Linn County, 2002

FIGURE 1
LOCATION MAP

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company



Area of Potential Effect (APE)

Proposed Turbine Location

Source: Iowa USDA Orthos 1960s

N

0 100 200

Feet

FIGURE 2
SITE MAP

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company

Area of Potential Effect (APE)

Approximate Forest Location 2010

Proposed Turbine Location

Source: Iowa USDA Orthos 1960s

N

0 100 200

Feet

FIGURE 3
1960s Aerial Photography

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company

Appendix A

Site Photos


Looking west from proposed turbine location at forested area


Looking east, proposed turbine location near center of photo


Looking south, proposed turbine
location near center of photo


Looking north, forested area west of proposed turbine
at left. Maintained vacant area at right of photo

Looking south from road, forested stream north of project area

Small stream in forested area

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rock Island Field Office
1511 47th Avenue
Moline, Illinois 61265
Phone: (309) 757-5800 Fax: (309) 757-5807

IN REPLY REFER TO:
FWS/RIFO

AUG 2 3 2010

August 24, 2010

Mr. Ted McCaslin, Project Scientist
Howard R. Green Company
Court International Building
2550 University Avenue W, Suite 400N
St. Paul, Minnesota 55114

Dear Mr. McCaslin:

We have reviewed the Kirkwood Community College Wind Energy Facility Habitat Assessment (Assessment) regarding wind energy development project in Johnson County, Iowa. The report was dated July 2010. Kirkwood Community College plans to install a wind turbine at their main campus in Cedar Rapids, Iowa. The 2.5 megawatt wind turbine is 80 meters tall at the hub and has three rotors 50 meters in length. The Kirkwood Community College project is funded through a State Energy Program (SEP) grant from the Iowa Office of Energy Independence (OEI) and United States Department of Energy (DOE). As the grantor, DOE is the Federal action agency. We have the following comments.

We understand from the Assessment that there is no suitable habitat in the project area for the federally listed prairie bush clover (*Lespedeza leptostachya*) or western prairie fringed orchid (*Platanthera praeclara*). The project area is located in Linn County, Iowa, in a vacant field with mowed and maintained grass. We concur with your determination that the proposed project will have no effect on these species. The federally listed endangered Indiana bat (*Myotis sodalis*) is not listed for Linn County, but may migrate through the area.

Additionally, the placement of the turbine is not adjacent to any migratory areas, refuges, major flyways, or known avian nesting areas, and the turbine is of tubular monopole design. We recommend that the DOE encourage "Renewable Energy Grant Funds" grant recipients to monitor wind turbines for impacts to birds and bats, and require notification to DOE and this office if operation of wind turbines results in mortality of these species. This would also aid in our assessment of future wind power projects, test the assumptions we are currently making, and promote the conservation of bats, including the endangered Indiana bat. Should the project be modified or new information indicate endangered species may be affected, consultation should be initiated.

Thank you for the opportunity to provide comments. If you have any additional questions or concerns, please contact Heidi Woeber of my staff at 309-757-5800, extension 209.

Sincerely,

Richard C. Nelson
Field Supervisor

s:\office users\heidi\concurnlaadoegrantsingleturbinekirkwoodcommcollege.doc

Preparer Checklist

Note: Any ground disturbing activities require consultation with the SHPO. Please fill out Part I and II of the "Request for SHPO Comment on a Project" form, under the archeology section, including all the requested information, and submit to OEI for review. Please fill out only one "Request for SHPO Comment on a Project" form for each project, (i.e. if you are disturbing ground *and* making physical alterations to a building on a project, fill out both portions of part II and submit all required information and documentation to OEI for review and comment).

☐ 1) The structure, object, or building, associated with this project is less than forty five (45) years of age *and* there are no ground disturbing activities.

If you checked box 1, please fill out the "Exempt from SHPO review" form. No further action is required – sign, and submit this form to OEI. If box one is NOT checked, please continue to number 2.

☐ 2) I am receiving Weatherization Assistance Program (WAP) funds.

If you checked box 2, please coutinue to box number 3. If you did not check box 2, please proceed to box 5.

☐ 3) All my project activities are included within Appendix A, either in sub-section A (exterior work), or/and sub-section B (interior work), and I have no ground disturbing activities associated with my project. [See pages 2-3 of this document]

If you checked box uumber 3, please stop and fill out the "Exempt from SHPO review" form. No further action is required – sign, and submit this form to OEI. If you did NOT check box 3, proceed to number 4.

☐ 4) A single work item, or numerous items, do not fit within the excluded activities specified in Appendix A, and/or I have ground disturbing activities. [See pages 4-6 of this document].

If you checked box number 4, please fill out the "Requcst for SHPO Commeut on a Project" form along with all the requested information, documentation, and project specifications for review.

☐ 5) I am receiving either State Energy Program (SEP) and/or Energy Efficiency Community Block Grant (EECBG) funds for my project.

If box 5 is checked, please continue to box number 6. If box 5 is not applicable, aud you are sure box 2 is also not applicable, then fill out the "Request for SHPO Commeut on a Project" form aloug with all requested material and submit to OEI for review.

☐ 6) My project is excluded from review because all my activities are included in Appendix B *and* I have no ground disturbing activities. [See pages 4-6 of this document].

If box 6 is checked, stop and fill out the "Exempt from SHPO review" form. No further action is required – sign, aud submit this form to OEI. If box 6 is NOT checked, please continue to number 7.

☒ 7) Not all my project activities for this project are excluded under Appendix B and/or I have ground disturbing activities associated with my project. [See pages 4-6 of this document]

If box 7 is checked please fill out the "Request for SHPO Comment on a Project" Form and submit it along with all the requested information for review, documentation, aud project specifications to OEI for review.

Preparer's Name Ted McCaslin **Signature** Ted McCaslin **Date** 3/4/10

REQUEST FOR SHPO COMMENT ON A PROJECT

Submit one copy with *each* property for which State Historic Preservation Office comment is requested. Please print or type.

☒ **This is a new submittal**
☐ **This is more information relating to SHPO R&C #:** _____

Instructions for completing this form are available online at www.iowahistory.org/preservartion under "Review and Compliance". If you have questions while completing this form, please refer to the instructions before contacting your DOE project administrator or SHPO, as appropriate. Please attach a copy of the lead federal agency statement and/or the signature authorization form to your submittal, if applicable.

Cover Letter: Please include a cover letter with a comprehensive description of the Area of Potential Effect (APE) and project activities. The APE should include: the project area, all easements, borrowing areas, equipment and material storage, and staging areas. If applicable, describe excavation and other earthmoving activities including 3-dimensional parameters (length, width, and depth).

I. GENERAL INFORMATION

a. Property Name: Kirkwood Wind Energy Facility
b. Property Street & Number: 6301 Kirkwood Blvd SW
c. County: Linn City: Cedar Rapids Zip: 52404
d. Federal Agency: Dept of Energy Federal Funding Program/Permit: DE-F0A-0000052
e. Agency Project No.: State Energy Program (SEP) #DE-EE000162
f. Contact Person on Project: Thomas Kaldenberg Phone: 319-398-5569
g. Contact Address: 6301 Kirkwood Blvd SW City: Cedar Rapids State: IA Zip: 52404
e-mail: thomas.kaldenberg@kirkwood.edu

II. IDENTIFICATION OF HISTORIC PLACES

Please check the box/boxes indicating whether you are requesting an archeological and/or architectural review of your project. Provide all documentation and information requested, and forward to the Office of Energy Independence for review and SHPO coordination.

☒ Archeology
- ☒ 7.5 min Quad U.S.G.S (1-mile radius) with quad name and APE outlined (maps on-line at www.ortho.gis.ia.state.edu)
- ☒ Site plan showing limits of proposed activities or general layout (engineering)
- ☒ Aerial photo: zoom to project area (photos on-line at www.ortho.gis.iastate.edu)
- ☒ Description of width and depth of proposed excavation and current conditions of project area
- ☒ OSA file search, Phase IA, or Phase I (whichever is appropriate)
- ☒ Number of acres in project: 4.5
- ☒ Legal location: Section(s) SW¼ of 15 Township(s) 82N Range(s): 07W

☐ Architecture
- ☐ Date of original construction for the building: _____
- ☐ Previous site information available (contact Iowa Site Inventory Coordinator)
- ☐ Update or new Iowa site Inventory Form (available online at www.iowahistory.org/preservation)
- ☐ Clear photos of property and surrounding area
- ☐ Location map (no bigger than 11x17) with the APE clearly defined (Quad map or city plat map)
- ☐ Copy of county or city assessor's card record or other appropriate property information
- ☐ Detailed description of proposed action, including copy of project specifications, if applicable

III. APPLICANT CERTIFICATION (TO BE COMPLETED BY OEI ONLY)

Determination of Effect (Check One)

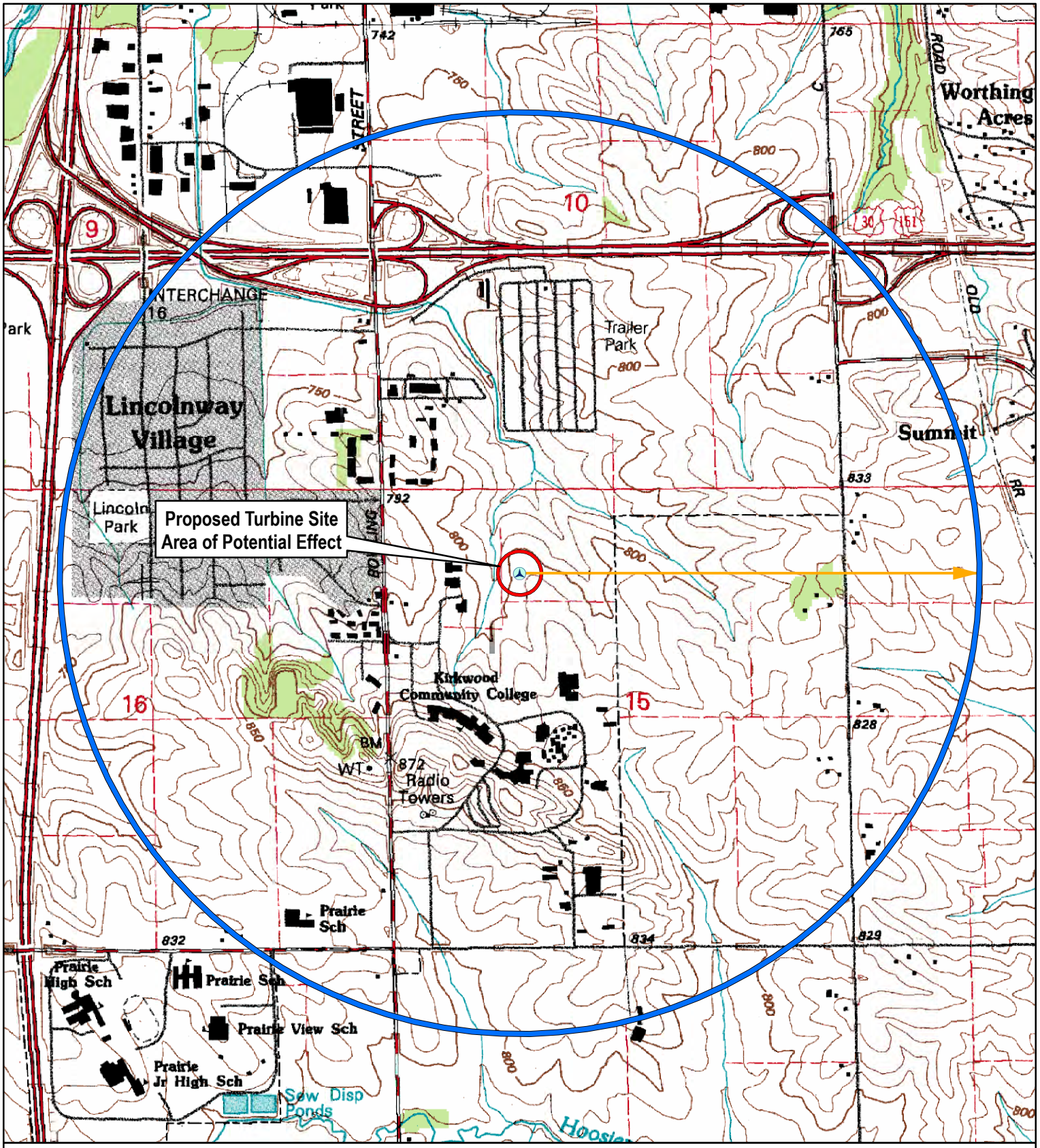
☐ **No historic properties will be affected** (i.e., none are present or there are historic properties present but the project will have no effect upon them)

☐ **No Adverse Effect to a historic property** (i.e., a historic property is present and affected. However, the project either has no adverse effect on the historic property, or the applicant or other federally authorized representative will consult with the SHPO to modify the project or impose conditions to avoid adverse effects.)

☐ **Adverse Effect to a historic property** (i.e., a historic property is present and adversely affected. The applicant, or other federally authorized representative, will consult with the SHPO and other consulting parties to resolve the adverse effect.)

I understand that the SHPO has 30 days from receipt to object to the finding.

Federally Authorized Signature: _____ Date: _____
Type name below ➔



Area of Potential Effect (APE)

1-Mile Buffer of APE

Proposed Turbine Location

1-Mile Radius of Project Site

N

0 750 1,500

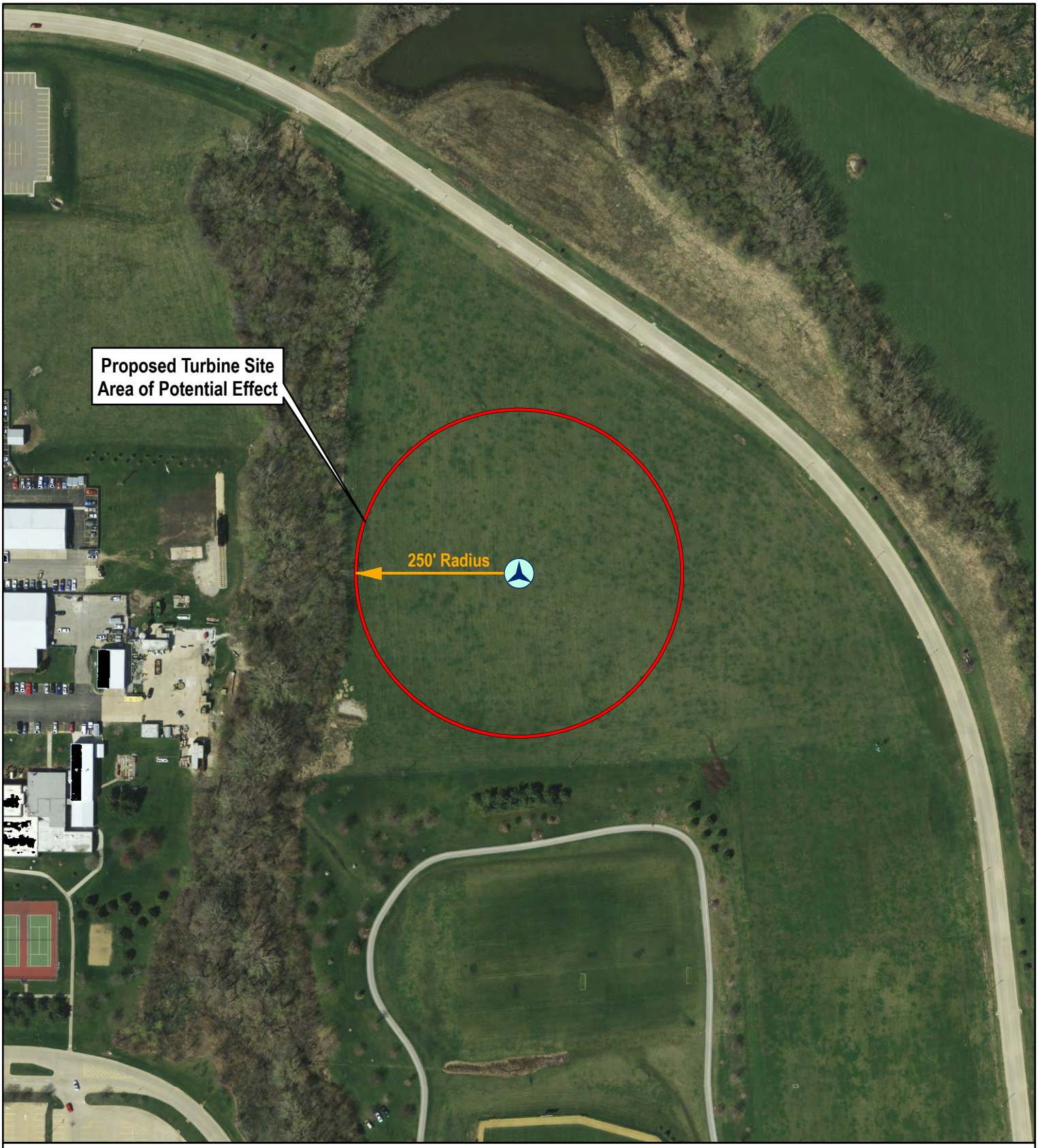
Feet

LOCATION MAP

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company

Source: USDA, NRCS
Digital Raster Graphic Mosaic of Linn County, Iowa
USGS 7.5' Quad Mosaic for Linn County, 2002



Area of Potential Effect (APE)

Proposed Turbine Location

250' Radius of Project Site

N

SITE PLAN & AERIAL PHOTO

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Source: Linn County GIS
0.5-ft resolution aerrial photo of Linn County, Iowa (2008)

Howard R. Green Company

Description of width and depth of proposed excavation and current conditions of project area

Underground utilities to the wind turbine will require 6-8 feet wide by three feet deep trenching. Excavation material will be side cast and returned after installation of utilities. The turbine location will require 12-20 feet of below grade excavation depending on geotechnical considerations and turbine design. A total of 1-2 acres of ground disturbance is expected for the project.

The proposed turbine location is within a vacant area of the campus. The area is covered maintained turf grass and construction will not require the clearing of any trees or structures. Adjacent land use includes playing fields, a wooded creek area, campus buildings and vacant maintained campus land.

STATE HISTORICAL SOCIETY of IOWA

A Division of the Iowa Department of Cultural Affairs

August 24, 2010

In response, refer to:
R&C #: **100857066**

RE: **DOE - CITY OF CEDAR RAPIDS - LINN COUNTY - KIRKWOOD WIND ENERGY FACILITY - DOE SEP #DE-EE000162 GRANT - STIMULUS FUNDS - PROPOSED INSTALLING 2.5MW WIND TURBINE - SEC. 15, T82N-R07W - 6301 KIRKWOOD BLVD SOUTHWEST - ADD'L INFORMATION - DETAILED MAP**

Dear Mr. Eppens:

We reviewed the information received in our office on 8/17/2010 concerning the proposed project for the above property. Thank you for providing the Iowa Historic Preservation Office (SHPO) with the opportunity to review this undertaking. We make the following comments and recommendations based on our examination of this material and in accordance with Section 106 of the National Historic Preservation Act of 1966; its implementing regulations, 36 CFR Part 800 (revised, effective August 5, 2004); and the Advisory Council on Historic Preservation's Policy Statement on Affordable Housing and Historic Preservation (adopted November 9, 2006).

We agree with your opinion that the property does not appear to be eligible for listing on the National Register of Historic Places. Therefore, we concur with your finding that No Historic Properties will be Affected by the proposed project.

If design changes involving undisturbed new rights-of-way or easements are made for this project, please forward additional information to our office for further comment along with the Agency Official's determination of effect. If project activities uncover any item(s) that might be of archaeological, historical, or architectural interest, or if important new archaeological, historical, or architectural data should be encountered in the project APE, the applicant should make reasonable efforts to avoid further impacts to the property until an assessment can be made by an individual meeting the Secretary of the Interior's professional qualifications standards (36 CFR Part 61).

We have made these comments and recommendations according to our responsibility defined by Federal law pertaining to the Section 106 process. Should you have any additional comments or questions, please contact me at jeremy.ammerman@iowa.gov or at 515.281.4129.

Sincerely,

Jeremy Ammerman, Architectural Historian
Iowa Historic Preservation Office

APPENDIX C

Noise Assessment

24-Hour Ambient Noise Survey

The proposed turbine is located on the Kirkwood Community College Main Campus in Cedar Rapids, Iowa. Three 24-monitoring period locations were selected to evaluate existing ambient noise in the proposed turbine area. Several Noise Sensitive Areas (NSAs) were identified near the proposed Kirkwood Wind Energy Facility during environmental scoping for the project. These NSAs include Kirkwood Estates, a mobile home park to north (Monitoring Location #1) and Kirkwood Courts (Monitoring Location #2), an apartment complex to the northwest. A third monitoring point was selected near the campus daycare facility, Kirkwood Kids, to the west of the proposed turbine (Monitoring Location #3).

Three datalogging sound level meters (SLMs) were utilized at locations representative of the NSAs to capture ambient noise levels over a period of time. Each monitoring location was equipped with a Quest SoundPro SE/DL SLM and weather protection kit. Due to security concerns for the equipment, two of the locations were adjusted from their previously determined locations. The Kirkwood Courts location (#2) was relocated approximately 150 feet to the southeast to an overhead utility pole. The Kirkwood Kids Daycare location (#3) was relocated approximately 125 feet to the east to a light pole on the southwest corner of their parking lot. No adjustments were necessary at the Kirkwood Estates location (#1). The equipment was setup on Thursday, December 9, 2010 with the intent to run for 24 hours. Weather conditions during this period ranged from 19.9º Fahrenheit to 36.0º Fahrenheit, 64% to 91% humidity, 29.88 in Hg to 30.01 in Hg pressure, and 4.6 mph to 9.0 mph winds.

The SLM set up at the Kirkwood Kids Daycare location (#3) experienced a battery problem and subsequently shut down after only recording approximately five hours of data. The SLM set up at the Kirkwood Estates location (#1) recorded 18 hours of useable data before experiencing a localized noise anomaly which corrupted the remaining data. No problems were experienced at the Kirkwood Courts location (#2).

Based on the SLM data, the Kirkwood Estates location had an average noise level of 52.6 dB(A) based on 18 hours of data, the Kirkwood Courts location had an average noise level of 54.5 dB(A) based on 24 hours of data, and the Kirkwood Kids Daycare location had an average noise level of 54.7 dB(A) based on 5 hours of data.

Noise Monitoring Locations

Proposed Turbine Location

N

0 150 300

Feet

Ambient Noise Monitoring Locations
12/09/10-12/10/10

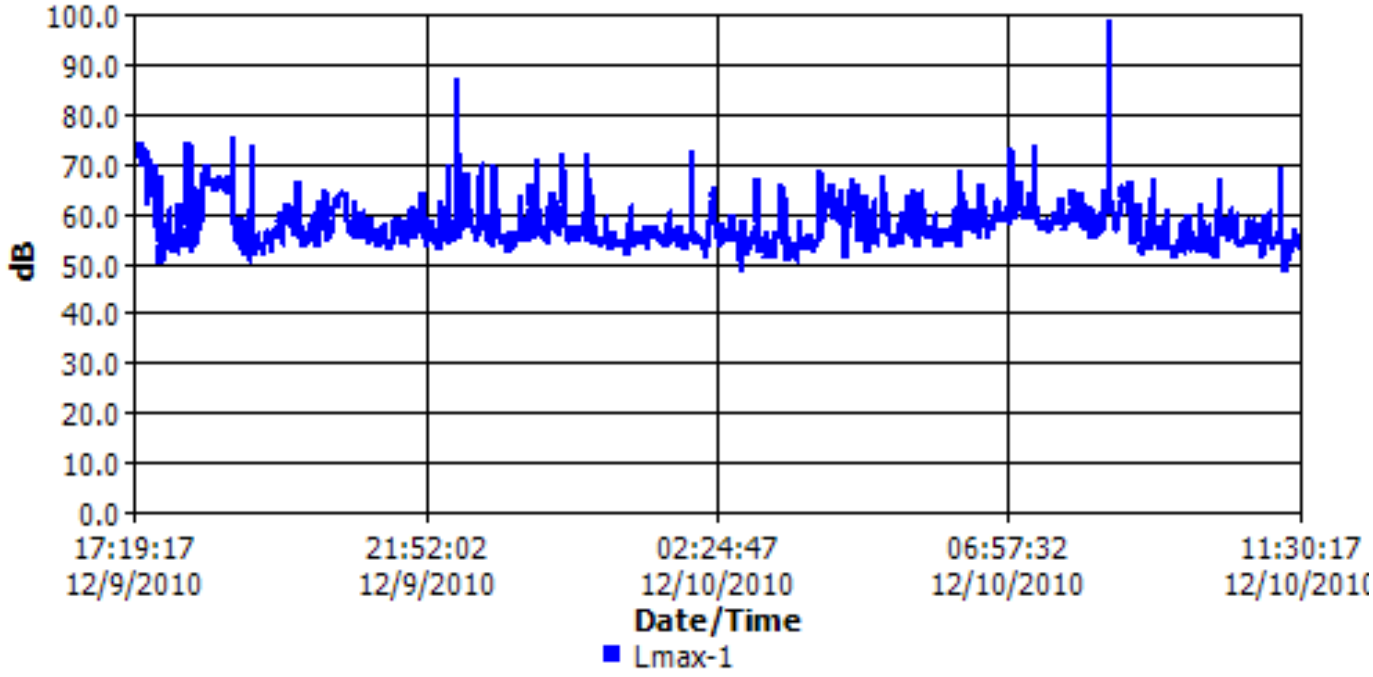
Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

HR Green

Kirkwood Estates

12/17/2010

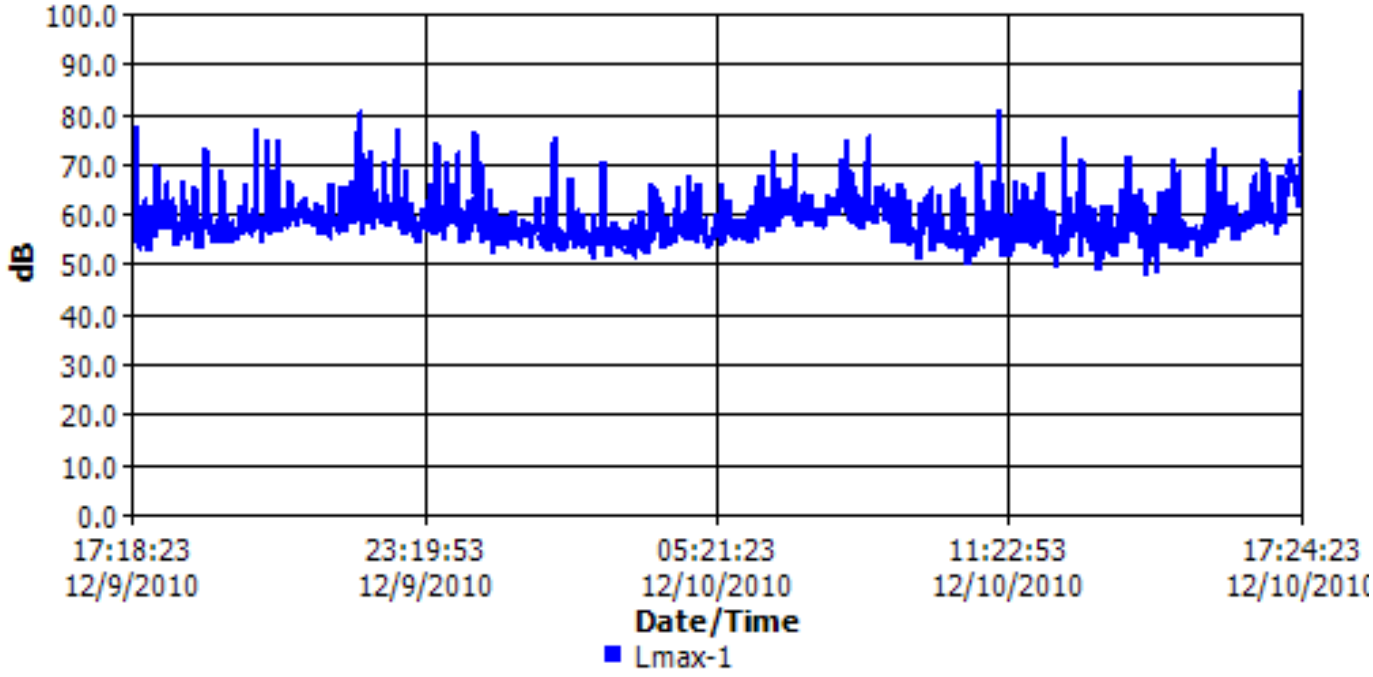
Logged Data Chart



Kirkwood Courts

12/17/2010

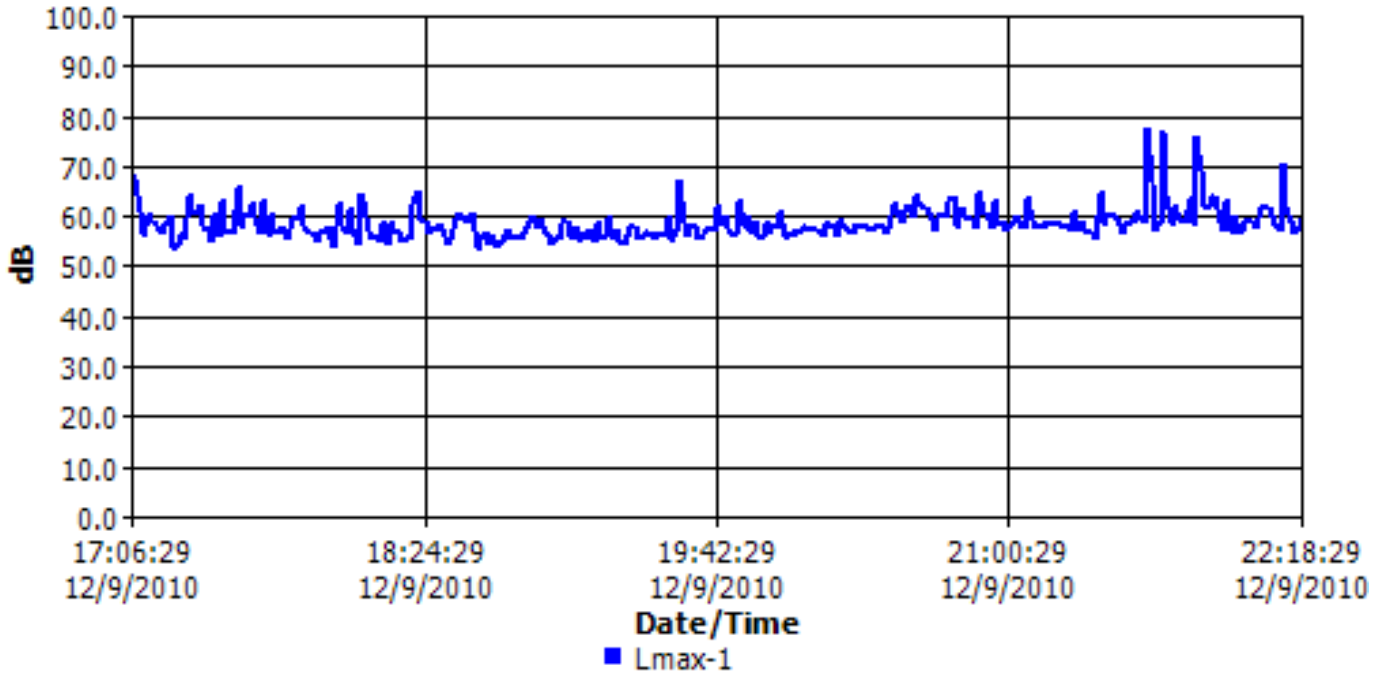
Logged Data Chart



Kirkwood Kids Daycare

12/17/2010

Logged Data Chart



Photograph 1 – Kirkwood Estates location facing North.

Photograph 2 – Kirkwood Estates location facing towards the proposed turbine.

Site Photographs

24-Hour Ambient Noise Study
Kirkwood Community NSAs
Cedar Rapids, IA

Photographed:

12-9-10

Howard R. Green Company

Photograph 3 – Kirkwood Courts location facing North.

Photograph 4 – Kirkwood Courts location facing towards the proposed turbine.

Site Photographs

24-Hour Ambient Noise Study
Kirkwood Community NSAs
Cedar Rapids, IA

Photographed:

12-9-10

Howard R. Green Company

Photograph 5 – Kirkwood Kids Daycare location facing North

Photograph 6 – Kirkwood Kids Daycare location facing towards the proposed turbine.

Site Photographs

24-Hour Ambient Noise Study
Kirkwood Community NSAs
Cedar Rapids, IA

Photographed:

12-9-10

Howard R. Green Company

APPENDIX D

Shadow Flicker Assessment

Shadow Flicker Analysis

The WindPRO Version 2.7.473 SHADOW extension model was used to model shadow flicker to nearby properties from the proposed Kirkwood Wind Energy Facility. The model setup and assumptions for the shadow flicker analysis are described below. Results are shown on the attached SHADOW model report and GIS figures.

The turbine location is the same intersecting point (41-54-59.51N, 91-39-03.19W, NAD 83) as listed in the FAA Determination of No Hazard to Air Navigation for the project. The model used hub height (80 m) and rotor diameter (99 m) consistent with the Clipper CW99 Liberty 2500kW turbine. The Clipper CW99 was selected for the model because it is manufactured nearby and meets the proposed generation needs for the project.

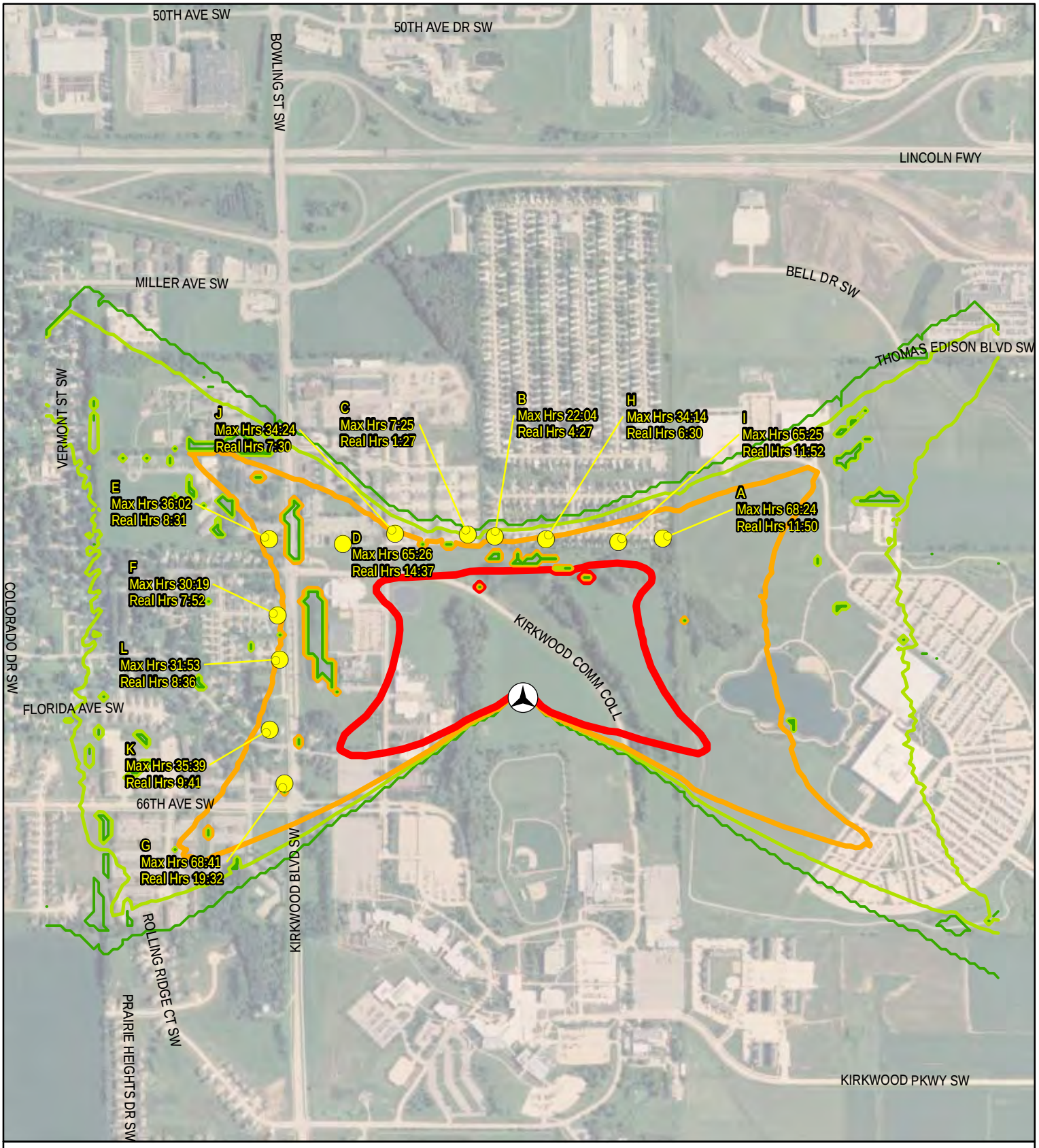
Adjacent land uses include commercial areas east of west of the proposed turbine, institutional areas west and south of the proposed turbine, and residential uses north and west of the proposed turbine. Cedar Rapids ordinances restrict the total annual shadow hours from wind turbine blade action on residential districts, but not on commercial or institutional districts.

Seven shadow receptors in residential districts near the turbine were selected and input into the model. Each receptor is assumed to have a single 2 x 2 meter window receptor and perpendicular (Green house direction mode in the model) to the shadow. Homes in the adjacent area include single family mobile homes (Receptors A, C, H & I), multiple unit apartments buildings (Receptors C, D, E, G, & J), single family houses (Receptors F & K), and duplexes (Receptor L).

Worst case (constant sunshine during daylight hours) and real case analysis (using average sunshine hours) flicker hours were modeled within SHADOW.

A number of assumptions were built into the SHADOW Model and are described below:

- Blade coverage – Shadow Flicker was only calculated when more than 20% of the sun disc is covered by the blade, the only time that flickering is and issue according to German guidelines. The German guidelines are the only know detailed guidelines for calculating shadow flicker at this time. (Also used for minimum sun height over horizon for influence assumption).
- Sunshine probability – Sunshine probability, used in the real case results only, was taken from the Madison, WI National Weather Service Station. The Madison station was the closest station with readily accessible and publically available sunshine hours.
- Annual operational time is assumed to be just below 80% or 6,970 hours a year.
- These hours are divided into 12 directional sectors and totaled based on a percentage ratio derived from a Wind Power Rose provided in a FirstLook Wind Assessment for the project.
- Elevation data was obtained from State of Iowa lidar data with a vertical accuracy of 18 cm.



Shadow Receptor (Max Hours/Real Hours)

Proposed Turbine Location

Worst Case Shadow Flicker Hours

- 1 Minute -10 Hours
- 10 Hours - 30 Hours
- 30 Hours - 100 Hours
- Over 100 Hours

N

0 450 900

Feet

WindPRO SHADOW Results
Worst Case Flicker Hours

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

HR Green

Shadow Receptor (Max Hours/Real Hours)

Proposed Turbine Location

Real Case Shadow Flicker Hours

- 1 Minute - 5 Hours
- 5 Hours - 10 Hours
- 10 Hours - 50 Hours
- Over 50 Hours

N

0 450 900

Feet

WindPRO SHADOW Results
Real Case Flicker Hours

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

HR Green

Project:
121310_Kirkwood Wind-Energy Facility

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12/15/2010 10:25 AM / 1
Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com
Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Main Result

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: foot1.wpo (4)
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10 m

Scale 1:12,500
New WTG
Shadow receptor

WTGs

	UTM NAD83 Zone: 15				WTG type						Shadow data	
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
	UTM NAD83 Zone: 15		[m]					[kW]	[m]	[m]	[m]	[RPM]
1	611,880	4,641,399	807.9	CLIPPER CW99 Libert...	Yes	CLIPPER	CW99 Liberty-2,500	2,500	99.0	80.0	1,261	15.5

Shadow receptor-Input

No.	UTM NAD83 Zone: 15 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
A	612,176	4,641,733	785.4	2.0	2.0	1.0	-320.0	90.0	"Green house mode"
B	611,822	4,641,737	773.2	2.0	2.0	1.0	0.0	90.0	"Green house mode"
C	611,765	4,641,741	784.9	2.0	2.0	1.0	0.0	90.0	"Green house mode"
D	611,503	4,641,722	800.6	2.0	2.0	1.0	0.0	90.0	"Green house mode"
E	611,348	4,641,732	793.4	2.0	2.0	1.0	0.0	90.0	"Green house mode"
F	611,365	4,641,572	780.9	2.0	2.0	1.0	0.0	90.0	"Green house mode"
G	611,380	4,641,219	805.2	2.0	2.0	1.0	0.0	90.0	"Green house mode"
H	611,930	4,641,731	771.3	2.0	2.0	1.0	-180.0	90.0	"Green house mode"
I	612,082	4,641,725	778.0	2.0	2.0	1.0	-180.0	90.0	"Green house mode"
J	611,612	4,641,743	800.0	2.0	2.0	1.0	-180.0	90.0	"Green house mode"
K	611,349	4,641,331	798.9	2.0	2.0	1.0	-180.0	90.0	"Green house mode"
L	611,370	4,641,478	781.0	2.0	1.0	2.0	-180.0	90.0	"Green house mode"

Project:
121310_Kirkwood Wind-Energy Facility

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Main Result

Calculation Results

Shadow receptor

No.	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	68:24	86	0:55	11:50
B	22:04	38	0:44	4:27
C	7:25	22	0:25	1:27
D	65:26	90	0:50	14:37
E	36:02	74	0:39	8:31
F	30:19	55	0:42	7:52
G	68:41	108	0:46	19:32
H	34:14	48	0:53	6:30
I	65:25	76	1:02	11:52
J	34:24	54	0:47	7:30
K	35:39	64	0:44	9:41
L	31:53	56	0:44	8:36

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	CLIPPER CW99 Liberty 2500 99.0 !O! hub: 80.0 m (3)	479:20	108:31

Project:
121310_Kirkwood Wind-Energy Facility

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Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: A - Shadow Receptor: 2.0 × 2.0 Azimuth: 40.0° Slope: 90.0° (9)

Assumptions for shadow calculations

Maximum distance for influence	200	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January			February			March	April	May	June	July	August	September	October	November			December		
1	07:35		14:44 (1)	07:20		15:14 (1)	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39			07:15		14:31 (1)
	16:46	55	15:39 (1)	17:21	18	15:32 (1)	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02			16:37	53	15:24 (1)
2	07:35		14:45 (1)	07:19		15:19 (1)	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40			07:16		14:31 (1)
	16:47	55	15:40 (1)	17:23	9	15:28 (1)	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01			16:37	54	15:25 (1)
3	07:35		14:45 (1)	07:18			06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41			07:17		14:32 (1)
	16:48	55	15:40 (1)	17:24			17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00			16:37	54	15:26 (1)
4	07:35		14:46 (1)	07:17			06:38	06:46	06:00	05:33	05:37	06:03	06:35	07:06	06:42			07:18		14:32 (1)
	16:49	55	15:41 (1)	17:25			18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58			16:36	55	15:27 (1)
5	07:35		14:46 (1)	07:16			06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44			07:19		14:33 (1)
	16:50	55	15:41 (1)	17:27			18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57			16:36	54	15:27 (1)
6	07:35		14:47 (1)	07:15			06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45			07:20		14:33 (1)
	16:51	55	15:42 (1)	17:28			18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56			16:36	55	15:28 (1)
7	07:35		14:46 (1)	07:14			06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46			07:21		14:33 (1)
	16:52	55	15:41 (1)	17:29			18:03	19:37	20:10	20:39	20:45	20:20	19:33	18:40	16:55			16:36	55	15:28 (1)
8	07:35		14:47 (1)	07:13			07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47			07:22		14:34 (1)
	16:53	55	15:42 (1)	17:30			18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54			16:36	55	15:29 (1)
9	07:35		14:48 (1)	07:12			07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49		14:49 (1)	07:23		14:33 (1)
	16:54	54	15:42 (1)	17:32			19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53	11	15:00 (1)	16:36	55	15:28 (1)
10	07:35		14:49 (1)	07:10			07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50		14:45 (1)	07:23		14:34 (1)
	16:55	54	15:43 (1)	17:33			19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52	18	15:03 (1)	16:36	55	15:29 (1)
11	07:34		14:49 (1)	07:09			07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51		14:43 (1)	07:24		14:34 (1)
	16:56	53	15:42 (1)	17:34			19:07	19:42	20:15	20:41	20:44	20:15	19:27	18:33	16:51	24	15:07 (1)	16:36	55	15:29 (1)
12	07:34		14:50 (1)	07:08			07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52		14:40 (1)	07:25		14:35 (1)
	16:57	53	15:43 (1)	17:36			19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50	29	15:09 (1)	16:36	55	15:30 (1)
13	07:34		14:51 (1)	07:07			07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54		14:38 (1)	07:26		14:35 (1)
	16:58	53	15:44 (1)	17:37			19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49	32	15:10 (1)	16:36	55	15:30 (1)
14	07:33		14:51 (1)	07:05			07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55		14:37 (1)	07:27		14:36 (1)
	16:59	52	15:43 (1)	17:38			19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48	34	15:11 (1)	16:36	55	15:31 (1)
15	07:33		14:52 (1)	07:04			07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56		14:36 (1)	07:27		14:36 (1)
	17:00	52	15:44 (1)	17:39			19:12	19:46	20:19	20:43	20:42	20:10	19:20	18:27	16:47	37	15:13 (1)	16:37	55	15:31 (1)
16	07:32		14:52 (1)	07:03			07:19	06:26	05:47	05:31	05:45	06:15	06:47	07:20	06:57		14:35 (1)	07:28		14:37 (1)
	17:02	52	15:44 (1)	17:41			19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46	39	15:14 (1)	16:37	55	15:32 (1)
17	07:32		14:53 (1)	07:01			07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21	06:58		14:34 (1)	07:29		14:37 (1)
	17:03	51	15:44 (1)	17:42			19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45	41	15:15 (1)	16:37	55	15:32 (1)
18	07:31		14:54 (1)	07:00			07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00		14:34 (1)	07:29		14:37 (1)
	17:04	50	15:44 (1)	17:43			19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44	42	15:16 (1)	16:37	55	15:32 (1)
19	07:31		14:54 (1)	06:58			07:13	06:22	05:44	05:31	05:48	06:18	06:51	07:23	07:01		14:33 (1)	07:30		14:38 (1)
	17:05	49	15:43 (1)	17:44			19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:20	16:44	44	15:17 (1)	16:38	55	15:33 (1)
20	07:30		14:56 (1)	06:57			07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24	07:02		14:32 (1)	07:31		14:38 (1)
	17:06	48	15:44 (1)	17:46			19:17	19:52	20:24	20:45	20:38	20:02	19:11	18:19	16:43	46	15:18 (1)	16:38	55	15:33 (1)
21	07:30		14:56 (1)	06:55			07:10	06:19	05:42	05:32	05:50	06:21	06:53	07:26	07:03		14:31 (1)	07:31		14:39 (1)
	17:08	47	15:43 (1)	17:47			19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:17	16:42	47	15:18 (1)	16:39	55	15:34 (1)
22	07:29		14:57 (1)	06:54			07:08	06:17	05:41	05:32	05:50	06:22	06:54	07:27	07:04		14:32 (1)	07:32		14:39 (1)
	17:09	46	15:43 (1)	17:48			19:20	19:54	20:26	20:46	20:37	19:59	19:07	18:16	16:41	48	15:20 (1)	16:39	55	15:34 (1)
23	07:28		14:58 (1)	06:53			07:07	06:16	05:40	05:32	05:51	06:23	06:55	07:28	07:06		14:31 (1)	07:32		14:40 (1)
	17:10	44	15:42 (1)	17:49			19:21	19:55	20:27	20:46	20:36	19:58	19:06	18:15	16:41	49	15:20 (1)	16:40	55	15:35 (1)
24	07:28		15:00 (1)	06:51			07:05	06:14	05:40	05:32	05:52	06:24	06:56	07:29	07:07		14:31 (1)	07:33		14:40 (1)
	17:11	42	15:42 (1)	17:51			19:22	19:56	20:28	20:46	20:35	19:56	19:04	18:13	16:40	50	15:21 (1)	16:40	55	15:35 (1)
25	07:27		15:01 (1)	06:49			07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30	07:08		14:30 (1)	07:33		14:41 (1)
	17:12	41	15:42 (1)	17:52			19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40	51	15:21 (1)	16:41	55	15:36 (1)
26	07:26		15:02 (1)	06:48			07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32	07:09		14:31 (1)	07:33		14:41 (1)
	17:14	39	15:41 (1)	17:53			19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39	52	15:23 (1)	16:41	55	15:36 (1)
27	07:25		15:03 (1)	06:46			07:00	06:10	05:37	05:33	05:55	06:27	06:59	07:33	07:10		14:31 (1)	07:34		14:42 (1)
	17:15	37	15:40 (1)	17:54			19:25	20:00	20:30	20:46	20:32	19:52	18:57	18:09	16:39	52	15:23 (1)	16:42	55	15:37 (1)
28	07:24		15:05 (1)	06:45			06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11		14:31 (1)	07:34		14:42 (1)
	17:16	34	15:39 (1)	17:55			19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38	52	15:23 (1)	16:43	55	15:37 (1)
29	07:23		15:07 (1)				06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12		14:31 (1)	07:34		14:43 (1)
	17:18	31	15:38 (1)				19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38	53	15:24 (1)	16:44	55	15:38 (1)
30	07:22		15:09 (1)				06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14		14:31 (1)	07:35		14:43 (1)
	17:19	27	15:36 (1)				19:29	20:03	20:33	20:46	20:30	19:47	18:52	18:05	16:37	53	15:24 (1)	16:44	55	15:38 (1)
31	07:21		15:11 (1)				06:53		05:35		05:59	06:31		07:38				07:35		14:44 (1)
	17:20	24	15:35 (1)				19:30		20:34		20:28	19:45		18:03				16:45	55	15:39 (1)
Potential sun hours	295			296			369	400	450	455	462	430	376	344	296			285		
Total, worst case		1473			27											904			1700	
Sun reduction		0.47			0.50											0.37			0.35	
Oper. time red.		0.80			0.80											0.80			0.80	
Wind dir. red.		0.55			0.55											0.55			0.55	
Total reduction		0.20			0.22											0.16			0.15	
Total, real		300			6											147			258	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 4

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: B - Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (10)

Assumptions for shadow calculations

Maximum distance for influence	200	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January			February	March	April	May	June	July	August	September	October	November	December		
1	07:35		11:11 (1)	07:21	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39	07:15		
	16:46	37	11:48 (1)	17:21	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02	16:37		
2	07:35		11:12 (1)	07:19	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40	07:16		
	16:47	36	11:48 (1)	17:23	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01	16:37		
3	07:35		11:13 (1)	07:18	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41	07:17		11:12 (1)
	16:48	34	11:47 (1)	17:24	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00	16:37	8	11:20 (1)
4	07:35		11:15 (1)	07:17	06:39	06:46	06:00	05:33	05:37	06:03	06:35	07:07	06:42	07:18		11:08 (1)
	16:49	31	11:46 (1)	17:25	18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58	16:36	17	11:25 (1)
5	07:35		11:16 (1)	07:16	06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44	07:19		11:06 (1)
	16:50	30	11:46 (1)	17:27	18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57	16:36	22	11:28 (1)
6	07:35		11:18 (1)	07:15	06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45	07:20		11:05 (1)
	16:51	27	11:45 (1)	17:28	18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56	16:36	26	11:31 (1)
7	07:35		11:20 (1)	07:14	06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46	07:21		11:04 (1)
	16:52	22	11:42 (1)	17:29	18:03	19:37	20:10	20:39	20:45	20:20	19:33	18:40	16:55	16:36	29	11:33 (1)
8	07:35		11:23 (1)	07:13	07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47	07:22		11:03 (1)
	16:53	17	11:40 (1)	17:30	18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54	16:36	31	11:34 (1)
9	07:35		11:27 (1)	07:12	07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49	07:23		11:01 (1)
	16:54	9	11:36 (1)	17:32	19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53	16:36	34	11:35 (1)
10	07:35			07:10	07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50	07:23		11:01 (1)
	16:55			17:33	19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52	16:36	36	11:37 (1)
11	07:34			07:09	07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51	07:24		11:01 (1)
	16:56			17:34	19:07	19:42	20:15	20:41	20:44	20:15	19:27	18:33	16:51	16:36	37	11:38 (1)
12	07:34			07:08	07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52	07:25		11:01 (1)
	16:57			17:36	19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50	16:36	38	11:39 (1)
13	07:34			07:07	07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54	07:26		11:01 (1)
	16:58			17:37	19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49	16:36	40	11:41 (1)
14	07:33			07:05	07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55	07:27		11:01 (1)
	16:59			17:38	19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48	16:36	41	11:42 (1)
15	07:33			07:04	07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56	07:27		11:00 (1)
	17:00			17:39	19:12	19:46	20:19	20:43	20:42	20:10	19:20	18:27	16:47	16:37	42	11:42 (1)
16	07:32			07:03	07:19	06:26	05:47	05:31	05:45	06:15	06:47	07:20	06:57	07:28		11:01 (1)
	17:02			17:41	19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46	16:37	42	11:43 (1)
17	07:32			07:01	07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21	06:58	07:29		11:01 (1)
	17:03			17:42	19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45	16:37	43	11:44 (1)
18	07:31			07:00	07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00	07:29		11:01 (1)
	17:04			17:43	19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44	16:37	43	11:44 (1)
19	07:31			06:58	07:13	06:22	05:44	05:31	05:48	06:18	06:51	07:23	07:01	07:30		11:02 (1)
	17:05			17:44	19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:21	16:44	16:38	43	11:45 (1)
20	07:30			06:57	07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24	07:02	07:31		11:01 (1)
	17:06			17:46	19:17	19:52	20:24	20:45	20:38	20:02	19:11	18:19	16:43	16:38	44	11:45 (1)
21	07:30			06:55	07:10	06:19	05:42	05:32	05:50	06:21	06:53	07:26	07:03	07:31		11:02 (1)
	17:08			17:47	19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:17	16:42	16:39	44	11:46 (1)
22	07:29			06:54	07:08	06:17	05:41	05:32	05:50	06:22	06:54	07:27	07:04	07:32		11:02 (1)
	17:09			17:48	19:20	19:54	20:26	20:46	20:37	19:59	19:07	18:16	16:41	16:39	44	11:46 (1)
23	07:28			06:53	07:07	06:16	05:40	05:32	05:51	06:23	06:55	07:28	07:06	07:32		11:03 (1)
	17:10			17:49	19:21	19:55	20:27	20:46	20:36	19:58	19:06	18:15	16:41	16:40	44	11:47 (1)
24	07:28			06:51	07:05	06:14	05:40	05:32	05:52	06:24	06:56	07:29	07:07	07:33		11:04 (1)
	17:11			17:51	19:22	19:56	20:28	20:46	20:35	19:56	19:04	18:13	16:40	16:40	43	11:47 (1)
25	07:27			06:50	07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30	07:08	07:33		11:05 (1)
	17:13			17:52	19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40	16:41	43	11:48 (1)
26	07:26			06:48	07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32	07:09	07:33		11:05 (1)
	17:14			17:53	19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39	16:42	43	11:48 (1)
27	07:25			06:46	07:00	06:10	05:38	05:33	05:55	06:27	06:59	07:33	07:10	07:34		11:06 (1)
	17:15			17:54	19:25	20:00	20:30	20:46	20:33	19:52	18:57	18:09	16:39	16:42	42	11:48 (1)
28	07:24			06:45	06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11	07:34		11:06 (1)
	17:16			17:55	19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38	16:43	42	11:48 (1)
29	07:23				06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12	07:34		11:08 (1)
	17:18				19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38	16:44	41	11:49 (1)
30	07:22				06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14	07:35		11:09 (1)
	17:19				19:29	20:03	20:33	20:46	20:30	19:47	18:52	18:05	16:37	16:44	40	11:49 (1)
31	07:21				06:53		05:35		05:59	06:31		07:38		07:35		11:09 (1)
	17:20				19:30		20:34		20:28	19:45		18:03		16:45	39	11:48 (1)
Potential sun hours	295			296	369	400	450	455	462	430	376	344	296	285		
Total, worst case		243													1081	
Sun reduction		0.47													0.35	
Oper. time red.		0.80													0.80	
Wind dir. red.		0.69													0.69	
Total reduction		0.26													0.19	
Total, real		62													206	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 5

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: C - Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (11)

Assumptions for shadow calculations

Maximum distance for influence	200	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January		February	March	April	May	June	July	August	September	October	November	December		
1	07:35	10:43 (1)	07:21	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39	07:15		
	16:46	9 10:52 (1)	17:21	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02	16:37		
2	07:35		07:20	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40	07:16		
	16:47		17:23	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01	16:37		
3	07:35		07:18	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41	07:17		
	16:48		17:24	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00	16:37		
4	07:35		07:17	06:39	06:46	06:00	05:33	05:37	06:03	06:35	07:07	06:42	07:18		
	16:49		17:25	18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58	16:36		
5	07:35		07:16	06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44	07:19		
	16:50		17:27	18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57	16:36		
6	07:35		07:15	06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45	07:20		
	16:51		17:28	18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56	16:36		
7	07:35		07:14	06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46	07:21		
	16:52		17:29	18:03	19:38	20:10	20:39	20:45	20:20	19:33	18:40	16:55	16:36		
8	07:35		07:13	07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47	07:22		
	16:53		17:30	18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54	16:36		
9	07:35		07:12	07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49	07:23		
	16:54		17:32	19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53	16:36		
10	07:35		07:10	07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50	07:23		
	16:55		17:33	19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52	16:36		
11	07:34		07:09	07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51	07:24		10:34 (1)
	16:56		17:34	19:07	19:42	20:15	20:41	20:44	20:15	19:27	18:33	16:51	16:36	7	10:41 (1)
12	07:34		07:08	07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52	07:25		10:32 (1)
	16:57		17:36	19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50	16:36	13	10:45 (1)
13	07:34		07:07	07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54	07:26		10:31 (1)
	16:58		17:37	19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49	16:36	16	10:47 (1)
14	07:33		07:05	07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55	07:27		10:30 (1)
	16:59		17:38	19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48	16:36	19	10:49 (1)
15	07:33		07:04	07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56	07:27		10:29 (1)
	17:00		17:39	19:12	19:46	20:19	20:43	20:42	20:10	19:20	18:27	16:47	16:37	20	10:49 (1)
16	07:32		07:03	07:19	06:26	05:47	05:31	05:45	06:15	06:47	07:20	06:57	07:28		10:29 (1)
	17:02		17:41	19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46	16:37	22	10:51 (1)
17	07:32		07:01	07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21	06:58	07:29		10:29 (1)
	17:03		17:42	19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45	16:37	24	10:53 (1)
18	07:31		07:00	07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00	07:29		10:29 (1)
	17:04		17:43	19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44	16:37	24	10:53 (1)
19	07:31		06:58	07:13	06:22	05:44	05:31	05:48	06:18	06:51	07:23	07:01	07:30		10:29 (1)
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25	07:27		06:50	07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30	07:08	07:33		10:33 (1)
	17:13		17:52	19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40	16:41	24	10:57 (1)
26	07:26		06:48	07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32	07:09	07:33		10:33 (1)
	17:14		17:53	19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39	16:42	24	10:57 (1)
27	07:25		06:46	07:00	06:10	05:38	05:33	05:55	06:27	06:59	07:33	07:10	07:34		10:34 (1)
	17:15		17:54	19:25	20:00	20:30	20:46	20:33	19:52	18:57	18:09	16:39	16:42	22	10:56 (1)
28	07:24		06:45	06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11	07:34		10:35 (1)
	17:16		17:55	19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38	16:43	21	10:56 (1)
29	07:23			06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12	07:34		10:37 (1)
	17:18			19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38	16:44	19	10:56 (1)
30	07:22			06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14	07:35		10:38 (1)
	17:19			19:29	20:03	20:33	20:46	20:30	19:47	18:52	18:05	16:37	16:44	17	10:55 (1)
31	07:22			06:53		05:35		05:59	06:31		07:38		07:35		10:40 (1)
	17:20			19:30		20:34		20:28	19:45		18:03		16:45	14	10:54 (1)
Potential sun hours	295		296	369	400	450	455	462	430	376	344	296	285		
Total, worst case		9												436	
Sun reduction		0.47												0.35	
Oper. time red.		0.80												0.80	
Wind dir. red.		0.70												0.70	
Total reduction		0.26												0.19	
Total, real		2												85	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 6

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: D - Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (12)

Assumptions for shadow calculations

Maximum distance for influence	200	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January		February		March	April	May	June	July	August	September	October	November		December	
1	07:35	08:14 (1)	07:21	08:34 (1)	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39		07:15	07:59 (1)
	16:46 49	09:03 (1)	17:21 26	09:00 (1)	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02		16:37 50	08:49 (1)
2	07:35	08:14 (1)	07:20	08:37 (1)	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40		07:16	08:00 (1)
	16:47 49	09:03 (1)	17:23 21	08:58 (1)	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01		16:37 50	08:50 (1)
3	07:35	08:14 (1)	07:18	08:40 (1)	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41		07:17	08:01 (1)
	16:48 50	09:04 (1)	17:24 16	08:56 (1)	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00		16:37 49	08:50 (1)
4	07:35	08:15 (1)	07:17	08:45 (1)	06:39	06:46	06:00	05:33	05:37	06:03	06:35	07:07	06:43		07:18	08:01 (1)
	16:49 49	09:04 (1)	17:25 5	08:50 (1)	18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58		16:36 50	08:51 (1)
5	07:35	08:15 (1)	07:16		06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44		07:19	08:01 (1)
	16:50 50	09:05 (1)	17:27		18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57		16:36 50	08:51 (1)
6	07:35	08:16 (1)	07:15		06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45		07:20	08:02 (1)
	16:51 49	09:05 (1)	17:28		18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56		16:36 49	08:51 (1)
7	07:35	08:16 (1)	07:14		06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46		08:14 (1) 07:21	08:02 (1)
	16:52 50	09:06 (1)	17:29		18:03	19:38	20:11	20:39	20:45	20:20	19:33	18:40	16:55 7		08:21 (1) 16:36 50	08:52 (1)
8	07:35	08:16 (1)	07:13		07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47		08:10 (1) 07:22	08:03 (1)
	16:53 50	09:06 (1)	17:30		18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54 17		08:27 (1) 16:36 49	08:52 (1)
9	07:35	08:17 (1)	07:12		07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49		08:07 (1) 07:23	08:02 (1)
	16:54 49	09:06 (1)	17:32		19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53 22		08:29 (1) 16:36 50	08:52 (1)
10	07:35	08:17 (1)	07:10		07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50		08:05 (1) 07:23	08:03 (1)
	16:55 50	09:07 (1)	17:33		19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52 26		08:31 (1) 16:36 49	08:52 (1)
11	07:34	08:17 (1)	07:09		07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51		08:04 (1) 07:24	08:04 (1)
	16:56 50	09:07 (1)	17:34		19:07	19:42	20:15	20:42	20:44	20:15	19:27	18:33	16:51 30		08:34 (1) 16:36 49	08:53 (1)
12	07:34	08:18 (1)	07:08		07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52		08:03 (1) 07:25	08:04 (1)
	16:57 49	09:07 (1)	17:36		19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50 32		08:35 (1) 16:36 49	08:53 (1)
13	07:34	08:19 (1)	07:07		07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54		08:02 (1) 07:26	08:05 (1)
	16:58 49	09:08 (1)	17:37		19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49 34		08:36 (1) 16:36 49	08:54 (1)
14	07:33	08:19 (1)	07:05		07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55		08:02 (1) 07:27	08:06 (1)
	16:59 49	09:08 (1)	17:38		19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48 36		08:38 (1) 16:36 48	08:54 (1)
15	07:33	08:20 (1)	07:04		07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56		08:00 (1) 07:27	08:06 (1)
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16	07:32	08:20 (1)	07:03		07:19	06:26	05:47	05:31	05:45	06:15	06:48	07:20	06:57		08:00 (1) 07:28	08:06 (1)
	17:02 48	09:08 (1)	17:41		19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46 40		08:40 (1) 16:37 49	08:55 (1)
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	17:03 48	09:09 (1)	17:42		19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45 42		08:41 (1) 16:37 49	08:56 (1)
18	07:31	08:21 (1)	07:00		07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00		07:59 (1) 07:29	08:07 (1)
	17:04 48	09:09 (1)	17:43		19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44 43		08:42 (1) 16:37 48	08:55 (1)
19	07:31	08:21 (1)	06:58		07:13	06:22	05:44	05:31	05:48	06:19	06:51	07:23	07:01		07:59 (1) 07:30	08:08 (1)
	17:05 47	09:08 (1)	17:44		19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:21	16:44 44		08:43 (1) 16:38 48	08:56 (1)
20	07:30	08:22 (1)	06:57		07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24	07:02		07:58 (1) 07:31	08:08 (1)
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	17:08 46	09:09 (1)	17:47		19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:17	16:42 46		08:45 (1) 16:39 48	08:57 (1)
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	17:13 42	09:08 (1)	17:52		19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40 48		08:46 (1) 16:41 48	08:59 (1)
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	17:14 40	09:07 (1)	17:53		19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39 48		08:47 (1) 16:42 49	09:00 (1)
27	07:25	08:28 (1)	06:46		07:00	06:10	05:38	05:33	05:55	06:27	06:59	07:33	07:10		07:59 (1) 07:34	08:11 (1)
	17:15 38	09:06 (1)	17:54		19:25	20:00	20:30	20:47	20:33	19:52	18:57	18:09	16:39 49		08:48 (1) 16:42 49	09:00 (1)
28	07:24	08:29 (1)	06:45		06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11		07:59 (1) 07:34	08:12 (1)
	17:16 36	09:05 (1)	17:55		19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38 49		08:48 (1) 16:43 48	09:00 (1)
29	07:23	08:30 (1)			06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12		07:59 (1) 07:34	08:13 (1)
	17:18 34	09:04 (1)			19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38 49		08:48 (1) 16:44 48	09:01 (1)
30	07:22	08:31 (1)			06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14		07:59 (1) 07:35	08:13 (1)
	17:19 32	09:03 (1)			19:29	20:03	20:33	20:47	20:30	19:47	18:52	18:05	16:37 49		08:48 (1) 16:44 49	09:02 (1)
31	07:22	08:33 (1)			06:53		05:35		05:59	06:31		07:38			07:35	08:13 (1)
	17:20 29	09:02 (1)			19:30		20:34		20:28	19:45		18:03			16:45 49	09:02 (1)
Potential sun hours	295		296		369	400	450	455	462	430	376	344	296		285	
Total, worst case		1408		68										937		1513
Sun reduction		0.47		0.50										0.37		0.35
Oper. time red.		0.80		0.80										0.80		0.80
Wind dir. red.		0.71		0.71										0.71		0.71
Total reduction		0.26		0.28										0.21		0.19
Total, real		368		19										196		295

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 7
Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com
Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: E - Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (13)

Assumptions for shadow calculations

Maximum distance for influence	200 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January		February		March	April	May	June	July	August	September	October		November		December	
1	07:35		07:21	07:58 (1)	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03		06:39	07:34 (1)	07:15	07:44 (1)
	16:46		17:21 38	08:36 (1)	17:57	19:31	20:04	20:35	20:46	20:27	19:44	18:50		17:02 26	08:00 (1)	16:37 17	08:01 (1)
2	07:35		07:20	07:58 (1)	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04		06:40	07:33 (1)	07:16	07:47 (1)
	16:47		17:23 38	08:36 (1)	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48		17:01 29	08:02 (1)	16:37 14	08:01 (1)
3	07:35		07:18	07:59 (1)	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05		06:41	07:32 (1)	07:17	07:49 (1)
	16:48		17:24 37	08:36 (1)	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47		17:00 31	08:03 (1)	16:37 10	07:59 (1)
4	07:35		07:17	07:59 (1)	06:39	06:46	06:00	05:33	05:37	06:03	06:35	07:07		06:43	07:31 (1)	07:18	07:53 (1)
	16:49		17:25 37	08:36 (1)	18:00	19:34	20:07	20:37	20:46	20:24	19:39	18:45		16:58 32	08:03 (1)	16:36 3	07:56 (1)
5	07:35		07:16	08:00 (1)	06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08		06:44	07:31 (1)	07:19	
	16:50		17:27 35	08:35 (1)	18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43		16:57 34	08:05 (1)	16:36	
6	07:35		07:15	08:01 (1)	06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09		06:45	07:30 (1)	07:20	
	16:51		17:28 34	08:35 (1)	18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:42		16:56 35	08:05 (1)	16:36	
7	07:35		07:14	08:01 (1)	06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10		06:46	07:29 (1)	07:21	
	16:52		17:29 32	08:33 (1)	18:03	19:38	20:11	20:39	20:45	20:20	19:33	18:40		16:55 36	08:05 (1)	16:36	
8	07:35	08:09 (1)	07:13	08:02 (1)	07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11		06:47	07:29 (1)	07:22	
	16:53 2	08:11 (1)	17:30 31	08:33 (1)	18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38		16:54 38	08:07 (1)	16:36	
9	07:35	08:05 (1)	07:12	08:04 (1)	07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12		06:49	07:29 (1)	07:23	
	16:54 10	08:15 (1)	17:32 28	08:32 (1)	19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36		16:53 38	08:07 (1)	16:36	
10	07:35	08:04 (1)	07:10	08:05 (1)	07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13		06:50	07:29 (1)	07:23	
	16:55 14	08:18 (1)	17:33 26	08:31 (1)	19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35		16:52 38	08:07 (1)	16:36	
11	07:34	08:02 (1)	07:09	08:06 (1)	07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14		06:51	07:29 (1)	07:24	
	16:56 17	08:19 (1)	17:34 22	08:28 (1)	19:07	19:42	20:15	20:42	20:44	20:15	19:27	18:33		16:51 39	08:08 (1)	16:36	
12	07:34	08:02 (1)	07:08	08:08 (1)	07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15		06:52	07:29 (1)	07:25	
	16:57 19	08:21 (1)	17:36 19	08:27 (1)	19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32		16:50 39	08:08 (1)	16:36	
13	07:34	08:02 (1)	07:07	08:12 (1)	07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16		06:54	07:29 (1)	07:26	
	16:58 21	08:23 (1)	17:37 12	08:24 (1)	19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30		16:49 38	08:07 (1)	16:36	
14	07:33	08:00 (1)	07:05		07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18		06:55	07:30 (1)	07:27	
	16:59 24	08:24 (1)	17:38		19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28		16:48 38	08:08 (1)	16:36	
15	07:33	08:00 (1)	07:04		07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19		06:56	07:30 (1)	07:27	
	17:00 25	08:25 (1)	17:39		19:12	19:46	20:19	20:44	20:42	20:10	19:20	18:27		16:47 38	08:08 (1)	16:37	
16	07:32	07:59 (1)	07:03		07:19	06:26	05:47	05:31	05:45	06:15	06:48	07:20		06:57	07:30 (1)	07:28	
	17:02 27	08:26 (1)	17:41		19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25		16:46 38	08:08 (1)	16:37	
17	07:32	07:59 (1)	07:01		07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21		06:58	07:30 (1)	07:29	
	17:03 29	08:28 (1)	17:42		19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24		16:45 37	08:07 (1)	16:37	
18	07:31	07:59 (1)	07:00		07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22		07:00	07:31 (1)	07:29	
	17:04 29	08:28 (1)	17:43		19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22		16:44 37	08:08 (1)	16:37	
19	07:31	07:58 (1)	06:58		07:13	06:22	05:44	05:31	05:48	06:19	06:51	07:23		07:01	07:32 (1)	07:30	
	17:05 31	08:29 (1)	17:44		19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:21		16:44 35	08:07 (1)	16:38	
20	07:30	07:58 (1)	06:57		07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24		07:02	07:32 (1)	07:31	
	17:06 33	08:31 (1)	17:46		19:18	19:52	20:24	20:45	20:38	20:02	19:11	18:19		16:43 35	08:07 (1)	16:38	
21	07:30	07:58 (1)	06:56		07:10	06:19	05:42	05:32	05:50	06:21	06:53	07:26		07:03	07:34 (1)	07:31	
	17:08 33	08:31 (1)	17:47		19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:18		16:42 33	08:07 (1)	16:39	
22	07:29	07:57 (1)	06:54		07:08	06:17	05:41	05:32	05:50	06:22	06:54	07:27		07:04	07:34 (1)	07:32	
	17:09 35	08:32 (1)	17:48		19:20	19:54	20:26	20:46	20:37	19:59	19:07	18:16		16:41 33	08:07 (1)	16:39	
23	07:28	07:58 (1)	06:53		07:07	06:16	05:40	05:32	05:51	06:23	06:55	07:28		07:06	07:35 (1)	07:32	
	17:10 35	08:33 (1)	17:49		19:21	19:55	20:27	20:46	20:36	19:58	19:06	18:15		16:41 31	08:06 (1)	16:40	
24	07:28	07:57 (1)	06:51		07:05	06:14	05:40	05:32	05:52	06:24	06:56	07:29		07:07	07:36 (1)	07:33	
	17:11 37	08:34 (1)	17:51		19:22	19:56	20:28	20:46	20:35	19:56	19:04	18:13		16:40 30	08:06 (1)	16:40	
25	07:27	07:57 (1)	06:50		07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30		07:08	07:36 (1)	07:33	
	17:13 37	08:34 (1)	17:52		19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12		16:40 29	08:05 (1)	16:41	
26	07:26	07:57 (1)	06:48		07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32		07:09	07:38 (1)	07:34	
	17:14 38	08:35 (1)	17:53		19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10		16:39 27	08:05 (1)	16:42	
27	07:25	07:57 (1)	06:46		07:00	06:10	05:38	05:33	05:55	06:27	06:59	07:33		07:10	07:39 (1)	07:34	
	17:15 38	08:35 (1)	17:54		19:25	20:00	20:31	20:47	20:33	19:52	18:57	18:09		16:39 26	08:05 (1)	16:42	
28	07:24	07:57 (1)	06:45		06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34		07:11	07:40 (1)	07:34	
	17:16 38	08:35 (1)	17:55		19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07		16:38 24	08:04 (1)	16:43	
29	07:23	07:57 (1)			06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	08:41 (1)	07:12		07:42 (1)	07:34
	17:18 38	08:35 (1)			19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06 14	08:55 (1)	16:38 21	08:03 (1)	16:44	
30	07:22	07:57 (1)			06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	08:38 (1)	07:14	07:43 (1)	07:35	
	17:19 39	08:36 (1)			19:29	20:03	20:33	20:47	20:30	19:47	18:52	18:05 19	08:57 (1)	16:37 19	08:02 (1)	16:44	
31	07:22	07:57 (1)			06:53		05:35		05:59	06:31		07:38	08:35 (1)			07:35	
	17:20 39	08:36 (1)			19:30		20:34		20:28	19:45		18:03 24	08:59 (1)			16:45	
Potential sun hours	295		296		369	400	450	455	462	430	376	344		296		285	
Total, worst case	688		389									57		984		44	
Sun reduction	0.47		0.50									0.49		0.37		0.35	
Oper. time red.	0.80		0.80									0.80		0.80		0.80	
Wind dir. red.	0.70		0.70									0.70		0.70		0.70	
Total reduction	0.26		0.28									0.27		0.21		0.19	
Total, real	178		107									16		203		8	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 8

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: F - Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (14)

Assumptions for shadow calculations

Maximum distance for influence	200 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January	February		March		April	May	June	July	August	September		October		November	December
1	07:35	07:21		06:43	07:23 (1)	06:51	06:04	05:35	05:35	06:00	06:32		07:03	08:05 (1)	06:39	07:15
	16:46	17:21		17:57 42	08:05 (1)	19:31	20:04	20:35	20:46	20:27	19:44		18:50 30	08:35 (1)	17:02	16:37
2	07:35	07:20		06:42	07:22 (1)	06:49	06:03	05:34	05:36	06:01	06:33		07:04	08:03 (1)	06:40	07:16
	16:47	17:23		17:58 42	08:04 (1)	19:32	20:05	20:35	20:46	20:26	19:42		18:48 33	08:36 (1)	17:01	16:37
3	07:35	07:18		06:40	07:23 (1)	06:48	06:02	05:34	05:36	06:02	06:34		07:05	08:02 (1)	06:41	07:17
	16:48	17:24		17:59 42	08:05 (1)	19:33	20:06	20:36	20:46	20:25	19:40		18:47 35	08:37 (1)	17:00	16:37
4	07:35	07:17		06:39	07:22 (1)	06:46	06:00	05:33	05:37	06:03	06:35		07:07	08:01 (1)	06:43	07:18
	16:49	17:25		18:00 42	08:04 (1)	19:34	20:07	20:37	20:46	20:24	19:39		18:45 37	08:38 (1)	16:58	16:36
5	07:35	07:16		06:37	07:23 (1)	06:44	05:59	05:33	05:37	06:04	06:36		07:08	08:00 (1)	06:44	07:19
	16:50	17:27		18:00 41	08:04 (1)	19:35	20:08	20:38	20:46	20:23	19:37		18:43 39	08:39 (1)	16:57	16:36
6	07:35	07:15		06:35	07:22 (1)	06:43	05:58	05:33	05:38	06:05	06:37		07:09	07:59 (1)	06:45	07:20
	16:51	17:28		18:01 42	08:04 (1)	19:36	20:09	20:38	20:46	20:22	19:35		18:42 40	08:39 (1)	16:56	16:36
7	07:35	07:14		06:34	07:22 (1)	06:41	05:57	05:32	05:39	06:06	06:38		07:10	07:58 (1)	06:46	07:21
	16:52	17:29		18:03 41	08:03 (1)	19:38	20:11	20:39	20:45	20:20	19:33		18:40 41	08:39 (1)	16:55	16:36
8	07:35	07:13		07:32	08:23 (1)	06:39	05:55	05:32	05:39	06:07	06:39		07:11	07:58 (1)	06:47	07:22
	16:53	17:30		18:04 39	09:02 (1)	19:39	20:12	20:40	20:45	20:19	19:32		18:38 41	08:39 (1)	16:54	16:36
9	07:35	07:12		07:30	08:23 (1)	06:38	05:54	05:32	05:40	06:08	06:40		07:12	07:57 (1)	06:49	07:23
	16:54	17:32		19:05 38	09:01 (1)	19:40	20:13	20:40	20:45	20:18	19:30		18:36 42	08:39 (1)	16:53	16:36
10	07:35	07:10		07:29	08:24 (1)	06:36	05:53	05:32	05:41	06:09	06:41		07:13	07:57 (1)	06:50	07:23
	16:55	17:33		19:06 36	09:00 (1)	19:41	20:14	20:41	20:44	20:17	19:28		18:35 42	08:39 (1)	16:52	16:36
11	07:34	07:09		07:27	08:24 (1)	06:34	05:52	05:32	05:41	06:10	06:42		07:14	07:56 (1)	06:51	07:24
	16:56	17:34		19:07 34	08:58 (1)	19:42	20:15	20:42	20:44	20:15	19:27		18:33 42	08:38 (1)	16:51	16:36
12	07:34	07:08		07:25	08:26 (1)	06:33	05:51	05:31	05:42	06:11	06:43		07:15	07:57 (1)	06:52	07:25
	16:57	17:36		19:08 31	08:57 (1)	19:43	20:16	20:42	20:43	20:14	19:25		18:32 42	08:39 (1)	16:50	16:36
13	07:34	07:07		07:24	08:27 (1)	06:31	05:50	05:31	05:43	06:12	06:44		07:16	07:57 (1)	06:54	07:26
	16:58	17:37		19:10 28	08:55 (1)	19:44	20:17	20:43	20:43	20:13	19:23		18:30 41	08:38 (1)	16:49	16:36
14	07:33	07:05		07:22	08:28 (1)	06:30	05:49	05:31	05:44	06:13	06:45		07:18	07:57 (1)	06:55	07:27
	16:59	17:38		19:11 24	08:52 (1)	19:45	20:18	20:43	20:42	20:11	19:21		18:28 40	08:37 (1)	16:48	16:36
15	07:33	07:04		07:20	08:31 (1)	06:28	05:48	05:31	05:44	06:14	06:46		07:19	07:57 (1)	06:56	07:27
	17:00	17:39		19:12 19	08:50 (1)	19:46	20:19	20:43	20:42	20:10	19:20		18:27 40	08:37 (1)	16:47	16:37
16	07:32	07:03		07:19	08:34 (1)	06:26	05:47	05:31	05:45	06:15	06:48		07:20	07:57 (1)	06:57	07:28
	17:02	17:41		19:13 12	08:46 (1)	19:47	20:20	20:44	20:41	20:08	19:18		18:25 39	08:36 (1)	16:46	16:37
17	07:32	07:01		07:17		06:25	05:46	05:31	05:46	06:16	06:49		07:21	07:58 (1)	06:58	07:29
	17:03	17:42		19:14		19:49	20:21	20:44	20:41	20:07	19:16		18:24 37	08:35 (1)	16:45	16:37
18	07:31	07:00	07:38 (1)	07:15		06:23	05:45	05:31	05:47	06:17	06:50		07:22	07:59 (1)	07:00	07:29
	17:04	17:43 15	07:53 (1)	19:15		19:50	20:22	20:45	20:40	20:05	19:14		18:22 35	08:34 (1)	16:44	16:37
19	07:31	06:58	07:35 (1)	07:13		06:22	05:44	05:31	05:48	06:19	06:51		07:23	08:00 (1)	07:01	07:30
	17:05	17:44 20	07:55 (1)	19:16		19:51	20:23	20:45	20:39	20:04	19:13		18:21 33	08:33 (1)	16:44	16:38
20	07:30	06:57	07:33 (1)	07:12		06:20	05:43	05:32	05:49	06:20	06:52		07:24	08:00 (1)	07:02	07:31
	17:06	17:46 25	07:58 (1)	19:18		19:52	20:24	20:45	20:38	20:02	19:11		18:19 31	08:31 (1)	16:43	16:38
21	07:30	06:56	07:31 (1)	07:10		06:19	05:42	05:32	05:50	06:21	06:53		07:26	08:02 (1)	07:03	07:31
	17:08	17:47 28	07:59 (1)	19:19		19:53	20:25	20:46	20:38	20:01	19:09		18:18 27	08:29 (1)	16:42	16:39
22	07:29	06:54	07:29 (1)	07:08		06:17	05:41	05:32	05:50	06:22	06:54		07:27	08:04 (1)	07:04	07:32
	17:09	17:48 32	08:01 (1)	19:20		19:54	20:26	20:46	20:37	19:59	19:07		18:16 24	08:28 (1)	16:41	16:39
23	07:28	06:53	07:28 (1)	07:07		06:16	05:40	05:32	05:51	06:23	06:55		07:28	08:06 (1)	07:06	07:32
	17:10	17:49 34	08:02 (1)	19:21		19:55	20:27	20:46	20:36	19:58	19:06		18:15 19	08:25 (1)	16:41	16:40
24	07:28	06:51	07:27 (1)	07:05		06:14	05:40	05:32	05:52	06:24	06:56		07:29	08:09 (1)	07:07	07:33
	17:11	17:51 36	08:03 (1)	19:22		19:56	20:28	20:46	20:35	19:56	19:04		18:13 13	08:22 (1)	16:40	16:40
25	07:27	06:50	07:26 (1)	07:03		06:13	05:39	05:33	05:53	06:25	06:57		07:30		07:08	07:33
	17:13	17:52 37	08:03 (1)	19:23		19:57	20:29	20:46	20:34	19:55	19:02		18:12		16:40	16:41
26	07:26	06:48	07:25 (1)	07:01		06:11	05:38	05:33	05:54	06:26	06:58		07:32		07:09	07:33
	17:14	17:53 39	08:04 (1)	19:24		19:58	20:30	20:46	20:33	19:53	19:00		18:10		16:39	16:42
27	07:25	06:46	07:24 (1)	07:00		06:10	05:38	05:33	05:55	06:27	06:59	08:17 (1)	07:33		07:10	07:34
	17:15	17:54 40	08:04 (1)	19:25		20:00	20:30	20:47	20:33	19:52	18:57 8	08:25 (1)	18:09		16:39	16:42
28	07:24	06:45	07:24 (1)	06:58		06:08	05:37	05:34	05:56	06:28	07:00	08:12 (1)	07:34		07:11	07:34
	17:16	17:55 41	08:05 (1)	19:26		20:01	20:31	20:47	20:32	19:50	18:55 18	08:30 (1)	18:07		16:38	16:43
29	07:23			06:56		06:07	05:36	05:34	05:57	06:29	07:01	08:09 (1)	07:35		07:12	07:34
	17:18			19:28		20:02	20:32	20:47	20:31	19:48	18:53 23	08:32 (1)	18:06		16:38	16:44
30	07:22			06:55		06:06	05:36	05:35	05:58	06:30	07:02	08:07 (1)	07:36		07:14	07:35
	17:19			19:29		20:03	20:33	20:47	20:30	19:47	18:52 27	08:34 (1)	18:05		16:37	16:44
31	07:22			06:53			05:35		05:59	06:31			07:38			07:35
	17:20			19:30			20:34		20:28	19:45			18:03			16:45
Potential sun hours	295	296		369		400	450	455	462	430	376		344		296	285
Total, worst case		347		553							76		843			
Sun reduction		0.50		0.50							0.58		0.49			
Oper. time red.		0.80		0.80							0.80		0.80			
Wind dir. red.		0.65		0.65							0.65		0.65			
Total reduction		0.26		0.26							0.30		0.26			
Total, real		89		144							23		216			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 9

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: G - Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (15)

Assumptions for shadow calculations

Maximum distance for influence	200 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35	07:21	06:43	06:51	06:04	06:27 (1) 05:35	06:18 (1) 05:35	06:26 (1) 06:00	06:26 (1) 06:32	07:03	06:39	07:15
	16:46	17:21	17:57	19:31	20:04 22	06:49 (1) 20:35 41	06:59 (1) 20:46 36	07:02 (1) 20:27 43	07:09 (1) 19:43	18:50	17:02	16:37
2	07:35	07:20	06:42	06:49	06:03	06:25 (1) 05:34	06:18 (1) 05:36	06:27 (1) 06:01	06:26 (1) 06:33	07:04	06:40	07:16
	16:47	17:23	17:58	19:32	20:05 26	06:51 (1) 20:35 41	06:59 (1) 20:46 36	07:03 (1) 20:26 43	07:09 (1) 19:42	18:48	17:01	16:37
3	07:35	07:18	06:40	06:48	06:02	06:24 (1) 05:34	06:18 (1) 05:36	06:26 (1) 06:02	06:27 (1) 06:34	07:05	06:41	07:17
	16:48	17:24	17:59	19:33	20:06 29	06:53 (1) 20:36 41	06:59 (1) 20:46 37	07:03 (1) 20:25 41	07:08 (1) 19:40	18:47	17:00	16:37
4	07:35	07:17	06:39	06:46	06:00	06:21 (1) 05:33	06:19 (1) 05:37	06:26 (1) 06:03	06:27 (1) 06:35	07:07	06:43	07:18
	16:49	17:25	18:00	19:34	20:07 32	06:53 (1) 20:37 40	06:59 (1) 20:46 38	07:04 (1) 20:24 40	07:07 (1) 19:38	18:45	16:58	16:36
5	07:35	07:16	06:37	06:44	05:59	06:20 (1) 05:33	06:19 (1) 05:37	06:26 (1) 06:04	06:28 (1) 06:36	07:08	06:44	07:19
	16:50	17:27	18:00	19:35	20:08 35	06:55 (1) 20:38 39	06:58 (1) 20:46 38	07:04 (1) 20:23 39	07:07 (1) 19:37	18:43	16:57	16:36
6	07:35	07:15	06:35	06:43	05:58	06:20 (1) 05:33	06:20 (1) 05:38	06:26 (1) 06:05	06:29 (1) 06:37	07:09	06:45	07:20
	16:51	17:28	18:01	19:36	20:09 36	06:56 (1) 20:38 38	06:58 (1) 20:46 38	07:04 (1) 20:22 37	07:06 (1) 19:35	18:42	16:56	16:36
7	07:35	07:14	06:34	06:41	05:57	06:19 (1) 05:32	06:20 (1) 05:39	06:26 (1) 06:06	06:29 (1) 06:38	07:10	06:46	07:21
	16:52	17:29	18:03	19:38	20:11 38	06:57 (1) 20:39 38	06:58 (1) 20:45 39	07:05 (1) 20:20 36	07:05 (1) 19:33	18:40	16:55	16:36
8	07:35	07:13	07:32	06:39	05:55	06:18 (1) 05:32	06:20 (1) 05:39	06:26 (1) 06:07	06:30 (1) 06:39	07:11	06:47	07:22
	16:53	17:30	18:04	19:39	20:12 39	06:57 (1) 20:40 38	06:58 (1) 20:45 39	07:05 (1) 20:19 34	07:04 (1) 19:32	18:38	16:54	16:36
9	07:35	07:12	07:30	06:38	05:54	06:17 (1) 05:32	06:21 (1) 05:40	06:26 (1) 06:08	06:31 (1) 06:40	07:12	06:49	07:23
	16:54	17:32	19:05	19:40	20:13 41	06:58 (1) 20:40 37	06:58 (1) 20:45 40	07:06 (1) 20:18 31	07:02 (1) 19:30	18:37	16:53	16:36
10	07:35	07:10	07:29	06:36	05:53	06:17 (1) 05:32	06:21 (1) 05:41	06:25 (1) 06:09	06:33 (1) 06:41	07:13	06:50	07:23
	16:55	17:33	19:06	19:41	20:14 42	06:59 (1) 20:41 37	06:58 (1) 20:44 41	07:06 (1) 20:17 28	07:01 (1) 19:28	18:35	16:52	16:36
11	07:34	07:09	07:27	06:34	05:52	06:15 (1) 05:32	06:22 (1) 05:41	06:25 (1) 06:10	06:34 (1) 06:42	07:14	06:51	07:24
	16:56	17:34	19:07	19:42	20:15 43	06:58 (1) 20:41 36	06:58 (1) 20:44 41	07:06 (1) 20:15 25	06:59 (1) 19:27	18:33	16:51	16:36
12	07:34	07:08	07:25	06:33	05:51	06:15 (1) 05:31	06:22 (1) 05:42	06:25 (1) 06:11	06:36 (1) 06:43	07:15	06:52	07:25
	16:57	17:36	19:08	19:43	20:16 44	06:59 (1) 20:42 36	06:58 (1) 20:43 42	07:07 (1) 20:14 21	06:57 (1) 19:25	18:32	16:50	16:36
13	07:34	07:07	07:24	06:31	05:50	06:15 (1) 05:31	06:23 (1) 05:43	06:26 (1) 06:12	06:39 (1) 06:44	07:16	06:54	07:26
	16:58	17:37	19:10	19:44	20:17 44	06:59 (1) 20:43 35	06:58 (1) 20:43 42	07:08 (1) 20:13 15	06:54 (1) 19:23	18:30	16:49	16:36
14	07:33	07:05	07:22	06:30	05:49	06:14 (1) 05:31	06:23 (1) 05:44	06:25 (1) 06:13	06:46 (1) 06:45	07:18	06:55	07:27
	16:59	17:38	19:11	19:45	20:18 45	06:59 (1) 20:43 35	06:58 (1) 20:42 42	07:07 (1) 20:11 2	06:47 (1) 19:21	18:28	16:48	16:36
15	07:33	07:04	07:20	06:28	05:48	06:14 (1) 05:31	06:24 (1) 05:44	06:25 (1) 06:14	06:46	07:19	06:56	07:27
	17:00	17:39	19:12	19:46	20:19 45	06:59 (1) 20:43 34	06:58 (1) 20:42 43	07:08 (1) 20:10	19:20	18:27	16:47	16:37
16	07:32	07:03	07:19	06:26	05:47	06:15 (1) 05:31	06:24 (1) 05:45	06:25 (1) 06:15	06:48	07:20	06:57	07:28
	17:02	17:41	19:13	19:47	20:20 45	07:00 (1) 20:44 34	06:58 (1) 20:41 44	07:09 (1) 20:08	19:18	18:25	16:46	16:37
17	07:32	07:01	07:17	06:25	05:46	06:15 (1) 05:31	06:24 (1) 05:46	06:25 (1) 06:16	06:49	07:21	06:58	07:29
	17:03	17:42	19:14	19:49	20:21 45	07:00 (1) 20:44 34	06:58 (1) 20:41 44	07:09 (1) 20:07	19:16	18:24	16:45	16:37
18	07:31	07:00	07:15	06:23	05:45	06:15 (1) 05:31	06:24 (1) 05:47	06:25 (1) 06:17	06:50	07:22	07:00	07:29
	17:04	17:43	19:15	19:50	20:22 45	07:00 (1) 20:45 34	06:58 (1) 20:40 45	07:10 (1) 20:05	19:14	18:22	16:44	16:38
19	07:31	06:58	07:13	06:22	05:44	06:14 (1) 05:31	06:25 (1) 05:48	06:24 (1) 06:19	06:51	07:23	07:01	07:30
	17:05	17:44	19:16	19:51	20:23 46	07:00 (1) 20:45 33	06:58 (1) 20:39 45	07:09 (1) 20:04	19:13	18:21	16:44	16:38
20	07:30	06:57	07:12	06:20	05:43	06:14 (1) 05:32	06:25 (1) 05:49	06:24 (1) 06:20	06:52	07:24	07:02	07:31
	17:06	17:46	19:18	19:52	20:24 46	07:00 (1) 20:45 33	06:58 (1) 20:38 46	07:10 (1) 20:02	19:11	18:19	16:43	16:38
21	07:30	06:55	07:10	06:19	05:42	06:14 (1) 05:32	06:26 (1) 05:50	06:24 (1) 06:21	06:53	07:26	07:03	07:31
	17:08	17:47	19:19	19:53	20:25 46	07:00 (1) 20:46 33	06:59 (1) 20:38 46	07:10 (1) 20:01	19:09	18:18	16:42	16:39
22	07:29	06:54	07:08	06:17	05:41	06:15 (1) 05:32	06:26 (1) 05:50	06:25 (1) 06:22	06:54	07:27	07:04	07:32
	17:09	17:48	19:20	19:54	20:26 46	07:01 (1) 20:46 33	06:59 (1) 20:37 45	07:10 (1) 19:59	19:07	18:16	16:41	16:39
23	07:28	06:53	07:07	06:16	05:40	06:15 (1) 05:32	06:26 (1) 05:51	06:25 (1) 06:23	06:55	07:28	07:06	07:32
	17:10	17:49	19:21	19:55	20:27 45	07:00 (1) 20:46 33	06:59 (1) 20:36 45	07:10 (1) 19:58	19:06	18:15	16:41	16:40
24	07:28	06:51	07:05	06:14	05:40	06:15 (1) 05:32	06:26 (1) 05:52	06:25 (1) 06:24	06:56	07:29	07:07	07:33
	17:11	17:51	19:22	19:56	20:28 45	07:00 (1) 20:46 33	06:59 (1) 20:35 46	07:11 (1) 19:56	19:04	18:13	16:40	16:40
25	07:27	06:50	07:03	06:13	05:39	06:15 (1) 05:33	06:26 (1) 05:53	06:25 (1) 06:25	06:57	07:30	07:08	07:33
	17:13	17:52	19:23	19:57	20:29 44	06:59 (1) 20:46 34	07:00 (1) 20:34 46	07:11 (1) 19:55	19:02	18:12	16:40	16:41
26	07:26	06:48	07:01	06:11	05:38	06:16 (1) 05:33	06:26 (1) 05:54	06:25 (1) 06:26	06:58	07:32	07:09	07:33
	17:14	17:53	19:24	19:58	20:30 44	07:00 (1) 20:46 34	07:00 (1) 20:33 46	07:11 (1) 19:53	19:00	18:10	16:39	16:42
27	07:25	06:46	07:00	06:10	05:38	06:15 (1) 05:33	06:26 (1) 05:55	06:25 (1) 06:27	06:59	07:33	07:10	07:34
	17:15	17:54	19:25	20:00	20:30 44	06:59 (1) 20:46 34	07:00 (1) 20:33 46	07:11 (1) 19:52	18:57	18:09	16:39	16:42
28	07:24	06:45	06:58	06:08	05:37	06:16 (1) 05:34	06:26 (1) 05:56	06:25 (1) 06:28	07:00	07:34	07:11	07:34
	17:16	17:55	19:26	20:01	20:31 44	07:00 (1) 20:47 35	07:01 (1) 20:32 45	07:10 (1) 19:50	18:55	18:07	16:38	16:43
29	07:23		06:56	06:07 06:35 (1)	05:36	06:16 (1) 05:34	06:26 (1) 05:57	06:25 (1) 06:29	07:01	07:35	07:12	07:34
	17:18		19:28	20:02 7 06:42 (1)	20:32 43	06:59 (1) 20:47 35	07:01 (1) 20:31 45	07:10 (1) 19:48	18:53	18:06	16:38	16:44
30	07:22		06:55	06:06 06:30 (1)	05:36	06:17 (1) 05:35	06:27 (1) 05:58	06:25 (1) 06:30	07:02	07:36	07:14	07:35
	17:19		19:29	20:03 17 06:47 (1)	20:33 43	07:00 (1) 20:46 35	07:02 (1) 20:30 45	07:10 (1) 19:47	18:52	18:05	16:37	16:44
31	07:22		06:53		05:35	06:17 (1)		06:25 (1) 06:31		07:38		07:35
	17:20		19:30		20:34 42	06:59 (1)		20:28 44 07:09 (1) 19:45		18:03		16:45
Potential sun hours	295	296	369	400	450	455	462	430	376	344	296	285
Total, worst case				24	1274	1073	1315	435				
Sun reduction				0.53	0.59	0.64	0.65	0.61				
Oper. time red.				0.80	0.80	0.80	0.80	0.80				
Wind dir. red.				0.57	0.57	0.57	0.57	0.57				
Total reduction				0.24	0.27	0.29	0.30	0.28				
Total, real				6	343	312	391	121				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

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12/15/2010 10:25 AM / 10

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: H - Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (16)

Assumptions for shadow calculations

Maximum distance for influence	200 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January		February	March	April	May	June	July	August	September	October	November		December	
1	07:35		12:26 (1)	07:21	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39		07:15	12:23 (1)
	16:46	49	13:15 (1)	17:21	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02		16:37	29	12:52 (1)
2	07:35		12:27 (1)	07:19	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40		07:16		12:21 (1)
	16:47	48	13:15 (1)	17:23	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01		16:37	33	12:54 (1)
3	07:35		12:28 (1)	07:18	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41		07:17		12:21 (1)
	16:48	47	13:15 (1)	17:24	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00		16:37	36	12:57 (1)
4	07:35		12:29 (1)	07:17	06:39	06:46	06:00	05:33	05:37	06:03	06:35	07:06	06:42		07:18		12:20 (1)
	16:49	46	13:15 (1)	17:25	18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58		16:36	38	12:58 (1)
5	07:35		12:31 (1)	07:16	06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44		07:19		12:19 (1)
	16:50	44	13:15 (1)	17:27	18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57		16:36	40	12:59 (1)
6	07:35		12:32 (1)	07:15	06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45		07:20		12:18 (1)
	16:51	43	13:15 (1)	17:28	18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56		16:36	43	13:01 (1)
7	07:35		12:33 (1)	07:14	06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46		07:21		12:18 (1)
	16:52	40	13:13 (1)	17:29	18:03	19:37	20:10	20:39	20:45	20:20	19:33	18:40	16:55		16:36	44	13:02 (1)
8	07:35		12:35 (1)	07:13	07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47		07:22		12:18 (1)
	16:53	38	13:13 (1)	17:30	18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54		16:36	45	13:03 (1)
9	07:35		12:37 (1)	07:12	07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49		07:23		12:16 (1)
	16:54	36	13:13 (1)	17:32	19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53		16:36	47	13:03 (1)
10	07:35		12:39 (1)	07:10	07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50		07:23		12:16 (1)
	16:55	33	13:12 (1)	17:33	19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52		16:36	48	13:04 (1)
11	07:34		12:40 (1)	07:09	07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51		07:24		12:16 (1)
	16:56	30	13:10 (1)	17:34	19:07	19:42	20:15	20:41	20:44	20:15	19:27	18:33	16:51		16:36	49	13:05 (1)
12	07:34		12:44 (1)	07:08	07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52		07:25		12:16 (1)
	16:57	25	13:09 (1)	17:36	19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50		16:36	50	13:06 (1)
13	07:34		12:47 (1)	07:07	07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54		07:26		12:17 (1)
	16:58	20	13:07 (1)	17:37	19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49		16:36	50	13:07 (1)
14	07:33		12:52 (1)	07:05	07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55		07:27		12:17 (1)
	16:59	10	13:02 (1)	17:38	19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48		16:36	51	13:08 (1)
15	07:33			07:04	07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56		07:27		12:16 (1)
	17:00			17:39	19:12	19:46	20:19	20:43	20:42	20:10	19:20	18:27	16:47		16:37	52	13:08 (1)
16	07:32			07:03	07:19	06:26	05:47	05:31	05:45	06:15	06:47	07:20	06:57		07:28		12:17 (1)
	17:02			17:41	19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46		16:37	52	13:09 (1)
17	07:32			07:01	07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21	06:58		07:29		12:18 (1)
	17:03			17:42	19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45		16:37	52	13:10 (1)
18	07:31			07:00	07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00		07:29		12:17 (1)
	17:04			17:43	19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44		16:37	53	13:10 (1)
19	07:31			06:58	07:13	06:22	05:44	05:31	05:48	06:18	06:51	07:23	07:01		07:30		12:18 (1)
	17:05			17:44	19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:20	16:44		16:38	53	13:11 (1)
20	07:30			06:57	07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24	07:02		07:31		12:18 (1)
	17:06			17:46	19:17	19:52	20:24	20:45	20:38	20:02	19:11	18:19	16:43		16:38	53	13:11 (1)
21	07:30			06:55	07:10	06:19	05:42	05:32	05:50	06:21	06:53	07:26	07:03		07:31		12:19 (1)
	17:08			17:47	19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:17	16:42		16:39	53	13:12 (1)
22	07:29			06:54	07:08	06:17	05:41	05:32	05:50	06:22	06:54	07:27	07:04		07:32		12:19 (1)
	17:09			17:48	19:20	19:54	20:26	20:46	20:37	19:59	19:07	18:16	16:41		16:39	53	13:12 (1)
23	07:28			06:53	07:07	06:16	05:40	05:32	05:51	06:23	06:55	07:28	07:06		07:32		12:20 (1)
	17:10			17:49	19:21	19:55	20:27	20:46	20:36	19:58	19:06	18:15	16:41		16:40	53	13:13 (1)
24	07:28			06:51	07:05	06:14	05:40	05:32	05:52	06:24	06:56	07:29	07:07		07:33		12:20 (1)
	17:11			17:51	19:22	19:56	20:28	20:46	20:35	19:56	19:04	18:13	16:40		16:40	53	13:13 (1)
25	07:27			06:49	07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30	07:08		07:33		12:21 (1)
	17:12			17:52	19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40		16:41	53	13:14 (1)
26	07:26			06:48	07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32	07:09		07:33		12:21 (1)
	17:14			17:53	19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39		16:42	53	13:14 (1)
27	07:25			06:46	07:00	06:10	05:37	05:33	05:55	06:27	06:59	07:33	07:10		07:34		12:22 (1)
	17:15			17:54	19:25	20:00	20:30	20:46	20:33	19:52	18:57	18:09	16:39		16:42	52	13:14 (1)
28	07:24			06:45	06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11	12:33 (1)	07:34		12:22 (1)
	17:16			17:55	19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38	9 12:42 (1)	16:43	52	13:14 (1)
29	07:23				06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12	12:28 (1)	07:34		12:24 (1)
	17:18				19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38	19 12:47 (1)	16:44	51	13:15 (1)
30	07:22				06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14	12:25 (1)	07:35		12:24 (1)
	17:19				19:29	20:03	20:33	20:46	20:30	19:47	18:52	18:05	16:37	25 12:50 (1)	16:44	51	13:15 (1)
31	07:21				06:53		05:35		05:59	06:31		07:38			07:35		12:25 (1)
	17:20				19:30		20:34		20:28	19:45		18:03			16:45	50	13:15 (1)
Potential sun hours	295			296	369	400	450	455	462	430	376	344	296		285		
Total, worst case		509												53		1492	
Sun reduction		0.47												0.37		0.35	
Oper. time red.		0.80												0.80		0.80	
Wind dir. red.		0.63												0.63		0.63	
Total reduction		0.23												0.19		0.17	
Total, real		119												10		261	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 11
Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com
Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: I - Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (17)

Assumptions for shadow calculations

Maximum distance for influence	200 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January		February	March	April	May	June	July	August	September	October	November		December		
1	07:35	13:59 (1)	07:21	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39		07:15		13:48 (1)
	16:46 61	15:00 (1)	17:21	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02		16:37	55	14:43 (1)
2	07:35	14:00 (1)	07:19	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40		07:16		13:47 (1)
	16:47 60	15:00 (1)	17:23	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01		16:37	57	14:44 (1)
3	07:35	14:00 (1)	07:18	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41		07:17		13:48 (1)
	16:48 60	15:00 (1)	17:24	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00		16:37	58	14:46 (1)
4	07:35	14:01 (1)	07:17	06:38	06:46	06:00	05:33	05:37	06:03	06:35	07:06	06:42		07:18		13:48 (1)
	16:49 60	15:01 (1)	17:25	18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58		16:36	58	14:46 (1)
5	07:35	14:02 (1)	07:16	06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44		07:19		13:48 (1)
	16:50 59	15:01 (1)	17:27	18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57		16:36	59	14:47 (1)
6	07:35	14:02 (1)	07:15	06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45		07:20		13:48 (1)
	16:51 59	15:01 (1)	17:28	18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56		16:36	60	14:48 (1)
7	07:35	14:02 (1)	07:14	06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46		07:21		13:49 (1)
	16:52 59	15:01 (1)	17:29	18:03	19:37	20:10	20:39	20:45	20:20	19:33	18:40	16:55		16:36	59	14:48 (1)
8	07:35	14:03 (1)	07:13	07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47		07:22		13:49 (1)
	16:53 58	15:01 (1)	17:30	18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54		16:36	60	14:49 (1)
9	07:35	14:04 (1)	07:12	07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49		07:23		13:48 (1)
	16:54 58	15:02 (1)	17:32	19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53		16:36	60	14:48 (1)
10	07:35	14:05 (1)	07:10	07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50		07:23		13:49 (1)
	16:55 57	15:02 (1)	17:33	19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52		16:36	60	14:49 (1)
11	07:34	14:05 (1)	07:09	07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51		07:24		13:49 (1)
	16:56 56	15:01 (1)	17:34	19:07	19:42	20:15	20:41	20:44	20:15	19:27	18:33	16:51		16:36	61	14:50 (1)
12	07:34	14:07 (1)	07:08	07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52		07:25		13:49 (1)
	16:57 55	15:02 (1)	17:36	19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50		16:36	62	14:51 (1)
13	07:34	14:08 (1)	07:07	07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54		07:26		13:50 (1)
	16:58 54	15:02 (1)	17:37	19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49		16:36	61	14:51 (1)
14	07:33	14:08 (1)	07:05	07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55	14:06 (1)	07:27		13:51 (1)
	16:59 54	15:02 (1)	17:38	19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48 14	14:20 (1)	16:36	61	14:52 (1)
15	07:33	14:10 (1)	07:04	07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56	14:03 (1)	07:27		13:50 (1)
	17:00 52	15:02 (1)	17:39	19:12	19:46	20:19	20:43	20:42	20:10	19:20	18:27	16:47 21	14:24 (1)	16:37	62	14:52 (1)
16	07:32	14:10 (1)	07:03	07:19	06:26	05:47	05:31	05:45	06:15	06:47	07:20	06:57	14:00 (1)	07:28		13:51 (1)
	17:02 51	15:01 (1)	17:41	19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46 27	14:27 (1)	16:37	62	14:53 (1)
17	07:32	14:12 (1)	07:01	07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21	06:58	13:58 (1)	07:29		13:52 (1)
	17:03 50	15:02 (1)	17:42	19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45 30	14:28 (1)	16:37	61	14:53 (1)
18	07:31	14:13 (1)	07:00	07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00	13:57 (1)	07:29		13:51 (1)
	17:04 48	15:01 (1)	17:43	19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44 34	14:31 (1)	16:37	62	14:53 (1)
19	07:31	14:14 (1)	06:58	07:13	06:22	05:44	05:31	05:48	06:18	06:51	07:23	07:01	13:55 (1)	07:30		13:52 (1)
	17:05 46	15:00 (1)	17:44	19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:20	16:44 37	14:32 (1)	16:38	62	14:54 (1)
20	07:30	14:16 (1)	06:57	07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24	07:02	13:53 (1)	07:31		13:52 (1)
	17:06 44	15:00 (1)	17:46	19:17	19:52	20:24	20:45	20:38	20:02	19:11	18:19	16:43 40	14:33 (1)	16:38	62	14:54 (1)
21	07:30	14:17 (1)	06:55	07:10	06:19	05:42	05:32	05:50	06:21	06:53	07:26	07:03	13:52 (1)	07:31		13:53 (1)
	17:08 42	14:59 (1)	17:47	19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:17	16:42 42	14:34 (1)	16:39	62	14:55 (1)
22	07:29	14:18 (1)	06:54	07:08	06:17	05:41	05:32	05:50	06:22	06:54	07:27	07:04	13:52 (1)	07:32		13:53 (1)
	17:09 40	14:58 (1)	17:48	19:20	19:54	20:26	20:46	20:37	19:59	19:07	18:16	16:41 44	14:36 (1)	16:39	62	14:55 (1)
23	07:28	14:20 (1)	06:53	07:07	06:16	05:40	05:32	05:51	06:23	06:55	07:28	07:06	13:51 (1)	07:32		13:54 (1)
	17:10 37	14:57 (1)	17:49	19:21	19:55	20:27	20:46	20:36	19:58	19:06	18:15	16:41 46	14:37 (1)	16:40	62	14:56 (1)
24	07:28	14:23 (1)	06:51	07:05	06:14	05:40	05:32	05:52	06:24	06:56	07:29	07:07	13:50 (1)	07:33		13:54 (1)
	17:11 34	14:57 (1)	17:51	19:22	19:56	20:28	20:46	20:35	19:56	19:04	18:13	16:40 48	14:38 (1)	16:40	62	14:56 (1)
25	07:27	14:25 (1)	06:49	07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30	07:08	13:49 (1)	07:33		13:55 (1)
	17:12 30	14:55 (1)	17:52	19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40 50	14:39 (1)	16:41	62	14:57 (1)
26	07:26	14:27 (1)	06:48	07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32	07:09	13:49 (1)	07:33		13:56 (1)
	17:14 27	14:54 (1)	17:53	19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39 51	14:40 (1)	16:42	61	14:57 (1)
27	07:25	14:30 (1)	06:46	07:00	06:10	05:37	05:33	05:55	06:27	06:59	07:33	07:10	13:49 (1)	07:34		13:56 (1)
	17:15 21	14:51 (1)	17:54	19:25	20:00	20:30	20:46	20:33	19:52	18:57	18:09	16:39 52	14:41 (1)	16:42	62	14:58 (1)
28	07:24	14:34 (1)	06:45	06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11	13:48 (1)	07:34		13:56 (1)
	17:16 13	14:47 (1)	17:55	19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38 54	14:42 (1)	16:43	62	14:58 (1)
29	07:23			06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12	13:48 (1)	07:34		13:57 (1)
	17:18			19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38 54	14:42 (1)	16:44	62	14:59 (1)
30	07:22			06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14	13:48 (1)	07:35		13:58 (1)
	17:19			19:29	20:03	20:33	20:46	20:30	19:47	18:52	18:05	16:37 55	14:43 (1)	16:44	61	14:59 (1)
31	07:21			06:53		05:35		05:59	06:31		07:38			07:35		13:58 (1)
	17:20			19:30		20:34		20:28	19:45		18:03			16:45	61	14:59 (1)
Potential sun hours	295		296	369	400	450	455	462	430	376	344	296		285		
Total, worst case		1345											699		1881	
Sun reduction		0.47											0.37		0.35	
Oper. time red.		0.80											0.80		0.80	
Wind dir. red.		0.58											0.58		0.58	
Total reduction		0.22											0.17		0.16	
Total, real		290											120		302	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 12

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: J - Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (18)

Assumptions for shadow calculations

Maximum distance for influence	200 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January			February	March	April	May	June	July	August	September	October	November			December		
1	07:35		09:00 (1)	07:21	06:43	06:51	06:04	05:35	05:35	06:00	06:32	07:03	06:39			07:15		08:51 (1)
	16:46	45	09:45 (1)	17:21	17:57	19:31	20:04	20:35	20:46	20:27	19:43	18:50	17:02			16:37	33	09:24 (1)
2	07:35		09:01 (1)	07:20	06:42	06:49	06:03	05:34	05:36	06:01	06:33	07:04	06:40			07:16		08:52 (1)
	16:47	44	09:45 (1)	17:23	17:58	19:32	20:05	20:35	20:46	20:26	19:42	18:48	17:01			16:37	34	09:26 (1)
3	07:35		09:02 (1)	07:18	06:40	06:48	06:02	05:34	05:36	06:02	06:34	07:05	06:41			07:17		08:51 (1)
	16:48	43	09:45 (1)	17:24	17:59	19:33	20:06	20:36	20:46	20:25	19:40	18:47	17:00			16:37	36	09:27 (1)
4	07:35		09:02 (1)	07:17	06:39	06:46	06:00	05:33	05:37	06:03	06:35	07:07	06:42			07:18		08:51 (1)
	16:49	43	09:45 (1)	17:25	18:00	19:34	20:07	20:37	20:46	20:24	19:38	18:45	16:58			16:36	38	09:29 (1)
5	07:35		09:03 (1)	07:16	06:37	06:44	05:59	05:33	05:37	06:04	06:36	07:08	06:44			07:19		08:51 (1)
	16:50	42	09:45 (1)	17:27	18:00	19:35	20:08	20:38	20:46	20:23	19:37	18:43	16:57			16:36	39	09:30 (1)
6	07:35		09:04 (1)	07:15	06:35	06:43	05:58	05:33	05:38	06:05	06:37	07:09	06:45			07:20		08:51 (1)
	16:51	41	09:45 (1)	17:28	18:01	19:36	20:09	20:38	20:46	20:22	19:35	18:41	16:56			16:36	40	09:31 (1)
7	07:35		09:06 (1)	07:14	06:34	06:41	05:57	05:32	05:39	06:06	06:38	07:10	06:46			07:21		08:51 (1)
	16:52	39	09:45 (1)	17:29	18:03	19:38	20:11	20:39	20:45	20:20	19:33	18:40	16:55			16:36	41	09:32 (1)
8	07:35		09:06 (1)	07:13	07:32	06:39	05:55	05:32	05:39	06:07	06:39	07:11	06:47			07:22		08:51 (1)
	16:53	38	09:44 (1)	17:30	18:04	19:39	20:12	20:40	20:45	20:19	19:32	18:38	16:54			16:36	42	09:33 (1)
9	07:35		09:07 (1)	07:12	07:30	06:38	05:54	05:32	05:40	06:08	06:40	07:12	06:49			07:23		08:50 (1)
	16:54	36	09:43 (1)	17:32	19:05	19:40	20:13	20:40	20:45	20:18	19:30	18:36	16:53			16:36	43	09:33 (1)
10	07:35		09:09 (1)	07:10	07:29	06:36	05:53	05:32	05:41	06:09	06:41	07:13	06:50			07:23		08:50 (1)
	16:55	34	09:43 (1)	17:33	19:06	19:41	20:14	20:41	20:44	20:17	19:28	18:35	16:52			16:36	44	09:34 (1)
11	07:34		09:09 (1)	07:09	07:27	06:34	05:52	05:31	05:41	06:10	06:42	07:14	06:51			07:24		08:50 (1)
	16:56	33	09:42 (1)	17:34	19:07	19:42	20:15	20:41	20:44	20:15	19:27	18:33	16:51			16:36	45	09:35 (1)
12	07:34		09:11 (1)	07:08	07:25	06:33	05:51	05:31	05:42	06:11	06:43	07:15	06:52			07:25		08:51 (1)
	16:57	31	09:42 (1)	17:36	19:08	19:43	20:16	20:42	20:43	20:14	19:25	18:32	16:50			16:36	44	09:35 (1)
13	07:34		09:13 (1)	07:07	07:24	06:31	05:50	05:31	05:43	06:12	06:44	07:16	06:54			07:26		08:51 (1)
	16:58	28	09:41 (1)	17:37	19:10	19:44	20:17	20:43	20:43	20:13	19:23	18:30	16:49			16:36	45	09:36 (1)
14	07:33		09:14 (1)	07:05	07:22	06:30	05:49	05:31	05:44	06:13	06:45	07:18	06:55			07:27		08:51 (1)
	16:59	25	09:39 (1)	17:38	19:11	19:45	20:18	20:43	20:42	20:11	19:21	18:28	16:48			16:36	46	09:37 (1)
15	07:33		09:17 (1)	07:04	07:20	06:28	05:48	05:31	05:44	06:14	06:46	07:19	06:56			07:27		08:51 (1)
	17:00	21	09:38 (1)	17:39	19:12	19:46	20:19	20:43	20:42	20:10	19:20	18:27	16:47			16:37	46	09:37 (1)
16	07:32		09:19 (1)	07:03	07:19	06:26	05:47	05:31	05:45	06:15	06:48	07:20	06:57			07:28		08:52 (1)
	17:02	17	09:36 (1)	17:41	19:13	19:47	20:20	20:44	20:41	20:08	19:18	18:25	16:46			16:37	46	09:38 (1)
17	07:32		09:23 (1)	07:01	07:17	06:25	05:46	05:31	05:46	06:16	06:49	07:21	06:58			07:29		08:52 (1)
	17:03	11	09:34 (1)	17:42	19:14	19:49	20:21	20:44	20:41	20:07	19:16	18:24	16:45			16:37	47	09:39 (1)
18	07:31			07:00	07:15	06:23	05:45	05:31	05:47	06:17	06:50	07:22	07:00			07:29		08:52 (1)
	17:04			17:43	19:15	19:50	20:22	20:45	20:40	20:05	19:14	18:22	16:44			16:37	47	09:39 (1)
19	07:31			06:58	07:13	06:22	05:44	05:31	05:48	06:19	06:51	07:23	07:01			07:30		08:53 (1)
	17:05			17:44	19:16	19:51	20:23	20:45	20:39	20:04	19:13	18:21	16:44			16:38	47	09:40 (1)
20	07:30			06:57	07:12	06:20	05:43	05:32	05:49	06:20	06:52	07:24	07:02			07:31		08:53 (1)
	17:06			17:46	19:18	19:52	20:24	20:45	20:38	20:02	19:11	18:19	16:43			16:38	47	09:40 (1)
21	07:30			06:55	07:10	06:19	05:42	05:32	05:50	06:21	06:53	07:26	07:03			07:31		08:54 (1)
	17:08			17:47	19:19	19:53	20:25	20:46	20:38	20:01	19:09	18:17	16:42			16:39	47	09:41 (1)
22	07:29			06:54	07:08	06:17	05:41	05:32	05:50	06:22	06:54	07:27	07:04			07:32		08:54 (1)
	17:09			17:48	19:20	19:54	20:26	20:46	20:37	19:59	19:07	18:16	16:41			16:39	47	09:41 (1)
23	07:28			06:53	07:07	06:16	05:40	05:32	05:51	06:23	06:55	07:28	07:06			07:32		08:55 (1)
	17:10			17:49	19:21	19:55	20:27	20:46	20:36	19:58	19:06	18:15	16:41			16:40	47	09:42 (1)
24	07:28			06:51	07:05	06:14	05:40	05:32	05:52	06:24	06:56	07:29	07:07			07:33		08:55 (1)
	17:11			17:51	19:22	19:56	20:28	20:46	20:35	19:56	19:04	18:13	16:40			16:40	47	09:42 (1)
25	07:27			06:50	07:03	06:13	05:39	05:33	05:53	06:25	06:57	07:30	07:08		09:00 (1)	07:33		08:56 (1)
	17:13			17:52	19:23	19:57	20:29	20:46	20:34	19:55	19:02	18:12	16:40	11	09:11 (1)	16:41	47	09:43 (1)
26	07:26			06:48	07:01	06:11	05:38	05:33	05:54	06:26	06:58	07:32	07:09		08:58 (1)	07:33		08:56 (1)
	17:14			17:53	19:24	19:58	20:30	20:46	20:33	19:53	19:00	18:10	16:39	17	09:15 (1)	16:42	47	09:43 (1)
27	07:25			06:46	07:00	06:10	05:38	05:33	05:55	06:27	06:59	07:33	07:10		08:56 (1)	07:34		08:56 (1)
	17:15			17:54	19:25	20:00	20:30	20:47	20:33	19:52	18:57	18:09	16:39	21	09:17 (1)	16:42	47	09:43 (1)
28	07:24			06:45	06:58	06:08	05:37	05:34	05:56	06:28	07:00	07:34	07:11		08:54 (1)	07:34		08:57 (1)
	17:16			17:55	19:26	20:01	20:31	20:47	20:32	19:50	18:55	18:07	16:38	25	09:19 (1)	16:43	46	09:43 (1)
29	07:23				06:56	06:07	05:36	05:34	05:57	06:29	07:01	07:35	07:12		08:53 (1)	07:34		08:58 (1)
	17:18				19:28	20:02	20:32	20:47	20:31	19:48	18:53	18:06	16:38	28	09:21 (1)	16:44	46	09:44 (1)
30	07:22				06:55	06:06	05:36	05:35	05:58	06:30	07:02	07:36	07:14		08:52 (1)	07:35		08:59 (1)
	17:19				19:29	20:03	20:33	20:47	20:30	19:47	18:52	18:05	16:37	30	09:22 (1)	16:44	45	09:44 (1)
31	07:22				06:53		05:35		05:59	06:31		07:38				07:35		08:59 (1)
	17:20				19:30		20:34		20:28	19:45		18:03				16:45	45	09:44 (1)
Potential sun hours	295			296	369	400	450	455	462	430	376	344	296			285		
Total, worst case		571												132			1361	
Sun reduction		0.47												0.37			0.35	
Oper. time red.		0.80												0.80			0.80	
Wind dir. red.		0.72												0.72			0.72	
Total reduction		0.27												0.21			0.20	
Total, real		152												28			270	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 13

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: K - Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (19)

Assumptions for shadow calculations

Maximum distance for influence	200	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April			May			June	July	August			September			October	November	December
1	07:35	07:21	06:43	06:51			06:04		07:00 (1)	05:35	05:35	06:00			06:32		06:58 (1)	07:03	06:39	07:15
	16:46	17:21	17:57	19:31			20:04	27	07:27 (1)	20:35	20:46	20:27			19:44	38	07:36 (1)	18:50	17:02	16:37
2	07:35	07:20	06:42	06:49			06:03		07:01 (1)	05:34	05:36	06:01			06:33		06:59 (1)	07:04	06:40	07:16
	16:47	17:23	17:58	19:32			20:05	24	07:25 (1)	20:35	20:46	20:26			19:42	36	07:35 (1)	18:48	17:01	16:37
3	07:35	07:18	06:40	06:48			06:02		07:04 (1)	05:34	05:36	06:02			06:34		07:00 (1)	07:05	06:41	07:17
	16:48	17:24	17:59	19:33			20:06	19	07:23 (1)	20:36	20:46	20:25			19:40	34	07:34 (1)	18:47	17:00	16:37
4	07:35	07:17	06:39	06:46		07:15 (1)	06:00		07:05 (1)	05:33	05:37	06:03			06:35		07:01 (1)	07:07	06:43	07:18
	16:49	17:25	18:00	19:34	10	07:25 (1)	20:07	14	07:19 (1)	20:37	20:46	20:24			19:38	31	07:32 (1)	18:45	16:58	16:36
5	07:35	07:16	06:37	06:44		07:11 (1)	05:59		07:11 (1)	05:33	05:37	06:04			06:36		07:02 (1)	07:08	06:44	07:19
	16:50	17:27	18:00	19:35	19	07:30 (1)	20:08	3	07:14 (1)	20:38	20:46	20:23			19:37	28	07:30 (1)	18:43	16:57	16:36
6	07:35	07:15	06:35	06:43		07:08 (1)	05:58			05:33	05:38	06:05			06:37		07:04 (1)	07:09	06:45	07:20
	16:51	17:28	18:01	19:36	24	07:32 (1)	20:09			20:38	20:46	20:22			19:35	24	07:28 (1)	18:42	16:56	16:36
7	07:35	07:14	06:34	06:41		07:05 (1)	05:57			05:32	05:39	06:06			06:38		07:06 (1)	07:10	06:46	07:21
	16:52	17:29	18:03	19:38	28	07:33 (1)	20:11			20:39	20:45	20:20			19:33	19	07:25 (1)	18:40	16:55	16:36
8	07:35	07:13	07:32	06:39		07:04 (1)	05:55			05:32	05:39	06:07		07:18 (1)	06:39		07:10 (1)	07:11	06:47	07:22
	16:53	17:30	18:04	19:39	31	07:35 (1)	20:12			20:40	20:45	20:19	8	07:26 (1)	19:32	10	07:20 (1)	18:38	16:54	16:36
9	07:35	07:12	07:30	06:38		07:02 (1)	05:54			05:32	05:40	06:08		07:14 (1)	06:40			07:12	06:49	07:23
	16:54	17:32	19:05	19:40	34	07:36 (1)	20:13			20:40	20:45	20:18	16	07:30 (1)	19:30			18:37	16:53	16:36
10	07:35	07:10	07:29	06:36		07:00 (1)	05:53			05:32	05:41	06:09		07:12 (1)	06:41			07:13	06:50	07:23
	16:55	17:33	19:06	19:41	36	07:36 (1)	20:14			20:41	20:44	20:17	20	07:32 (1)	19:28			18:35	16:52	16:36
11	07:34	07:09	07:27	06:34		07:00 (1)	05:52			05:32	05:41	06:10		07:10 (1)	06:42			07:14	06:51	07:24
	16:56	17:34	19:07	19:42	37	07:37 (1)	20:15			20:41	20:44	20:15	24	07:34 (1)	19:27			18:33	16:51	16:36
12	07:34	07:08	07:25	06:33		06:58 (1)	05:51			05:31	05:42	06:11		07:08 (1)	06:43			07:15	06:52	07:25
	16:57	17:36	19:08	19:43	40	07:38 (1)	20:16			20:42	20:43	20:14	28	07:36 (1)	19:25			18:32	16:50	16:36
13	07:34	07:07	07:24	06:31		06:58 (1)	05:50			05:31	05:43	06:12		07:06 (1)	06:44			07:16	06:54	07:26
	16:58	17:37	19:10	19:44	40	07:38 (1)	20:17			20:43	20:43	20:13	31	07:37 (1)	19:23			18:30	16:49	16:36
14	07:33	07:05	07:22	06:30		06:57 (1)	05:49			05:31	05:44	06:13		07:05 (1)	06:45			07:18	06:55	07:27
	16:59	17:38	19:11	19:45	41	07:38 (1)	20:18			20:43	20:42	20:11	33	07:38 (1)	19:21			18:28	16:48	16:36
15	07:33	07:04	07:20	06:28		06:55 (1)	05:48			05:31	05:44	06:14		07:04 (1)	06:46			07:19	06:56	07:27
	17:00	17:39	19:12	19:46	43	07:38 (1)	20:19			20:43	20:42	20:10	35	07:39 (1)	19:20			18:27	16:47	16:37
16	07:32	07:03	07:19	06:26		06:55 (1)	05:47			05:31	05:45	06:15		07:03 (1)	06:48			07:20	06:57	07:28
	17:02	17:41	19:13	19:47	43	07:38 (1)	20:20			20:44	20:41	20:08	36	07:39 (1)	19:18			18:25	16:46	16:37
17	07:32	07:01	07:17	06:25		06:55 (1)	05:46			05:31	05:46	06:16		07:02 (1)	06:49			07:21	06:58	07:29
	17:03	17:42	19:14	19:49	43	07:38 (1)	20:21			20:44	20:41	20:07	38	07:40 (1)	19:16			18:24	16:45	16:37
18	07:31	07:00	07:15	06:23		06:55 (1)	05:45			05:31	05:47	06:17		07:01 (1)	06:50			07:22	07:00	07:29
	17:04	17:43	19:15	19:50	43	07:38 (1)	20:22			20:45	20:40	20:05	40	07:41 (1)	19:14			18:22	16:44	16:38
19	07:31	06:58	07:13	06:22		06:54 (1)	05:44			05:31	05:48	06:19		07:00 (1)	06:51			07:23	07:01	07:30
	17:05	17:44	19:16	19:51	43	07:37 (1)	20:23			20:45	20:39	20:04	41	07:41 (1)	19:13			18:21	16:44	16:38
20	07:30	06:57	07:12	06:20		06:54 (1)	05:43			05:32	05:49	06:20		07:00 (1)	06:52			07:24	07:02	07:31
	17:06	17:46	19:18	19:52	44	07:38 (1)	20:24			20:45	20:38	20:02	41	07:41 (1)	19:11			18:19	16:43	16:38
21	07:30	06:55	07:10	06:19		06:54 (1)	05:42			05:32	05:50	06:21		06:59 (1)	06:53			07:26	07:03	07:31
	17:08	17:47	19:19	19:53	43	07:37 (1)	20:25			20:46	20:38	20:01	42	07:41 (1)	19:09			18:18	16:42	16:39
22	07:29	06:54	07:08	06:17		06:54 (1)	05:41			05:32	05:50	06:22		06:59 (1)	06:54			07:27	07:04	07:32
	17:09	17:48	19:20	19:54	43	07:37 (1)	20:26			20:46	20:37	19:59	42	07:41 (1)	19:07			18:16	16:41	16:39
23	07:28	06:53	07:07	06:16		06:54 (1)	05:40			05:32	05:51	06:23		06:58 (1)	06:55			07:28	07:06	07:32
	17:10	17:49	19:21	19:55	41	07:35 (1)	20:27			20:46	20:36	19:58	43	07:41 (1)	19:06			18:15	16:41	16:40
24	07:28	06:51	07:05	06:14		06:55 (1)	05:40			05:32	05:52	06:24		06:58 (1)	06:56			07:29	07:07	07:33
	17:11	17:51	19:22	19:56	40	07:35 (1)	20:28			20:46	20:35	19:56	43	07:41 (1)	19:04			18:13	16:40	16:40
25	07:27	06:50	07:03	06:13		06:54 (1)	05:39			05:33	05:53	06:25		06:58 (1)	06:57			07:30	07:08	07:33
	17:13	17:52	19:23	19:57	40	07:34 (1)	20:29			20:46	20:34	19:55	43	07:41 (1)	19:02			18:12	16:40	16:41
26	07:26	06:48	07:01	06:11		06:55 (1)	05:38			05:33	05:54	06:26		06:57 (1)	06:58			07:32	07:09	07:33
	17:14	17:53	19:24	19:58	38	07:33 (1)	20:30			20:46	20:33	19:53	44	07:41 (1)	19:00			18:10	16:39	16:42
27	07:25	06:46	07:00	06:10		06:56 (1)	05:38			05:33	05:55	06:27		06:57 (1)	06:59			07:33	07:10	07:34
	17:15	17:54	19:25	20:00	36	07:32 (1)	20:30			20:47	20:33	19:52	43	07:40 (1)	18:57			18:09	16:39	16:42
28	07:24	06:45	06:58	06:08		06:56 (1)	05:37			05:34	05:56	06:28		06:57 (1)	07:00			07:34	07:11	07:34
	17:16	17:55	19:26	20:01	35	07:31 (1)	20:31			20:47	20:32	19:50	43	07:40 (1)	18:55			18:07	16:38	16:43
29	07:23		06:56	06:07		06:58 (1)	05:36			05:34	05:57	06:29		06:57 (1)	07:01			07:35	07:12	07:34
	17:18		19:28	20:02	32	07:30 (1)	20:32			20:47	20:31	19:48	42	07:39 (1)	18:53			18:06	16:38	16:44
30	07:22		06:55	06:06		06:59 (1)	05:36			05:35	05:58	06:30		06:58 (1)	07:02			07:36	07:14	07:35
	17:19		19:29	20:03	30	07:29 (1)	20:33			20:47	20:30	19:47	40	07:38 (1)	18:52			18:05	16:37	16:44
31	07:22		06:53				05:35				05:59	06:31		06:58 (1)				07:38		07:35
	17:20		19:30				20:34				20:28	19:45	39	07:37 (1)				18:03		16:45
Potential sun hours	295	296	369	400			450			455	462	430			376			344	296	285
Total, worst case					977			87					855			220				
Sun reduction					0.53			0.59					0.61			0.58				
Oper. time red.					0.80			0.80					0.80			0.80				
Wind dir. red.					0.60			0.60					0.60			0.60				
Total reduction					0.25			0.28					0.29			0.28				
Total, real					246			25					250			61				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

Printed/Page
12/15/2010 10:25 AM / 14

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar

Shadow receptor: L - Shadow Receptor: 2.0 × 1.0 Azimuth: -180.0° Slope: 90.0° (20)

Assumptions for shadow calculations

Maximum distance for influence	200	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [MADISON]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.43	5.24	5.95	7.01	8.58	9.67	9.71	8.48	7.21	5.48	3.66	3.19

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	328	224	196	144	406	862	868	531	517	1,188	1,272	6,970

Idle start wind speed: Cut in wind speed from power curve

	January	February	March		April		May	June	July	August	September		October		November	December
1	07:35	07:21	06:43		06:51	07:55 (1)	06:04	05:35	05:35	06:00	06:32		07:03	07:39 (1)	06:39	07:15
	16:46	17:21	17:57		19:31 29	08:24 (1)	20:04	20:35	20:46	20:27	19:44		18:50 33	08:12 (1)	17:02	16:37
2	07:35	07:20	06:42		06:49	07:57 (1)	06:03	05:34	05:36	06:01	06:33		07:04	07:41 (1)	06:40	07:16
	16:47	17:23	17:58		19:32 25	08:22 (1)	20:05	20:35	20:46	20:26	19:42		18:48 29	08:10 (1)	17:01	16:37
3	07:35	07:18	06:40		06:48	07:59 (1)	06:02	05:34	05:36	06:02	06:34		07:05	07:42 (1)	06:41	07:17
	16:48	17:24	17:59		19:33 20	08:19 (1)	20:06	20:36	20:46	20:25	19:40		18:47 25	08:07 (1)	17:00	16:37
4	07:35	07:17	06:39		06:46	08:01 (1)	06:00	05:33	05:37	06:03	06:35		07:07	07:45 (1)	06:43	07:18
	16:49	17:25	18:00		19:34 14	08:15 (1)	20:07	20:37	20:46	20:24	19:38		18:45 20	08:05 (1)	16:58	16:36
5	07:35	07:16	06:37		06:44		05:59	05:33	05:37	06:04	06:36		07:08	07:49 (1)	06:44	07:19
	16:50	17:27	18:00		19:35		20:08	20:38	20:46	20:23	19:37		18:43 12	08:01 (1)	16:57	16:36
6	07:35	07:15	06:35		06:43		05:58	05:33	05:38	06:05	06:37		07:09		06:45	07:20
	16:51	17:28	18:01		19:36		20:09	20:38	20:46	20:22	19:35		18:42		16:56	16:36
7	07:35	07:14	06:34		06:41		05:57	05:32	05:39	06:06	06:38		07:10		06:46	07:21
	16:52	17:29	18:03		19:38		20:11	20:39	20:45	20:20	19:33		18:40		16:55	16:36
8	07:35	07:13	07:32		08:15 (1)	06:39	05:55	05:32	05:39	06:07	06:39		07:57 (1)	07:11	06:47	07:22
	16:53	17:30	18:04	6	08:21 (1)	19:39	20:12	20:40	20:45	20:19	19:32	13	08:10 (1)	18:38	16:54	16:36
9	07:35	07:12	07:30		08:09 (1)	06:38	05:54	05:32	05:40	06:08	06:40		07:53 (1)	07:12	06:49	07:23
	16:54	17:32	19:05	17	08:26 (1)	19:40	20:13	20:40	20:45	20:18	19:30	20	08:13 (1)	18:36	16:53	16:36
10	07:35	07:10	07:29		08:05 (1)	06:36	05:53	05:32	05:41	06:09	06:41		07:50 (1)	07:13	06:50	07:23
	16:55	17:33	19:06	24	08:29 (1)	19:41	20:14	20:41	20:44	20:17	19:28	25	08:15 (1)	18:35	16:52	16:36
11	07:34	07:09	07:27		08:03 (1)	06:34	05:52	05:32	05:41	06:10	06:42		07:48 (1)	07:14	06:51	07:24
	16:56	17:34	19:07	27	08:30 (1)	19:42	20:15	20:42	20:44	20:15	19:27	29	08:17 (1)	18:33	16:51	16:36
12	07:34	07:08	07:25		08:01 (1)	06:33	05:51	05:31	05:42	06:11	06:43		07:46 (1)	07:15	06:52	07:25
	16:57	17:36	19:08	31	08:32 (1)	19:43	20:16	20:42	20:43	20:14	19:25	32	08:18 (1)	18:32	16:50	16:36
13	07:34	07:07	07:24		07:59 (1)	06:31	05:50	05:31	05:43	06:12	06:44		07:45 (1)	07:16	06:54	07:26
	16:58	17:37	19:10	34	08:33 (1)	19:44	20:17	20:43	20:43	20:13	19:23	34	08:19 (1)	18:30	16:49	16:36
14	07:33	07:05	07:22		07:58 (1)	06:30	05:49	05:31	05:44	06:13	06:45		07:43 (1)	07:18	06:55	07:27
	16:59	17:38	19:11	36	08:34 (1)	19:45	20:18	20:43	20:42	20:11	19:21	37	08:20 (1)	18:28	16:48	16:36
15	07:33	07:04	07:20		07:57 (1)	06:28	05:48	05:31	05:44	06:14	06:46		07:42 (1)	07:19	06:56	07:27
	17:00	17:39	19:12	38	08:35 (1)	19:46	20:19	20:43	20:42	20:10	19:20	38	08:20 (1)	18:27	16:47	16:37
16	07:32	07:03	07:19		07:56 (1)	06:26	05:47	05:31	05:45	06:15	06:48		07:41 (1)	07:20	06:57	07:28
	17:02	17:41	19:13	39	08:35 (1)	19:47	20:20	20:44	20:41	20:08	19:18	40	08:21 (1)	18:25	16:46	16:37
17	07:32	07:01	07:17		07:54 (1)	06:25	05:46	05:31	05:46	06:16	06:49		07:40 (1)	07:21	06:58	07:29
	17:03	17:42	19:14	41	08:35 (1)	19:49	20:21	20:44	20:41	20:07	19:16	41	08:21 (1)	18:24	16:45	16:37
18	07:31	07:00	07:15		07:54 (1)	06:23	05:45	05:31	05:47	06:17	06:50		07:39 (1)	07:22	07:00	07:29
	17:04	17:43	19:15	42	08:36 (1)	19:50	20:22	20:45	20:40	20:05	19:14	42	08:21 (1)	18:22	16:44	16:37
19	07:31	06:58	07:13		07:53 (1)	06:22	05:44	05:31	05:48	06:19	06:51		07:38 (1)	07:23	07:01	07:30
	17:05	17:44	19:16	43	08:36 (1)	19:51	20:23	20:45	20:39	20:04	19:13	43	08:21 (1)	18:21	16:44	16:38
20	07:30	06:57	07:12		07:52 (1)	06:20	05:43	05:32	05:49	06:20	06:52		07:38 (1)	07:24	07:02	07:31
	17:06	17:46	19:18	44	08:36 (1)	19:52	20:24	20:45	20:38	20:02	19:11	43	08:21 (1)	18:19	16:43	16:38
21	07:30	06:55	07:10		07:52 (1)	06:19	05:42	05:32	05:50	06:21	06:53		07:37 (1)	07:26	07:03	07:31
	17:08	17:47	19:19	43	08:35 (1)	19:53	20:25	20:46	20:38	20:01	19:09	44	08:21 (1)	18:18	16:42	16:39
22	07:29	06:54	07:08		07:52 (1)	06:17	05:41	05:32	05:50	06:22	06:54		07:37 (1)	07:27	07:04	07:32
	17:09	17:48	19:20	44	08:36 (1)	19:54	20:26	20:46	20:37	19:59	19:07	44	08:21 (1)	18:16	16:41	16:39
23	07:28	06:53	07:07		07:51 (1)	06:16	05:40	05:32	05:51	06:23	06:55		07:37 (1)	07:28	07:06	07:32
	17:10	17:49	19:21	44	08:35 (1)	19:55	20:27	20:46	20:36	19:58	19:06	43	08:20 (1)	18:15	16:41	16:40
24	07:28	06:51	07:05		07:51 (1)	06:14	05:40	05:32	05:52	06:24	06:56		07:37 (1)	07:29	07:07	07:33
	17:11	17:51	19:22	43	08:34 (1)	19:56	20:28	20:46	20:35	19:56	19:04	43	08:20 (1)	18:13	16:40	16:40
25	07:27	06:50	07:03		07:51 (1)	06:13	05:39	05:33	05:53	06:25	06:57		07:37 (1)	07:30	07:08	07:33
	17:13	17:52	19:23	42	08:33 (1)	19:57	20:29	20:46	20:34	19:55	19:02	42	08:19 (1)	18:12	16:40	16:41
26	07:26	06:48	07:01		07:52 (1)	06:11	05:38	05:33	05:54	06:26	06:58		07:37 (1)	07:32	07:09	07:33
	17:14	17:53	19:24	41	08:33 (1)	19:58	20:30	20:46	20:33	19:53	19:00	41	08:18 (1)	18:10	16:39	16:42
27	07:25	06:46	07:00		07:52 (1)	06:10	05:38	05:33	05:55	06:27	06:59		07:37 (1)	07:33	07:10	07:34
	17:15	17:54	19:25	40	08:32 (1)	20:00	20:30	20:47	20:33	19:52	18:57	40	08:17 (1)	18:09	16:39	16:42
28	07:24	06:45	06:58		07:52 (1)	06:08	05:37	05:34	05:56	06:28	07:00		07:37 (1)	07:34	07:11	07:34
	17:16	17:55	19:26	38	08:30 (1)	20:01	20:31	20:47	20:32	19:50	18:55	39	08:16 (1)	18:07	16:38	16:43
29	07:23		06:56		07:53 (1)	06:07	05:36	05:34	05:57	06:29	07:01		07:38 (1)	07:35	07:12	07:34
	17:18		19:28	37	08:30 (1)	20:02	20:32	20:47	20:31	19:48	18:53	37	08:15 (1)	18:06	16:38	16:44
30	07:22		06:55		07:53 (1)	06:06	05:36	05:35	05:58	06:30	07:02		07:38 (1)	07:36	07:14	07:35
	17:19		19:29	35	08:28 (1)	20:03	20:33	20:47	20:30	19:47	18:52	35	08:13 (1)	18:05	16:37	16:44
31	07:22		06:53		07:54 (1)		05:35		05:59	06:31				07:38		07:35
	17:20		19:30	32	08:26 (1)		20:34		20:28	19:45				18:03		16:45
Potential sun hours	295	296	369		400		450	455	462	430	376		344		296	285
Total, worst case				861		88						845		119		
Sun reduction				0.50		0.53						0.58		0.49		
Oper. time red.				0.80		0.80						0.80		0.80		
Wind dir. red.				0.64		0.64						0.64		0.64		
Total reduction				0.25		0.27						0.29		0.25		
Total, real				217		23						246		30		

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
121310_Kirkwood Wind-Energy Facility

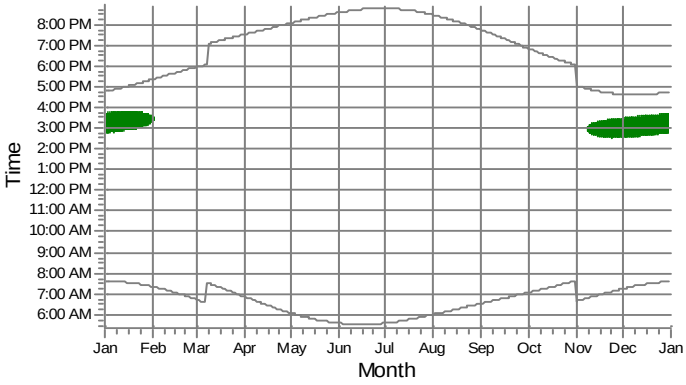
Printed/Page
12/15/2010 10:25 AM / 15

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

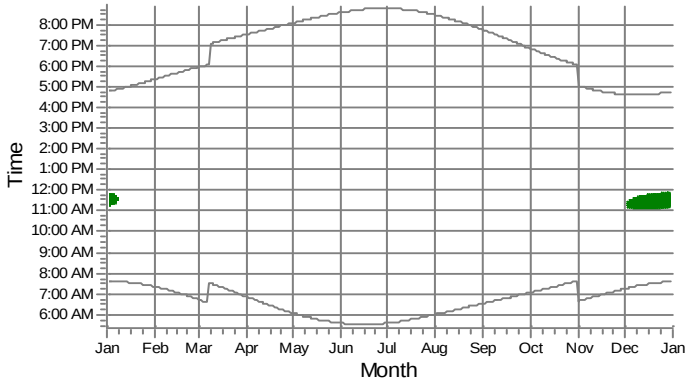
Calculated:
12/13/2010 3:06 PM/2.7.473

SHADOW - Calendar, graphical

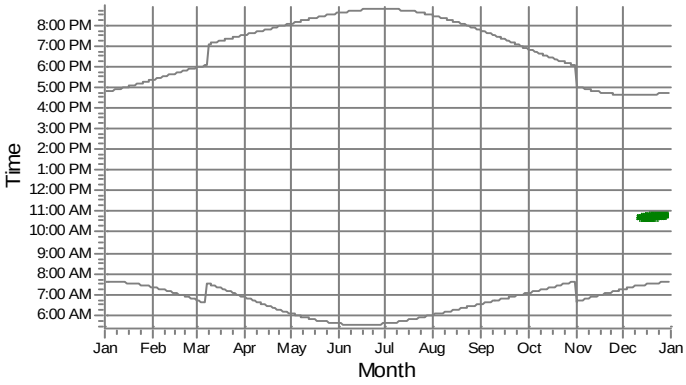
A: Shadow Receptor: 2.0 × 2.0 Azimuth: 40.0° Slope: 90.0° (9)



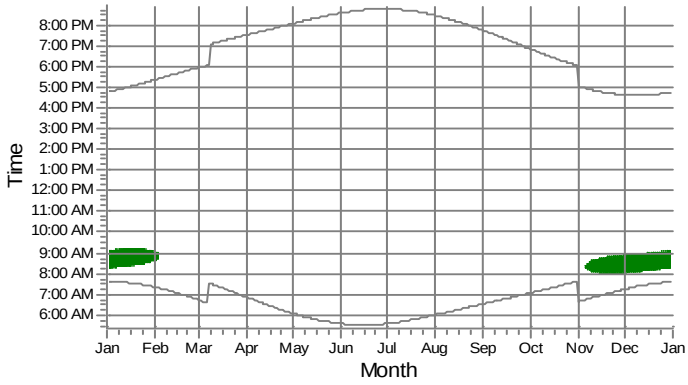
B: Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (10)



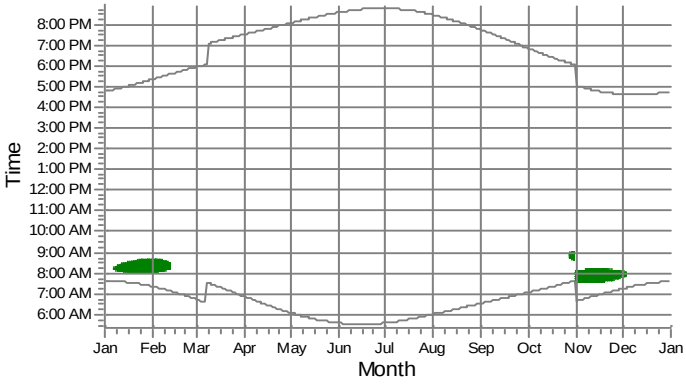
C: Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (11)



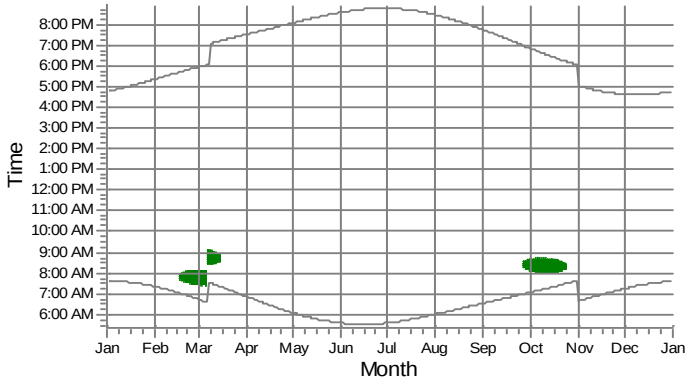
D: Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (12)



E: Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (13)



F: Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (14)



WTGs

1: CLIPPER CW99 Liberty 2500 99.0 !O! hub: 80.0 m (3)

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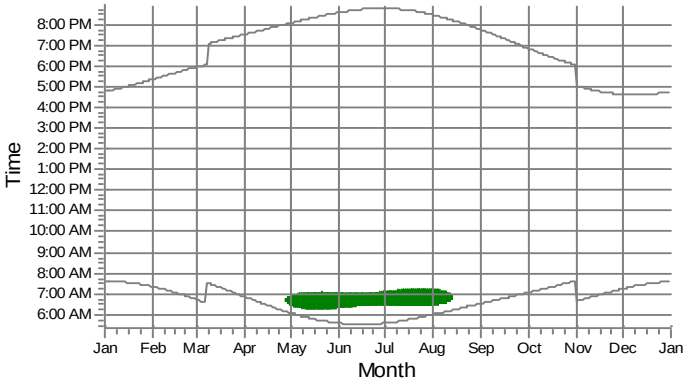
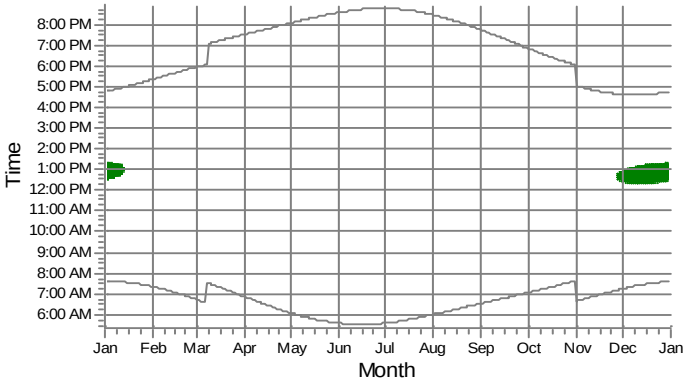
SHADOW - Calendar, graphical

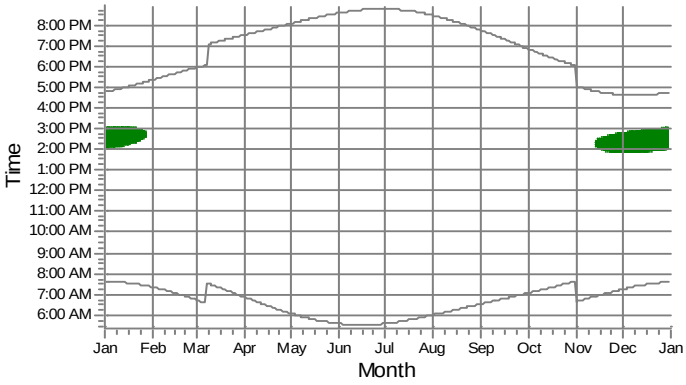
G: Shadow Receptor: 2.0 × 2.0 Azimuth: 0.0° Slope: 90.0° (15)



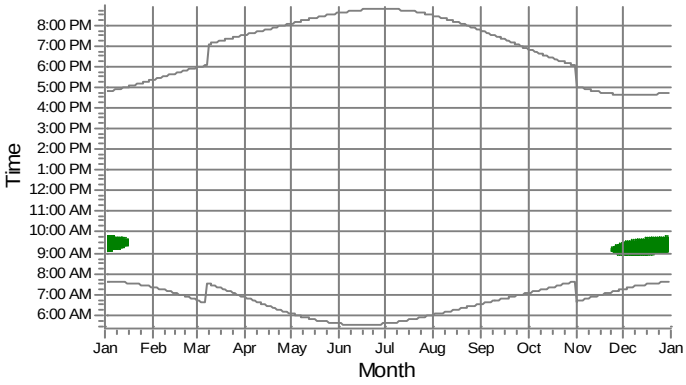
H: Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (16)



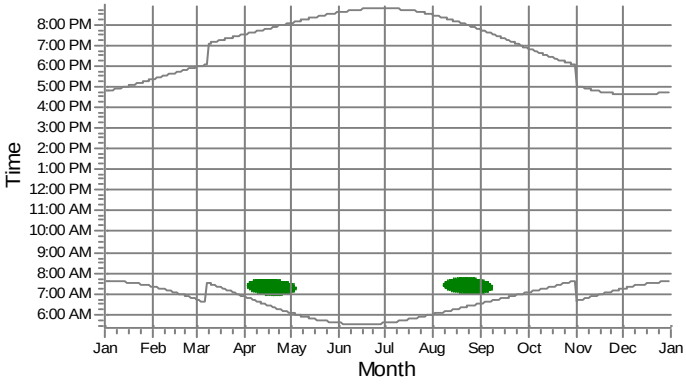
I: Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (17)



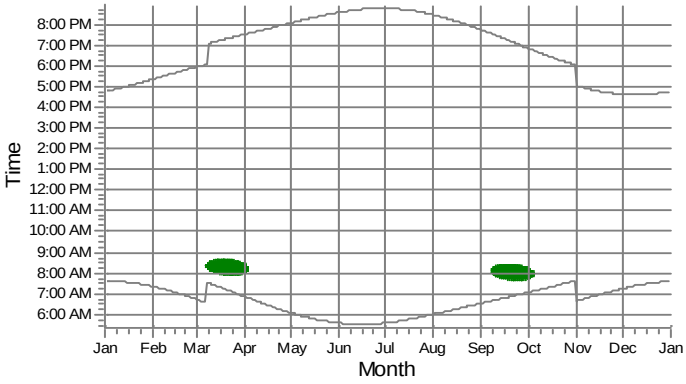
J: Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (18)



K: Shadow Receptor: 2.0 × 2.0 Azimuth: -180.0° Slope: 90.0° (19)



L: Shadow Receptor: 2.0 × 1.0 Azimuth: -180.0° Slope: 90.0° (20)



WTGs

1: CLIPPER CW99 Liberty 2500 99.0 !O! hub: 80.0 m (3)

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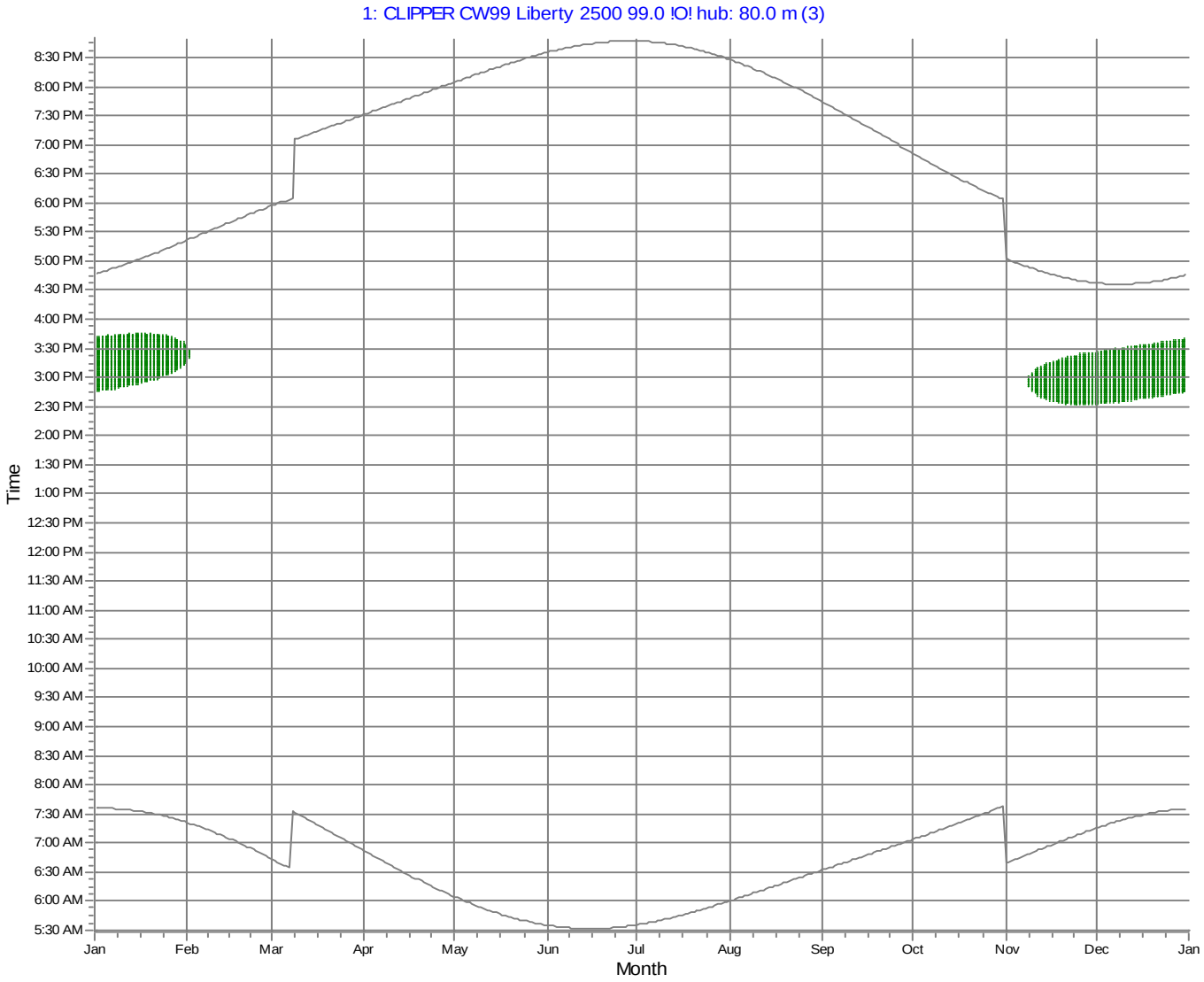
SHADOW - Calendar per WTG, graphical

WTG: 1 - CLIPPER CW99 Liberty 2500 99.0 !O! hub: 80.0 m (3)



WTGs

A: Shadow Receptor: 2.0 × 2.0 Azimuth: 40.0° Slope: 90.0° (9)

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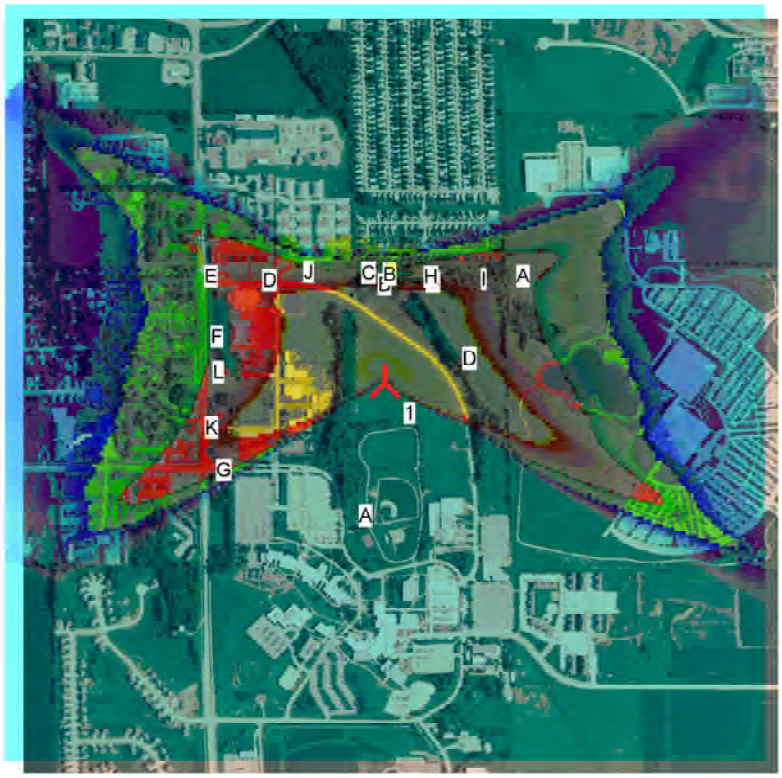
SHADOW - Map

WTG: 1 - CLIPPER CW99 Liberty 2500 99.0 !O! hub: 80.0 m (3)

Hours per year, real case

- 0 - 4
- 5 - 9
- 10 - 24
- 25 - 200



0 250 500 750 1000m

Map: , Print scale 1:20,000, Map center UTM NAD 83 Zone: 15 East: 611,880 North: 4,641,400

New WTG
Obstacle
Shadow receptor

Isolines showing shadow in Hours per year, real case

0 5 10 50

Sound Analysis

The WindPRO Version 2.7.473 DECIBEL extension model was used to model noise emissions and check if noise requirements are met at noise sensitive areas (NSAs) near the proposed Kirkwood Wind Energy Facility. The model setup and assumptions for the noise analysis are described below. Results are shown on the attached DECIBEL model report and GIS Figure. The turbine location, setup and type (Clipper CW99 Liberty 2500kW) from the Shadow Flicker analysis.

The ISO 9613-2 General Attenuation of Sound During Propagation Outdoors noise calculation model was used for wind speeds 8.0 m/s, 10.0 m/s and 12.0 m/s. The 8.0 m/s minimum wind speed model was selected as the lowest speed at which maximum sound power level is generated by the CW99 (107 dB +/- 2 dB), according to specifications forwarded by Clipper. The 107 dB sound power was used for all calculations.

The ground attenuation factor was set at 0.0. This assumes the ground is all hard surfaces during the winter months, when the least ground attenuation is expected. (Note: A decrease of up to 7 dB(A) was modeled at NSAs when a 70% porous ground surface is assumed.) The City of Cedar Rapids does not have a pure tone noise ordinance so a place holder pure tone penalty 0.0 dB(A) was included in the model.

Generic octave data and other noise data built into the SHADOW extension for the Clipper CW99 was used. Clipper was contacted to obtain octave data but declined to release it for the purpose of this study.

Six NSAs were drawn into the project maps. These include: Kirkwood Estates mobile home park north of the proposed turbine location (A), apartments north and west of the proposed turbine location (B, C, and E), single family homes west of the proposed turbine (D), and duplexes west of the proposed turbine location (F). Noise level demands were set to be consistent with the City of Cedar Rapids nighttime demands for residences – 50 dB(A).

Proposed Turbine Location

Noise Sensitve Areas

Noise Model Results (8.0 m/s)

35 dB(A)

40 dB(A)

45 dB(A)

50 dB(A)

55 dB(A)

N

0 250 500

Feet

WindPRO DECIBEL Results

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

HR Green

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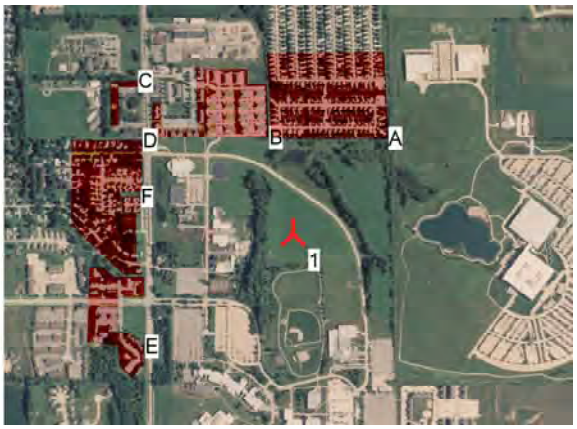
DECIBEL - Main Result

Noise calculation model:
ISO 9613-2 General
Wind speed:
8.0 m/s - 12.0 m/s, step 2.0 m/s
Ground attenuation:
General, Ground factor: 0.0
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tone penalty are added to demand: 0.0 dB(A)
Height above ground level, when no value in NSA object:
0.0 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:25,000
New WTG Noise sensitive area

WTGs

	UTM NAD83 Zone: 15					WTG type						Noise data							
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	First wind speed	LwaRef	Last wind speed	LwaRef	Pure tones	Octave data	
	UTM NAD83 Zone: 15		[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	[m/s]	[dB(A)]			
1	611,880	4,641,399	807.9	CLIPPER CW99 Liberty 2500...	Yes	CLIPPER	CW99 Liberty-2,500	2,500	99.0	80.0	USER	Max dB	8.0	107.0	12.0	107.0	No	Generic	*)

***)Notice: One or more noise data for this WTG is generic or input by user**

Calculation Results

Sound Level

Noise sensitive area		UTM NAD83 Zone: 15				Demands	Sound Level	Demands fulfilled ?
No.	Name	East	North	Z [m]	Imission height [m]	Max Noise [dB(A)]	Max From WTGs [dB(A)]	Noise
A	Kirkwood Estates	611,882	4,641,717	777.2	0.0	0.0	47.2	Yes
B	Kirkwood Courts	611,798	4,641,719	793.6	0.0	0.0	46.9	Yes
C	Apartments	611,304	4,641,755	785.3	0.0	0.0	40.2	Yes
D	Single Family	611,379	4,641,304	787.5	0.0	0.0	43.0	Yes
E	Multi-Family	611,385	4,641,257	818.9	0.0	0.0	43.0	Yes
F	SingleFamily	611,373	4,641,468	781.0	0.0	0.0	42.9	Yes

Distances (m)

	WTG
NSA	1
A	318
B	330
C	677
D	510
E	515
F	512

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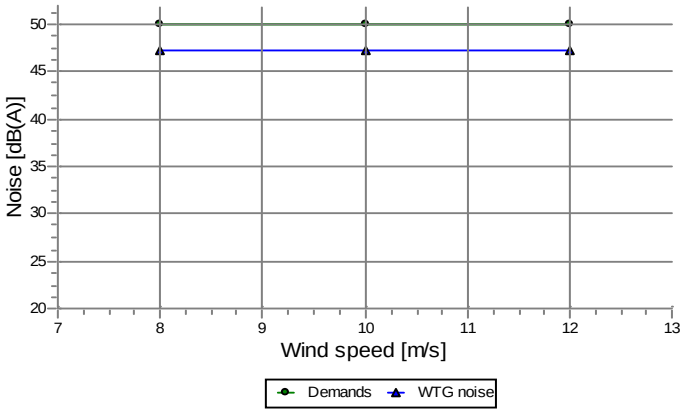
DECIBEL - Detailed results

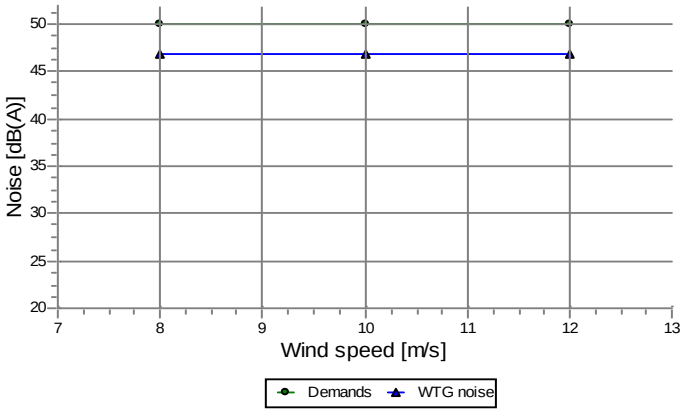
Noise calculation model: ISO 9613-2 General

Kirkwood Estates (A)



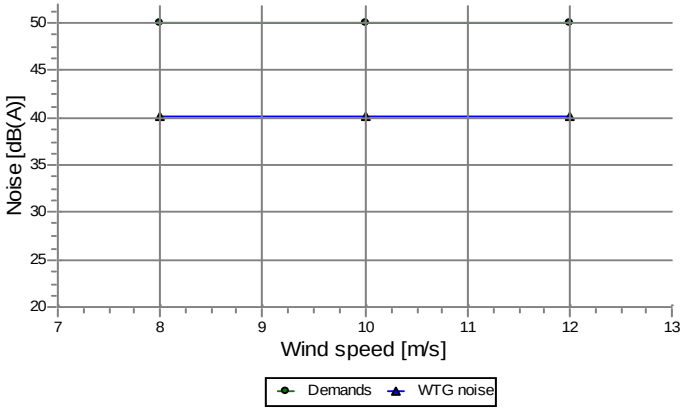
	Sound Level		
Wind speed [m/s]	Demands [dB(A)]	WTG noise [dB(A)]	Demands fulfilled ?
8.0	50.0	47.2	Yes
10.0	50.0	47.2	Yes
12.0	50.0	47.2	Yes

Kirkwood Courts (B)



	Sound Level		
Wind speed [m/s]	Demands [dB(A)]	WTG noise [dB(A)]	Demands fulfilled ?
8.0	50.0	46.9	Yes
10.0	50.0	46.9	Yes
12.0	50.0	46.9	Yes

Apartments (C)



	Sound Level		
Wind speed [m/s]	Demands [dB(A)]	WTG noise [dB(A)]	Demands fulfilled ?
8.0	50.0	40.2	Yes
10.0	50.0	40.2	Yes
12.0	50.0	40.2	Yes

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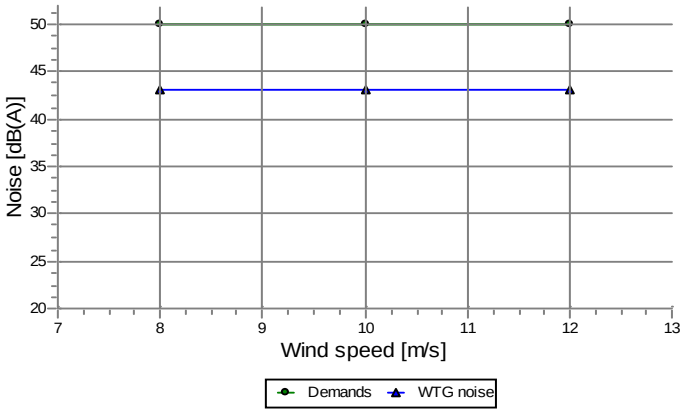
DECIBEL - Detailed results

Noise calculation model: ISO 9613-2 General

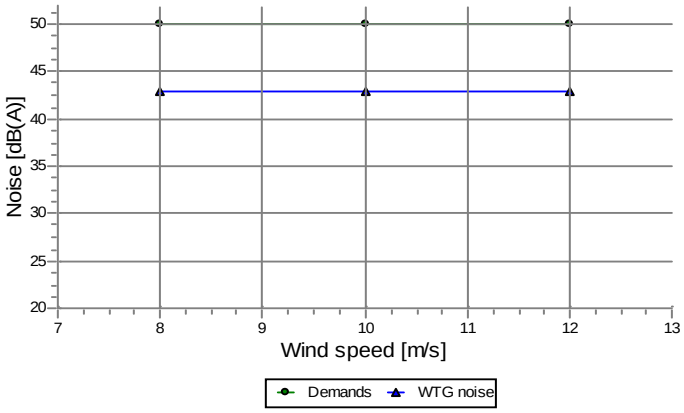
Single Family (D)



Sound Level

Wind speed [m/s]	Demands [dB(A)]	WTG noise [dB(A)]	Demands fulfilled ?
8.0	50.0	43.0	Yes
10.0	50.0	43.0	Yes
12.0	50.0	43.0	Yes

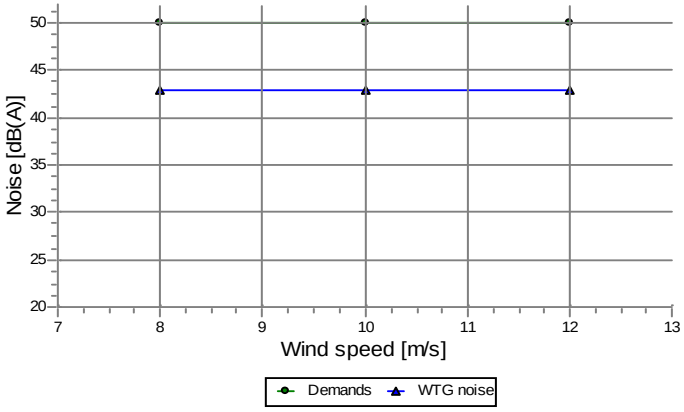
Multi-Family (E)



Sound Level

Wind speed [m/s]	Demands [dB(A)]	WTG noise [dB(A)]	Demands fulfilled ?
8.0	50.0	43.0	Yes
10.0	50.0	43.0	Yes
12.0	50.0	43.0	Yes

SingleFamily (F)



Sound Level

Wind speed [m/s]	Demands [dB(A)]	WTG noise [dB(A)]	Demands fulfilled ?
8.0	50.0	42.9	Yes
10.0	50.0	42.9	Yes
12.0	50.0	42.9	Yes

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DECIBEL - Assumptions for noise calculation

Noise calculation model: ISO 9613-2 General

Noise calculation model:
ISO 9613-2 General
Wind speed:
8.0 m/s - 12.0 m/s, step 2.0 m/s
Ground attenuation:
General, Ground factor: 0.0
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tone penalty are added to demand: 0.0 dB(A)
Height above ground level, when no value in NSA object:
0.0 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)
Octave data required
Air absorption

63 [db/km]	125 [db/km]	250 [db/km]	500 [db/km]	1,000 [db/km]	2,000 [db/km]	4,000 [db/km]	8,000 [db/km]
0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

WTG: CLIPPER CW99 Liberty 2500 99.0 !O!
Noise: Max dB

Source	Source/Date	Creator	Edited
Clipper	12/6/2010	USER	12/6/2010 5:17 PM

Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones		Octave data 63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
User value	80.0	8.0	107.0	No	Generic data	88.6	95.6	99.0	101.6	101.4	98.5	93.7	84.2
User value	80.0	10.0	107.0	No	Generic data	88.6	95.6	99.0	101.6	101.4	98.5	93.7	84.2
User value	80.0	12.0	107.0	No	Generic data	88.6	95.6	99.0	101.6	101.4	98.5	93.7	84.2

NSA: Kirkwood Estates-A
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand:

8.0 [m/s]	10.0 [m/s]	12.0 [m/s]
50.0 dB(A)	50.0 dB(A)	50.0 dB(A)

Distance demand: 0.0 m

NSA: Kirkwood Courts-B
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand:

8.0 [m/s]	10.0 [m/s]	12.0 [m/s]
50.0 dB(A)	50.0 dB(A)	50.0 dB(A)

Distance demand: 0.0 m

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DECIBEL - Assumptions for noise calculation

Noise calculation model: ISO 9613-2 General

NSA: Apartments-C
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand:

8.0 [m/s]	10.0 [m/s]	12.0 [m/s]
50.0 dB(A)	50.0 dB(A)	50.0 dB(A)

Distance demand: 0.0 m

NSA: Single Family-D
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand:

8.0 [m/s]	10.0 [m/s]	12.0 [m/s]
50.0 dB(A)	50.0 dB(A)	50.0 dB(A)

Distance demand: 0.0 m

NSA: Multi-Family-E
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand:

8.0 [m/s]	10.0 [m/s]	12.0 [m/s]
50.0 dB(A)	50.0 dB(A)	50.0 dB(A)

Distance demand: 0.0 m

NSA: SingleFamily-F
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand:

8.0 [m/s]	10.0 [m/s]	12.0 [m/s]
50.0 dB(A)	50.0 dB(A)	50.0 dB(A)

Distance demand: 0.0 m

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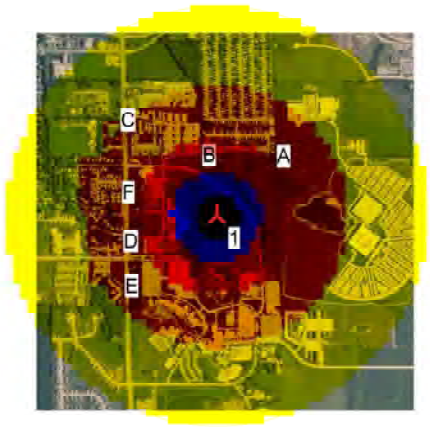
DECIBEL - Map 8.0 m/s

Noise calculation model: ISO 9613-2 General



0 500 1000 1500 2000 m

Map: , Print scale 1:40,000, Map center UTM NAD 83 Zone: 15 East: 611,880 North: 4,641,399
Noise calculation model: ISO 9613-2 General. Wind speed: 8.0 m/s

New WTG
Noise sensitive area
Height above sea level from active line object
35.0 dB(A)
40.0 dB(A)
45.0 dB(A)
50.0 dB(A)
55.0 dB(A)

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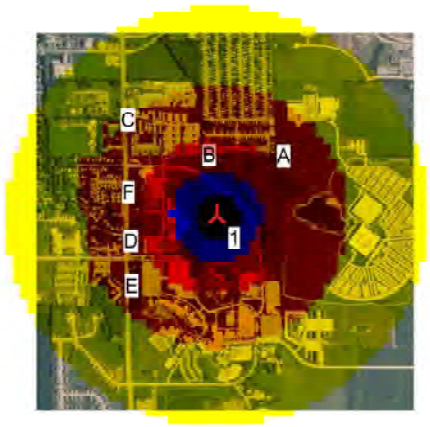
DECIBEL - Map 10.0 m/s

Noise calculation model: ISO 9613-2 General



0 500 1000 1500 2000 m

Map: , Print scale 1:40,000, Map center UTM NAD 83 Zone: 15 East: 611,880 North: 4,641,399
Noise calculation model: ISO 9613-2 General. Wind speed: 10.0 m/s

New WTG
Noise sensitive area

Height above sea level from active line object

35.0 dB(A) 40.0 dB(A) 45.0 dB(A) 50.0 dB(A) 55.0 dB(A)

Project:
121310_Kirkwood Wind-Energy Facility

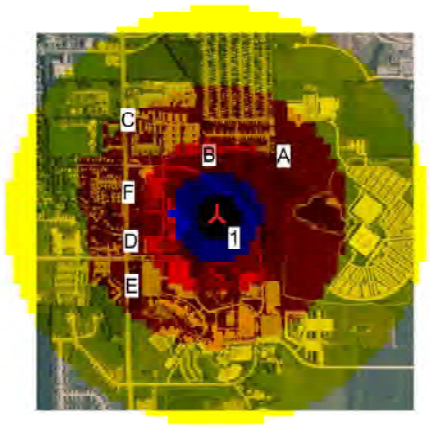
Printed/Page
12/14/2010 9:13 AM / 8

Licensed user:
Howard R. Green Company
8710 Earhar Lane SW
US-CEDAR RAPIDS, IA 52409
319 841 4000
Ted McCaslin / tmccaslin@hrgreen.com

Calculated:
12/14/2010 9:10 AM/2.7.473

DECIBEL - Map 12.0 m/s

Noise calculation model: ISO 9613-2 General



0 500 1000 1500 2000 m

Map: , Print scale 1:40,000, Map center UTM NAD 83 Zone: 15 East: 611,880 North: 4,641,399
Noise calculation model: ISO 9613-2 General. Wind speed: 12.0 m/s

New WTG Noise sensitive area

Height above sea level from active line object

35.0 dB(A) 40.0 dB(A) 45.0 dB(A) 50.0 dB(A) 55.0 dB(A)

VISUAL IMPACT ASSESSMENT
KIRKWOOD WIND ENERGY FACILITY

July 2010

Howard R. Green Company
Cedar Rapids, Iowa

PROJECT DESCRIPTION

The proposed facility includes a single 2.5MW wind turbine. The proposed turbine and associated interconnect will be installed in early 2011. The total height of the turbine is 427 feet above ground level. The proposed turbine will be located on currently vacant land in the north half of the Kirkwood Community College Main Campus in Cedar Rapids, Iowa.

PROJECT VISIBILITY, APPEARANCE AND LANDSCAPE CONTEXT

The wind turbine will be highly visible. The proposed turbine will be a prominent feature in the landscape. Land use near the proposed turbine location includes institutional, commercial, office, residential and agricultural land uses. The turbine is surrounded to the north, east and west by large deciduous trees and baseball and softball fields to the south. The turbine will be one of the tallest features on the campus along with two approximately 400-feet-tall communication towers in the southwest part of the campus.

The turbine will be situated on the Kirkwood Community College campus and its presence will be consistent with the schools technical curriculum and renewable energy goals. It is anticipated that the single turbine will be a landmark for the campus and help orient people both on and off of the campus to locations in the area.

The turbine location is at the southern edge of Cedar Rapids. Much of the surrounding area is developed or partially developed. In addition to the two communication towers, two water towers, several cellular towers, billboards, and overhead utility towers are present within a mile of the proposed turbine. The proposed turbine will be prominent and be unique in shape and motion, but it will not be the only large vertical structure in the landscape.

SCENIC-RESOURCE VALUES AND SENSITIVITY LEVELS

The project area is experiencing some development from Cedar Rapids to the east, west and southwest. It is also located in the Iowa City/Cedar Rapids Tech Corridor. The turbine would be consistent with development in the tech corridor and help to anchor the college's visual location as development surrounds the campus at the south edge of the Cedar Rapids.

ASSESSMENT OF AESTHETIC IMPACTS

Google Earth was used with a 3-D plug-in from WindPro 2.7 software to show the proposed turbine in a number of landscape positions within and around the campus and assess positive and negative aesthetic impacts. See attached photos annotations detail from selected views.

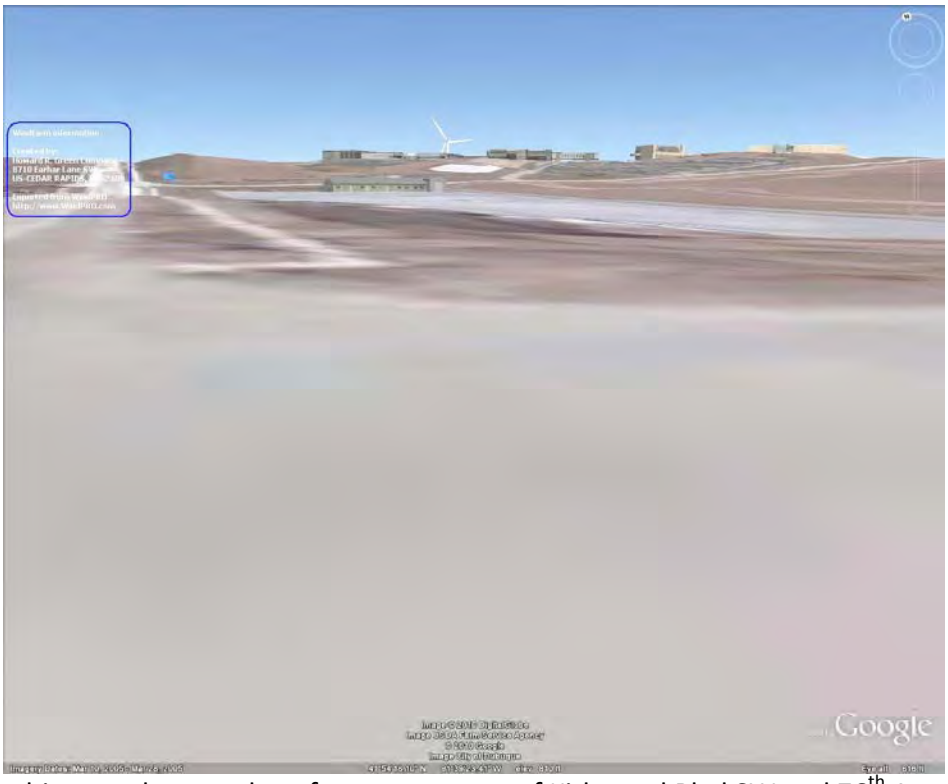
MITIGATION TECHNIQUES

No mitigation for obstructed views or landscape setting disturbances is expected.

DETERMINATION OF ACCEPTABILITY OR UNDUE AESTHETIC IMPACTS

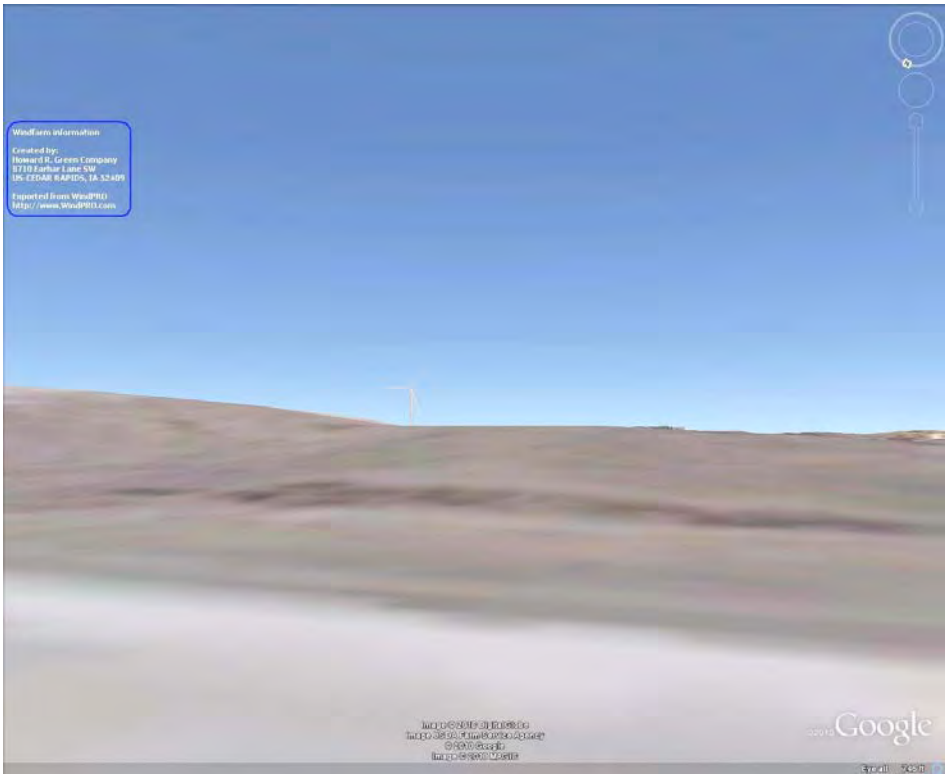
The proposed turbine site is located in a developed/developing area that is not known for its scenic or cultural significance. The turbine will not be visible from Palisades/Kapler State Park approximately 11 miles to the east or the Amana Colonies approximately 20 miles southeast; both nearby areas known for their scenic and cultural significance. The proposed turbine location in the City/Cedar Rapids Tech Corridor and within an educational facility make the turbine acceptable visual impact at its proposed location.

Community Training and Response Center. The nearest classroom building to the turbine.



View of turbine southwest edge of campus corner of Kirkwood Blvd SW and 76th Ave Drive SW

The north entrance to Kirkwood Community College. Turbine is prominent and not obstructed by trees. Trees near the main entrance to the south would obstruct the turbine from view.



View of the turbine from US Highway 30 west of Kirkwood Blvd.

Looking north, the turbine and Kirkwood Hall

Looking northwest, the turbine with Kirkwood Facilities building in forefront.

APPENDIX E

Microwave Assessment

Wind Power GeoPlanner™

Licensed Microwave Report

Kirkwood Community College Wind Energy Facility

Prepared on Behalf of
Howard R Green
Company

June 25, 2010

COMSEARCH
A CommScope Company

Table of Contents

1. Introduction

The use of wind energy, one of the oldest forms of harnessing a natural energy source, is now one of the world's fastest growing alternative energy sources. The United States is committed to the use of wind energy, and over the next several years billions of dollars will be spent on wind power projects. However, as new wind turbine generators are installed around the country, it is important to note that they may pose an interference threat to existing microwave systems and broadcast stations licensed to operate in the United States.

Wind turbines can interfere with microwave paths by physically blocking the line-of-sight between two microwave transmitters. Additionally, wind turbines have the potential to cause blockage and reflections ("ghosting") to television reception. Blockage is caused by the physical presence of the turbines between the television station and the reception points. Ghosting is caused by multipath interference that occurs when a broadcast signal reflects off of a large reflective object—in this case a wind turbine—and arrives at a television receiver delayed in time from the signal that arrives via direct path.

Many states and other jurisdictions recognize the need for regulations addressing interference to radio signal transmissions from the wind turbine installations. Specifically, local planning authorities typically require project developers to ensure wind turbines will not cause interference. In some cases they require developers to notify the telecommunication operators in the area of the proposed wind turbine installation. Other factors prompting developers to undertake proactive investigation into potential interference include the need to prevent legal and regulatory problems and the desire to promote goodwill within the community—a good neighbor approach.

Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services.

This report focuses on the potential impact of wind turbines on licensed non-federal government microwave systems. Comsearch provides additional wind energy services, a description of which is available upon request.

2. Summary of Results

An overall summary of results appears below.

Project Information

Name: Kirkwood Community College Wind Energy Facility

County: Linn

State: Iowa

Total Microwave Paths	Paths with Obstructions	Total Turbines	Turbine Obstructions
5	0	1	0

Methodology

Our obstruction analysis was performed using Comsearch's proprietary microwave database, which contains all non-government licensed paths from 0.9 - 23 GHz[1]. First, we determined all microwave paths that intersect the area of interest[2]. The area of interest was defined by the client and encompasses the planned turbine location. Next, for each microwave path that intersected the project area, we calculated a Worst Case Fresnel Zone (WCFZ). The mid-point of a full microwave path is the location where the widest (or worst case) Fresnel zone occurs. Fresnel zones were calculated for each path using the following formula.

$$Rn \cong 17.3\sqrt{\frac{n}{F_{GHz}}\left(\frac{d_1 d_2}{d_1 + d_2}\right)}$$

Where,

R_n = Fresnel Zone radius at a specific point in the microwave path, meters
n = Fresnel Zone number, 1
F_{GHz} = Frequency of microwave system, GHz
d_1 = Distance from antenna 1 to a specific point in the microwave path, kilometers
d_2 = Distance from antenna 2 to a specific point in the microwave path, kilometers

For worst case Fresnel zone calculations, $d_1 = d_2$

[1] Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

[2] We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

The calculated WCFZ radius, giving the linear path an area or swath, buffers each microwave path in the project area. See the Tables and Figures section for a summary of paths and WCFZ distances. In general, this is the two-dimensional area where the planned wind turbines should be avoided, if possible. A depiction of the WCFZ overlaid on topographic basemaps can be found in the Tables and Figures section, and is also included on the enclosed CD[3].

Discussion of Potential Obstructions

For this project, one turbine was considered in the analysis, with a blade diameter of 100 meters and turbine hub height of 80 meters.

The proposed turbine was not found to have a potential conflict with the incumbent microwave paths.

[3] The ESRI® shapefiles contained on the enclosed CD are in NAD 83 UTM Zone 15 projected coordinate system.

3. Tables and Figures

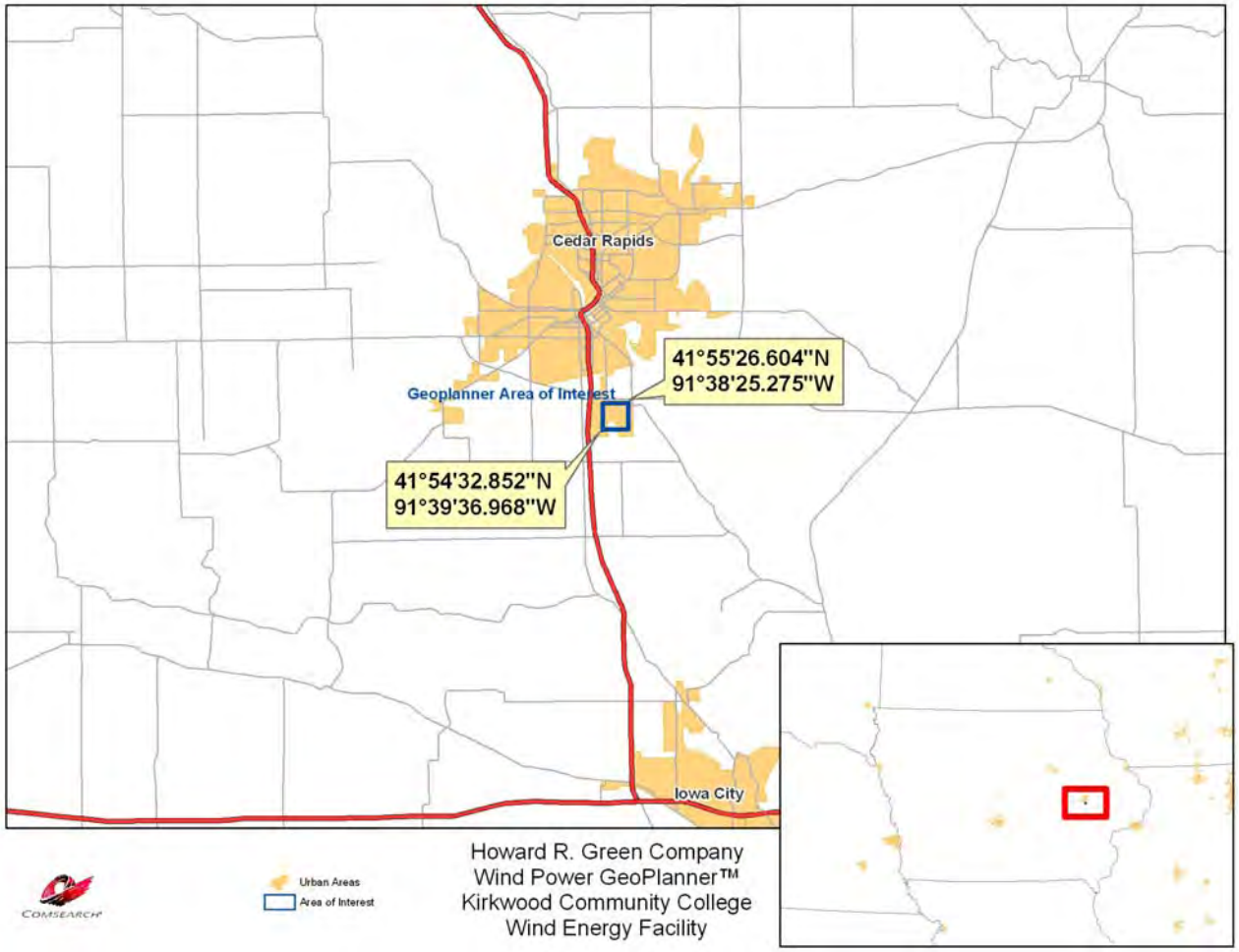


Figure 1: Area of Interest

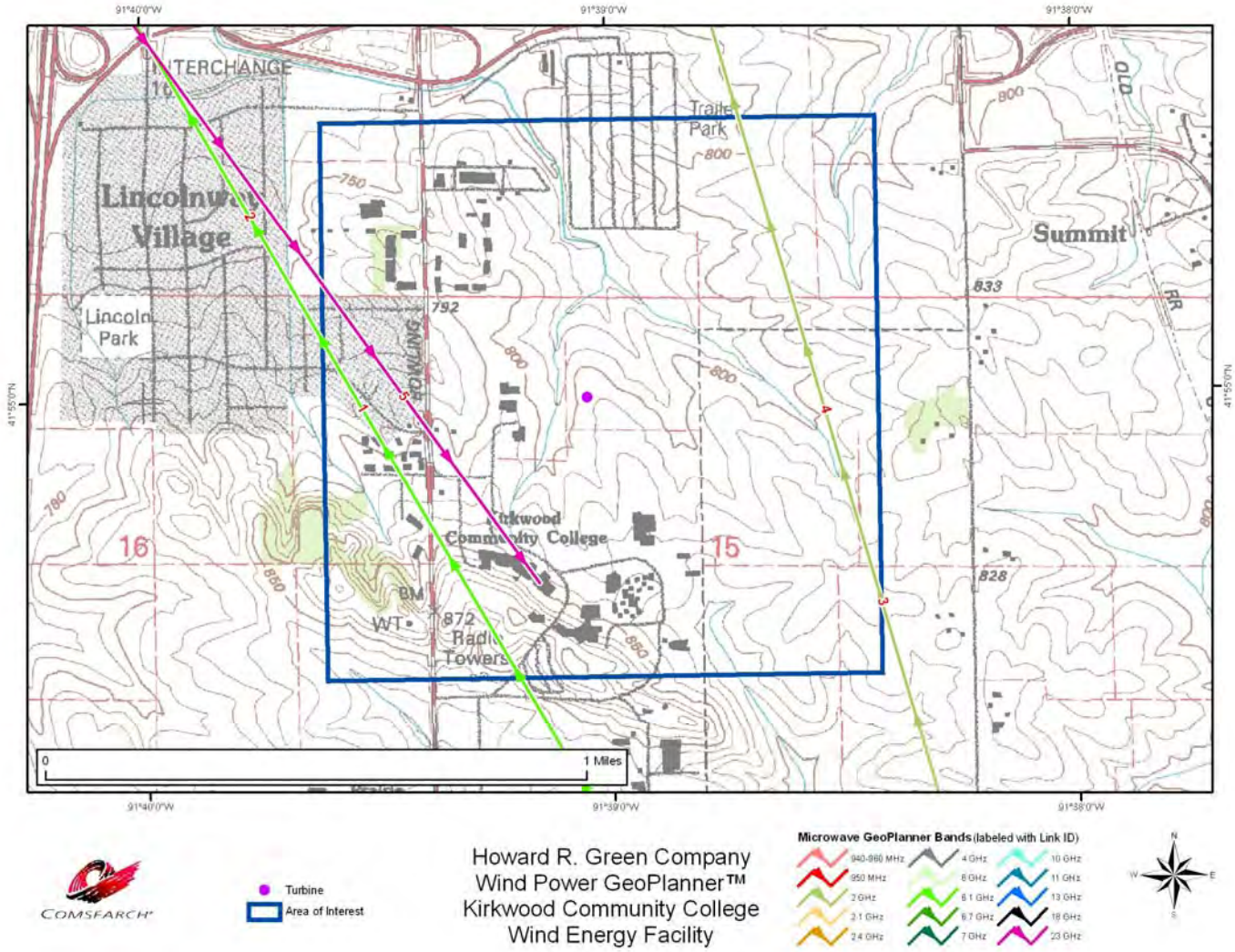


Figure 2: Microwave Paths that Intersect the Area of Interest

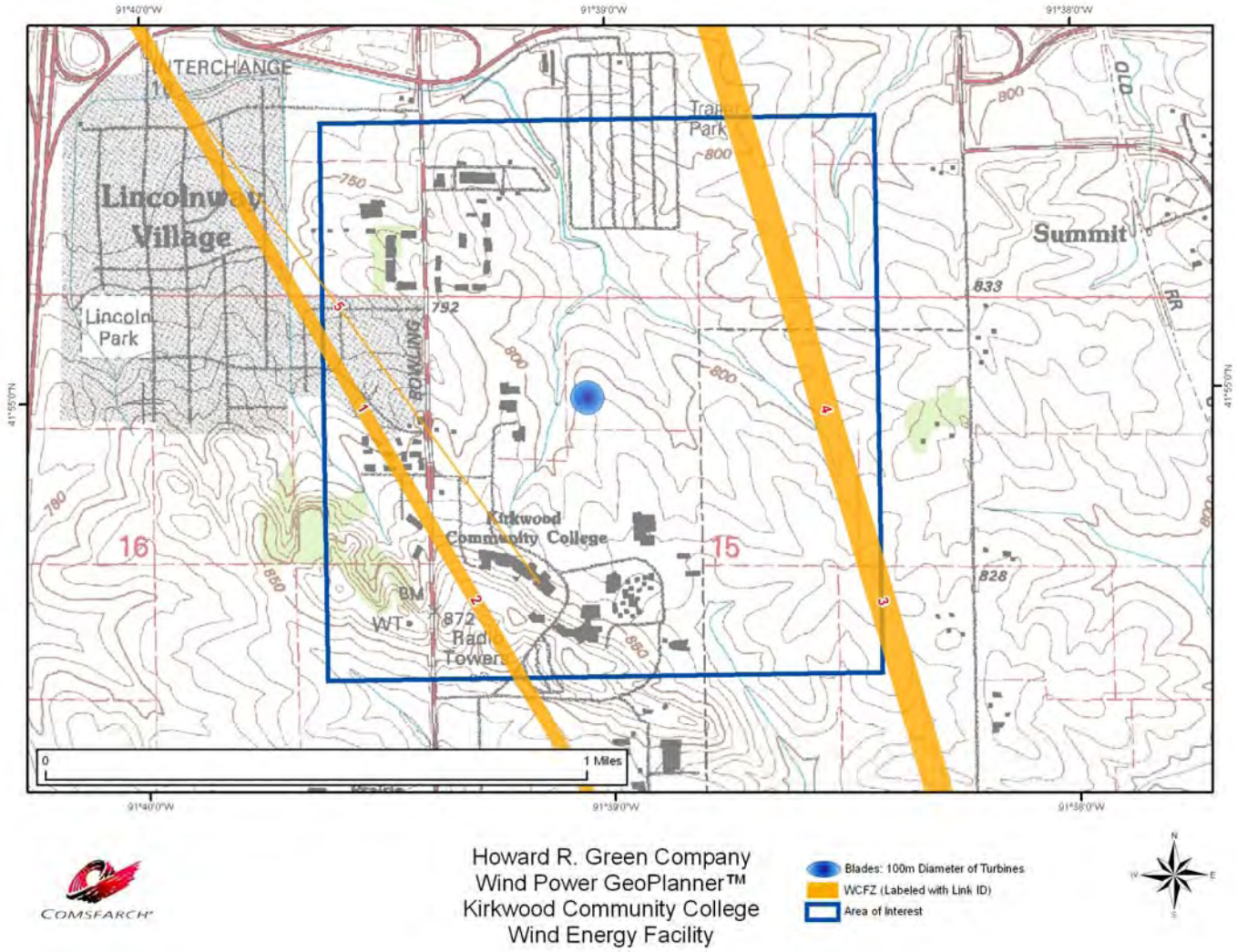


Figure 3: Microwave Paths with WCFZ Buffers

ID	Site Name 1	Site Name 2	Callsign 1	Callsign 2	Band	Licensee	WCFZ (m)
1, 2	IOWA CITY E	CEDAR RAPID	WMK527	WLT331	Lower 6 GHz	USCOC of Greater Iowa, Inc.	20.74
3, 4	IOWA CITY	HIAWATHA	WMU692	RXONLY	2 GHz	CEDAR RAPIDS TELEVISION COMPANY	40.70
5	SIXTH ST	KIRKWOOD CC	WNEP502	RXONLY	23 GHz	GRANTWOOD AREA EDUCATION	3.29

Table 1: Microwave Paths that Intersect the Area of Interest

(See enclosed mw_geopl.xls for more information and GP_dict_matrix_description.xls for detailed field descriptions)

4. Contact Us

For questions or information regarding the Licensed Microwave Report, contact:

Contact person:	Denise Finney
Title:	Account Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5650
Fax:	703-726-5595
Email:	dfinney@comsearch.com
Web site:	www.comsearch.com

APPENDIX F

Wetlands Assessment

Howard R. Green Company

July 2, 2010

U.S. Army Corps of Engineers, Rock Island
ATTN: Regulatory Branch
Clock Tower Building
Post Office Box 2004
Rock Island, Illinois 61204-2004

Re: Kirkwood Community College Wind Energy Facility Consulation

Dear Regulatory:

Kirkwood Community College in Cedar Rapids, Iowa is proposing the construction of a single 2.5 megawatt wind turbine facility on the Kirkwood main campus. Kirkwood is a recipient of State Energy Program (SEP) grant from the Iowa Office of Energy Independence (OEI) and United States Department of Energy (DOE). Partial project funding for the proposed turbine is from this grant.

HR Green, on behalf of Kirkwood, is requesting a preliminary jurisdictional determination for potential impacts to waters of the United States within the project Area of Potential Effect (APE) identified on the attached Figures 1-3. USACE consultation is required as part of initial NEPA review for this project. The project facility will include the turbine tower footprint, transformer at the base of the tower, and access road from Tower Rd SW adjacent to the proposed turbine site.

Wetland Observations

A review of the USGS quad map Cedar Rapids South shows the project area is adjacent to an unnamed perennial stream that is a tributary of Prairie Creek. Elevations within the APE appear between 790 and 810 feet. The project area is within the Upper Mississippi-Iowa-Skunk-Wapsipinicon HUC8 watershed (#07080205).

Mapped soils within the APE include a sliver 0.02 acre of hydric soil and 4.48 acres of non-hydric soils. A PEMA (Palustrine, Emergent, Temporary Flooded) NWI polygon appears approximately 100 feet west of the APE. See Figure 2 for more detail.

HR Green Project Scientist Ted McCaslin visited the project site on June 12, 2010. No indications of inundation, saturation or hydrophytic vegetation were observed within the APE. Species observed within the project area include: Kentucky bluegrass (*Poa praetensis*), fescue (*Festuca spp*.), dandelion (*Taraxacum officianale*), white clover (*Trifolium repens*), common plantain (*Plantago major*) and crabgrass (*Digitaria spp*.). The project area appears to be in row crops in a 1960s aerial photograph (See Figure 3).

Court International Building | 2550 University Avenue W, Suite 400N | St. Paul, MN 55114
Phone: 651.644.4389 | Fax: 651.644.9446 | www.hrgreen.com

The adjacent stream shown on the USGS quad and the NWI polygon areas in Figures 1 & 2 were investigated for wetland indicators. A sand/silt substrate, narrow (3-5 feet wide) stream was observed at the mapped stream location and mature trees appear to have grown next to the stream adjacent to the project area. The PEMA NWI polygon appeared completely forested during the site visit.

Observed tree species included eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), boxelder (*Acer negundo*), white mulberry (*Morus alba*), black cherry (*Prunus serotina*), and black willow (*Salix nigra*). Forested wetlands may be present in this forest area. The forested areas are completely outside of the project APE.

Conclusions

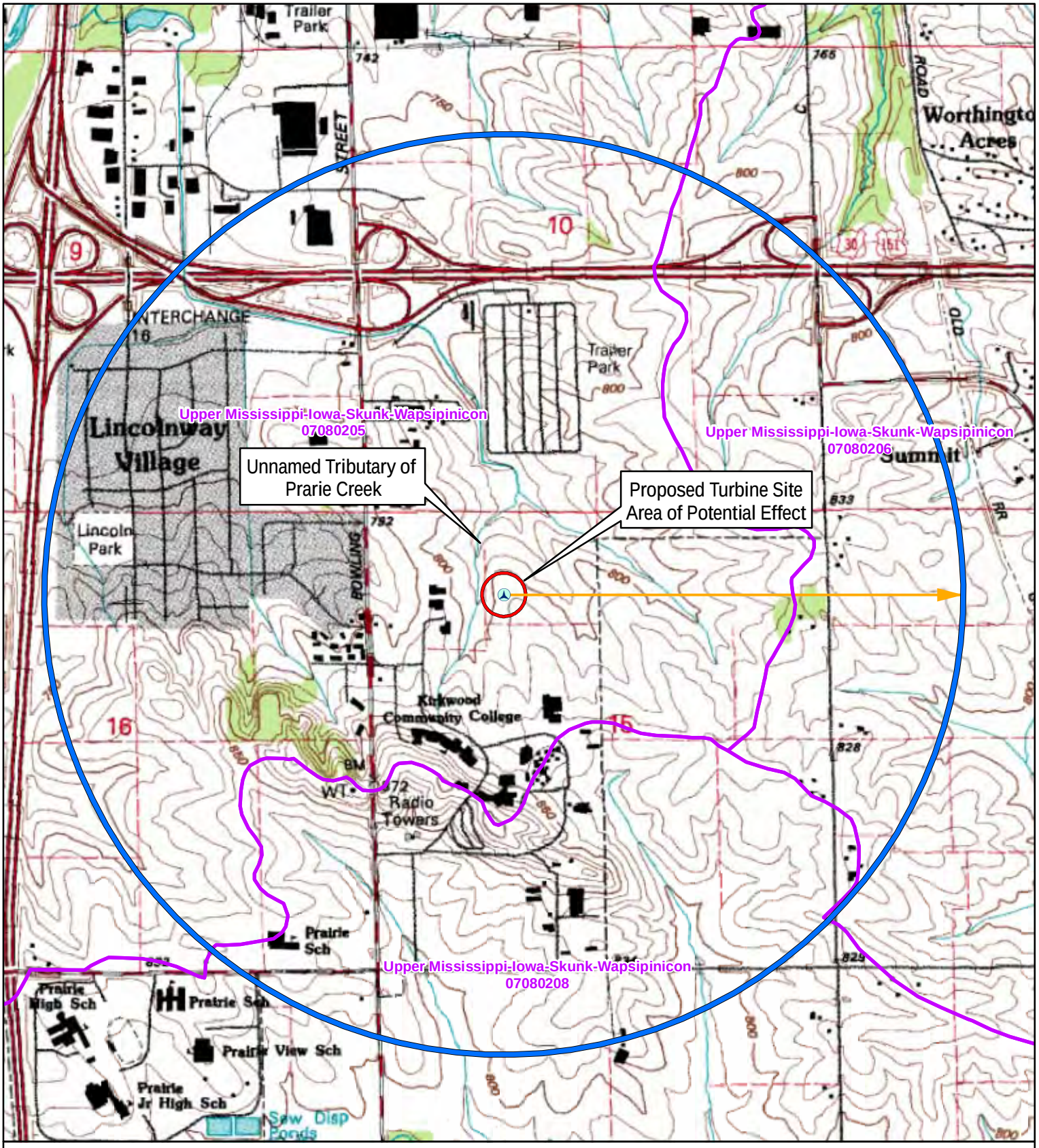
No wetland indicators were observed within the APE during a preliminary review and site visit. A perennial stream and forested wetlands adjacent to the stream appear to the west of the APE.

Please call me at 651-659-7708 or email tmccaslin@hrgreen.com if you have questions.

Sincerely,
HOWARD R. GREEN COMPANY

Ted McCaslin
Project Scientist

Enclosures
Figure 1 – USGS 1:24,000 Quadrangle Map of Project Area
Figure 2 – Site Map with NWI & Soils Data
Figure 3 – 1960s Aerial Photography
Site Photos



Source: USDA, NRCS
Digital Raster Graphic Mosaic of Linn County, Iowa
USGS 7.5' Quad Mosaic for Linn County, 2002

FIGURE 1
LOCATION MAP

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company

Map Unit Symbol	Map Unit Name	Hydric Soil?	Drainage Class	Acres in APE
377B	Dinsdale silty clay loam, 2 to 5 percent slopes	No	Moderately well drained	2.58
84	Clyde silty clay loam	Yes	Poorly drained	0.02
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	No	Moderately well drained	1.9

Area of Potential Effect (APE)

Linn County SSURGO

Hydric Soils

National Wetlands Inventory

Proposed Turbine Location

Sources: USDA SSURGO for Linn County; IowaDNR NR-GIS

N

0 50 100 200

Feet

FIGURE 2
Soils and NWI

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company

Area of Potential Effect (APE)

Approximate Forest Location 2010

Proposed Turbine Location

Source: Iowa USDA Orthos 1960s

N

0 100 200

Feet

FIGURE 3
1960s Aerial Photography

Proposed Wind Facility
Kirkwood Community College
Cedar Rapids, Iowa

Howard R. Green Company


Looking west from proposed turbine location at forested area
Tributary of Prairie Creek runs south to north through area


Looking east, proposed turbine location near center of photo


Looking south, proposed turbine
location near center of photo


Looking north, forested area west of proposed turbine
at left. Maintained vacant area at right of photo


Looking south from road, forested stream north of project area


Small stream in forested area
No impacts to stream Proposed

JUL 19 2010

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING - P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF

July 14, 2010

Operations Division

SUBJECT: CEMVR-OD-P-2010-816

Mr. Ted McCaslin
HR Green Company
Court International Building
2550 University Avenue W, Suite 400 N
St. Paul, Minnesota 55114

Dear Mr. McCaslin:

Our office reviewed your letter July 2, 2010, concerning the proposed construction of a single 2.5 megawatt wind turbine facility on the Kirkwood Community College Main Campus in Section 15, Township 82 North, Range 7 West, Linn County, Iowa.

We determined your project (wind turbine location only) as proposed does not require a Department of the Army (DA) Section 404 permit. The decision regarding this action is based on information found in the administrative record which documents the District's decision-making process, the basis for the decision, and the final decision. No indication of discharge of dredged or fill material was found to occur in waters of the United States (including wetlands). Therefore, this determination resulted.

You have also indicated that an access road will be built on the site. If this road will impact wetlands, a permit may be required. If it will not impact wetlands, then no permit will be required for the road.

This letter contains an approved jurisdictional determination for the subject site. If you object to this jurisdictional determination, you may request an administrative appeal under Corps regulations found at 33 CFR Part 331. Enclosed is a Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal this approved jurisdictional determination, you must submit a completed RFA form to the Mississippi Valley Division Office at the following address:

Mr. James B. Wiseman, Jr.
Administrative Appeals Review Officer
Mississippi Valley Division
P.O. Box 80 (1400 Walnut Street)
Vicksburg, MS 39181-0080

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by September 13, 2010.

It is not necessary to submit an RFA form to the Division Office if you do not object to the approved jurisdictional determination contained in this letter.

You are advised that this determination for your project is valid for five years from the date of this letter. If the project is not completed within this five-year period or your project plans change, you should contact our office for another determination.

Although a DA permit will not be required for the project, this does not eliminate the requirement that you must still acquire other applicable Federal, state, and local permits.

The Rock Island District Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete the attached postcard and return it or go to our Customer Service Survey found on our web site at http://per2.nwp.usace.army.mil/survey.html. (Be sure to select "Rock Island District" under the area entitled: Which Corps office did you deal with?).

Should you have any questions, please contact our Regulatory Branch by letter, or telephone Mr. Albert Frohlich at 309/794-5859.

Sincerely,

Donna M. Jones, P.E.
Chief, Enforcement Section
Regulatory Branch

Enclosures

Copies Furnished: (w/o enclosures)

Ms. Chris Schwake (3)
Iowa Department of Natural Resources
Water Resources Section
Wallace State Office Building
502 East 9th Street
Des Moines, Iowa 50319-0034

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Kirkwood Community College	File Number: 2010-816	7/14/2010
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, iucluding its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district eugineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form aud sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engiueer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
Name Albert J. Frohlich US Army Corps of Engineers District, Rock Island **ATTN: Regulatory Branch** Clock Tower Building Post Office Box 2004 Rock Island, Illinois 61204-2004 Telephone: 309/794-5859	James B. Wiseman, Jr. Administrative Appeals Review Officer Mississippi Valley Division P.O. Box 80 (1400 Walnut Street) Vicksburg, MS 39181-0080 Telephone: (601) 634-5820 Fax: (601) 634-5816 (fax)

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

	Date:	Telephone number:
_____ Signature of appellant or agent.		

APPROVED JURISDICTIONAL DETERMINATION FORM

U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): 7/14/2010

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: ROCK ISLAND, CEMVR-OD-P-2010-816

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: Iowa County/parish/borough: Linn City:

Center coordinates of site (lat/long in degree decimal format): Lat. ° **Pick List**, Long. ° **Pick List**.

Universal Transverse Mercator: N 4641328 E 611785

Name of nearest waterbody: Prairie Creek

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Iowa River

Name of watershed or Hydrologic Unit Code (HUC): 7080205

☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.

☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☒ Office (Desk) Determination. Date: 7/14/2010

☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☐ Waters subject to the ebb and flow of the tide.

☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are no** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]

☐ TNWs, including territorial seas
☐ Wetlands adjacent to TNWs
☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
☐ Non-RPWs that flow directly or indirectly into TNWs
☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
☐ Impoundments of jurisdictional waters
☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:

Non-wetland waters: linear feet: width (ft) and/or acres.

Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: **Pick List**

Elevation of established OHWM (if known): .

2. Non-regulated waters/wetlands (check if applicable):[3]

☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: .

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.

[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).

[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. **TNW**
   Identify TNW: .

   Summarize rationale supporting determination: .

2. **Wetland adjacent to TNW**
   Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a siguificant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. **Characteristics of non-TNWs that flow directly or indirectly into TNW**

   (i) **General Area Conditions:**
   Watershed size: **Pick List**
   Drainage area: **Pick List**
   Average annual rainfall: inches
   Average annual snowfall: inches

   (ii) **Physical Characteristics:**
   (a) Relationship with TNW:
   ☐ Tributary flows directly into TNW.
   ☐ Tributary flows through **Pick List** tributaries before entering TNW.

   Project waters are **Pick List** river miles from TNW.
   Project waters are **Pick List** river miles from RPW.
   Project waters are **Pick List** aerial (straight) miles from TNW.
   Project waters are **Pick List** aerial (straight) miles from RPW.
   Project waters cross or serve as state boundaries. Explain: .

   Identify flow route to TNW[5]: .
   Tributary stream order, if known: .

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain: .
☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):

☐ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☐ Muck
☐ Bedrock	☐ Vegetation. Type/% cover:	
☐ Other. Explain: .		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: .
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Pick List.** Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☐ the presence of litter and debris
☐ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☐ sediment deposition	☐ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community
☐ other (list):	

☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.
☐ tidal gauges	
☐ other (list):	

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: .
Identify specific pollutants, if known: .

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

- ☐ Riparian corridor. Characteristics (type, average width): .
- ☐ Wetland fringe. Characteristics: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: aeres

Wetland type. Explain: .

Wetland quality. Explain: .

Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain: .

Surface flow is**: Pick List**

Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .

- ☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

- ☐ Directly abutting
- ☐ Not directly abutting
  - ☐ Discrete wetland hydrologic connection. Explain: .
  - ☐ Ecological connection. Explain: .
  - ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List.**

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed charaeteristics; etc.). Explain: .

Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

- ☐ Riparian buffer. Characteristics (type, average width): .
- ☐ Vegetation type/percent cover. Explain: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally:

Provide estimates for jurisdictional waters in the review area (check all that apply):
- ☐ Tributary waters: linear feet width (ft).
- ☐ Other non-wetland waters: acres.
  Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
   ☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional waters within the review area (check all that apply):
   - ☐ Tributary waters: linear feet width (ft).
   - ☐ Other non-wetland waters: acres.
     Identify type(s) of waters: .

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
   ☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
   - ☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .
   - ☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

   Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
   ☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

   Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
   ☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
   As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
   - ☐ Demonstrate that impoundment was created from "waters of the U.S.," or
   - ☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
   - ☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
- ☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
- ☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
- ☐ which are or could be used for industrial purposes by industries in interstate commerce.
- ☐ Interstate isolated waters. Explain: .
- ☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

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[8] See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

Provide estimates for jurisdictional waters in the review area (check all that apply):
- ☐ Tributary waters: linear feet width (ft).
- ☐ Other non-wetland waters: acres.
  - Identify type(s) of waters: .
- ☐ Wetlands: aeres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
- ☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) eommeree.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where sueh a finding is required for jurisdietion. Explain: .
- ☐ Other: (explain, if not eovered above): .

Provide aereage estimates for non-jurisdietional waters in the review area, where the sole potential basis of jurisdietion is the MBR factors (i.e., presenee of migratory birds, presenee of endangered speeies, use of water for irrigated agriculture), using best professional judgment (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide aereage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately referenee sources below):
- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☐ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name:24K, Cedar Rapids South, IA.
- ☐ USDA Natural Resources Couservation Servicc Soil Survey. Citation: .
- ☒ National wetlands inventory map(s). Cite name:Cedar Rapids South, IA.
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-ycar Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date): .
  - or ☐ Other (Name & Date): .
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Applicable/supporting case law: .
- ☐ Applicable/supporting scientific literature: .
- ☐ Othcr information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: There are no wetlands within the mapped project site. HR Green submitted documentation to support these findings in a preliminary on-site review.