DOE/EA-1818

# FINAL
# ENVIRONMENTAL ASSESSMENT

## FOR

# PETTISVILLE LOCAL SCHOOLS WIND ENERGY PROJECT

## PETTISVILLE
## FULTON COUNTY, OHIO

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:** *Final Environmental Assessment: Pettisville Local Schools Wind Energy Project, Pettisville, Fulton County, Ohio* (DOE/EA-1818)

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**Abstract:** The U.S. Department of Energy (DOE) provided Federal funding to the Ohio Department of Development (ODOD) under the State Energy Program (SEP). ODOD proposes to provide $1,225,000 of its SEP funds to the Pettisville Local Schools (Pettisville). Pettisville would use these funds to design, permit, and construct a 750-kilowatt wind turbine at the Pettisville Pre-Kindergarten through Twelfth Grade School located at 255 Summit Street, Pettisville, Ohio. DOE has authorized ODOD to use a percentage of the Federal funding for preliminary activities, which include preparing this EA, conducting analysis, and agency consultation. Such activities are associated with the Proposed Action and do not significantly impact the environment nor represent an irreversible or irretrievable commitment by DOE in advance of its conclusion of the potential environmental impacts from the proposed project.

The wind turbine would provide 750 kilowatts of renewable energy, which would fulfill 98 percent of the school's annual electricity demands and help to reduce greenhouse gas emissions. Pettisville has selected an Aeronautica 750 model wind turbine with a 177-foot rotor diameter and a 213-foot tower height. Overall, the turbine would stand 302 feet at its tallest blade tip extent. Approximately 1,000 linear feet of associated underground electrical transmission equipment would be installed to connect the wind turbine to the existing school switchgear. No new access roads or road improvements would be required for this project.

This EA analyzes the potential environmental impacts of the proposed construction, operation, and decommissioning of the Pettisville Local Schools Wind Energy Project and the alternative of not implementing this project (the No-Action Alternative).

**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 |
| BMPs | best management practices |
| CFR | *Code of Federal Regulations* |
| 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 |
| EA | Environmental Assessment |
| EMF | electromagnetic fields |
| EPA | U.S. Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FONSI | Finding of No Significant Impact |
| $L_{eq}$ | equivalent noise level |
| $L_{max}$ | maximum noise level |
| MBTA | *Migratory Bird Treaty Act* |
| NEPA | *National Environmental Policy Act* |
| NHPA | *National Historic Preservation Act* |
| NPDES | National Pollutant Discharge Elimination System |
| NTIA | National Telecommunications and Information Administration |
| ODOD | Ohio Department of Development |
| ODNR | Ohio Department of Natural Resources |
| ODOW | Ohio Department of Natural Resources Division of Wildlife |
| OHPO | Ohio Historic Preservation Office |
| OSHA | Occupational Safety and Health Administration |
| Pettisville | Pettisville Local Schools |
| $PM_n$ | particulate matter with an aerodynamic diameter less than or equal to *n* micrometers |
| Recovery Act | *American Recovery and Reinvestment Act of 2009* |
| SEP | State Energy Program |
| SHPO | State Historic Preservation Officer |
| U.S.C. | *United State Code* |
| USFWS | U.S. Fish and Wildlife Service |

# CONTENTS

Section Page

**1. INTRODUCTION ..... 1**
1.1 National Environmental Policy Act and Related Procedures ..... 1
1.2 Background ..... 1
1.3 Purpose and Need ..... 2
1.3.1 DOE's Purpose and Need ..... 2
1.3.2 Ohio's Purpose and Need ..... 2
1.4 Ohio's SEP Project Selection Process ..... 3
1.5 Public and Agency Involvement ..... 3
1.5.1 DOE's Public Scoping Process ..... 3
1.5.2 Public Involvement ..... 3
1.5.3 Draft Environmental Assessment ..... 5
**2. PROPOSED ACTION AND ALTERNATIVES ..... 6**
2.1 DOE's Proposed Action ..... 6
2.2 Ohio's Proposed Project ..... 6
2.2.1 Proposed Project Location ..... 6
2.2.2 Construction and Installation ..... 7
2.2.3 Operations and Maintenance ..... 9
2.2.4 Decommissioning ..... 10
2.3 Alternatives ..... 10
2.3.1 DOE Action Alternative ..... 10
2.3.2 No-Action Alternative ..... 11
2.3.3 Siting Options Considered by Pettisville ..... 11
2.4 Permits, Approvals, and Notifications ..... 11
2.5 Project Proponent-Committed Practices ..... 12
2.5.1 Bird, Bat, and Raptor Avoidance and Minimization Measures ..... 12
2.5.2 Health, Safety and Noise ..... 12
2.5.3 Soil ..... 12
2.5.4 Waste Management ..... 12
2.5.5 Cultural Resources ..... 13
2.5.6 Flicker Effects ..... 13
2.5.7 Icing and Fire ..... 13
**3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS ..... 14**
3.1 No-Action Alternative ..... 14
3.2 Ohio's Proposed Project ..... 14
3.2.1 Considerations Not Carried Forward for Further Analysis ..... 14
3.2.1.1 Water Resources ..... 14
3.2.1.2 Waste Management ..... 15
3.2.1.3 Intentional Destructive Acts ..... 16
3.2.2 Considerations Carried Forward for Further Analysis ..... 16
3.2.2.1 Land Use ..... 16
3.2.2.2 Visual Resources ..... 18
3.2.2.3 Noise ..... 25
3.2.2.4 Cultural Resources ..... 32

3.2.2.5 Geology and Soils ....35
3.2.2.6 Biological Resources ....36
3.2.2.7 Human Health and Safety ....39
3.2.2.8 Transportation ....41
3.2.2.9 Socioeconomics and Environmental Justice ....42
3.2.2.10 Air Quality and Climate Change ....42
3.2.2.11 Utilities and Energy ....43
3.3 Irreversible/Irretrievable Commitment of Resources ....44
3.5 The Relationship Between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity ....45
**4. CUMULATIVE IMPACTS ....46**
4.1 Reasonably Foreseeable Projects ....46
4.2 Summary of Cumulative Impacts ....47
4.2.1 Greenhouse Gas Impacts ....47
4.2.2 Visual Resources ....48
4.2.3 Biological Resources ....48
**5. REFERENCES ....49**

## LIST OF TABLES

Table Page

1-1 Summary of Respondents .... 5
2-1 Federal, State, and Local Permits, and Notifications .... 11
3-1 Pettisville Visualization Receptor Locations .... 20
3-2 Typical Sound Pressure Levels Measured in the Environment and Industry .... 25
3-3 Definitions of Commonly Used Acoustical Terms .... 26
3-4 Summary of Baseline Sound Monitoring Results in A-weighted Decibels .... 29
3-5 Typical Construction Noise Emission Levels .... 29
3-6 Turbine Sound Levels at Various Distances .... 30
3-7 Predicted Turbine DNL Sound Levels .... 31
3-8 Comparison of Predicted Turbine Noise Levels to Measured $L_{90}$ Values .... 31
3-9 Daytime Noise Impact Analysis .... 31
3-10 Nighttime Noise Impact Analysis .... 32
3-11 Fulton County, Ohio Project Area Soil Composition .... 36
3-12 First Energy Solutions Fuel Mix .... 43

# TABLE OF FIGURES

Figure Page

2-1 Pettisville Project Site and Vicinity ..... 7
2-2 Site Plan ..... 8
3-1 Clinton Township Zoning Map ..... 17
3-2 Nearby Communication Tower and Power Lines ..... 18
3-3 Nearby Farm Silo ..... 18
3-4 Existing Tall Towers within 4 Miles of the Proposed Turbine Site ..... 19
3-5 Visual Simulation Depicted from Residence at Corner of Willow and County Road D Northwest of the Turbine ..... 20
3-6 Visual Simulation Depicted from Residence at County Road D Northwest of the Turbine 20
3-7 Visual Simulation Depicted from the Intersection of Ballpark and County Road D ..... 21
3-8 Visual Simulation Depicted from Pettisville Missionary Church ..... 21
3-9 Monitoring Sites for Measuring Baseline Sound Conditions and Predicted Turbine Sound Level Contours ..... 28
3-10 Aeronautica 54-750 Sound Pressure Level as a Function of Distance ..... 30

# APPENDICES

**Appendix A: Figures**

Figure 1a Project Location on United States Geological Survey Map
Figure 1b Project Location on Area Map
Figure 2 Project Location on Larger United States Geological Survey Map
Figure 3 Project Location on Aerial Photo
Figure 4 Pettisville Turbine Placement, Fall Zone and Alternate Locations Map
Figure 5 Pettisville Overall Site Plan
Figure 6 Project Area National Wetlands Inventory Map
Figure 7 Project Area 100-Year Floodplain Map
Figure 8 Ohio Rivers including National Wild and Scenic Rivers Map
Figure 9 Clinton Township and Fulton County, OH Zoning Map
Figure 10 Pettisville Noise Monitoring Analysis Map
Figure 11-ARRA SEP Awarded Wind Turbine Projects in Ohio

**Appendix B: Visualization, Photo Analysis and Shadow Flicker Analysis**

Attachment B1 Visualization and Photo Analysis
Attachment B2 Shadow Flicker Analysis

**Appendix C: Agency Coordination and Approvals**

Attachment C1 Ohio Department of Natural Resources Response
Attachment C2 U.S. Fish and Wildlife Service Response (USFWS) (Initial letter dated 9/21/2009)
Attachment C3 USFWS Response (Follow-up letter dated 9/2/2010)
Attachment C4 Ohio Department of Transportation Aviation Response
Attachment C5 Federal Aviation Administration Determination of No Hazard
Attachment C6 National Telecommunications and Information Administration Response

Attachment C7 Clinton Township Zoning Application

**Appendix D: Analysis and Supporting Documentation**

Attachment D1 Notice of Public Scoping for Pettisville Local Schools Wind Energy Project
Attachment D2 Media Coverage of Pettisville Public Involvement
Attachment D3 Aeronautica 750 Wind Turbine Technical Specifications
Attachment D4 Pettisville Turbine Equipment Transportation Plan
Attachment D5 Turbine Use, Safety Policies, and General Background
Attachment D6 Pettisville (Clinton Township) Zoning Code
Attachment D7 Pettisville Wind Resource Report Weibull Performance Calculations
Attachment D8 Pettisville Wind Turbine Soil Investigation Report
Attachment D9 Notice of Availability Mailing List
Attachment D10 Notice of Availability
Attachment D11 Affidavit for Notice

**Appendix E: Historical and Cultural Documentation**

Attachment E1 Request for Consultation from Ohio State Historical Preservation Office (OHPO)
Attachment E2 OHPO Section 106 Review – Project Summary Form
Attachment E3 Section 106 Compliance Report for Pettisville Local Schools Wind Energy Project
Attachment E4 OHPO No Adverse Effects Concurrence Letter (dated 2/7/2011)

# 1. INTRODUCTION

## 1.1 National Environmental Policy Act and Related Procedures

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

DOE must meet these requirements before it can make a final decision to proceed with any proposed Federal action that could cause adverse impacts to human health or the environment. This EA provides DOE and other decisionmakers the information needed to make an informed decision about the installation, operation, and eventual decommissioning of the proposed wind turbine. 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 without Federal funds. The EA does not analyze other action alternatives.

## 1.2 Background

Pettisville Local Schools (Pettisville) proposes to construct, operate, and eventually decommission a single 750-kilowatt wind turbine, along with approximately 1,000 feet of associated underground electrical transmission equipment at the newly constructed Pettisville Pre-Kindergarten through Twelfth Grade School campus located at 255 Summit Street in Pettisville, Ohio (proposed project). The proposed turbine location is County Road D, in the school's newly constructed athletic complex (see Appendix A Figures 1a, 1b, 2, and 3). The estimated project cost is $1,875,000. The Ohio Department of Development's (ODOD's) Energy Resources Division selected this project to receive a $1,225,000 sub-grant. This sub-grant would come from a grant that the State of Ohio received from DOE under the DOE's State Energy Program (SEP) and the *American Recovery and Reinvestment Act of 2009* (Pub. L. 111-5, 123 Stat. 115; ARRA or Recovery Act). The purpose of 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. In the Recovery Act, Congress appropriated $3.1 billion to SEP, and DOE issued the State of Ohio a grant in the amount of $96,083,000,,pursuant to a Federal statutory formula for distributing the SEP funds. The potential use of Federal SEP funds to assist in the financing of the proposed project constitutes a Federal action subject to review under NEPA.

In compliance with Council on Environmental Quality and DOE NEPA regulations, this EA examines the potential environmental impacts of the DOE's Proposed Action (providing funding for the design, permitting, and construction of the Pettisville Wind Energy Project) and the No-Action Alternative. This EA also describes options that Pettisville (sub-recipient) considered during development of its application to the State of Ohio, which is the recipient of Federal funding under the DOE SEP. This EA will provide DOE with the information needed to make an informed decision about whether allowing the State of Ohio to provide a portion of its Federal funds for the proposed project might result in significant environmental impacts.

## 1.3 Purpose and Need

### 1.3.1 DOE'S PURPOSE AND NEED

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, and promote renewable energy. Funding provided as part of the State of Ohio's SEP sub-grant to Pettisville would partially satisfy the needs of DOE to assist U.S. cities, counties, states, and American Indian tribes through SEP 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.

### 1.3.2 OHIO'S PURPOSE AND NEED

Ohio's purpose and need is to grow the economy of the state by connecting companies and communities to financial and technical resources to deploy renewable energy technologies, and to support the goals of SEP and the Recovery Act to reduce energy costs, reduce reliance on imported energy, reduce the impacts of energy production and energy use on the environment, and to preserve and create jobs.

Ohio is using its SEP Recovery Act funding for programs to increase the energy efficiency of businesses and industry while promoting deployment of clean energy projects that will help improve the cost-effectiveness and economic stability of businesses and industry in the state.

## 1.4 Ohio's SEP Project Selection Process

The Ohio SEP, administered by ODOD, includes five sub-programs:

- Deploying Renewable Energy in Ohio
- Making Efficiency Work
- Targeting Industry Efficiency
- Banking on New Energy Financing
- Setting the Stage for Ohio's Carbon Management Strategy

ODOD selected the Pettisville Local Schools Wind Energy Project to receive a sub-grant through ODOD's sub-program, "Deploying Renewable Energy in Ohio," which provides grants to public and private entities to fund a variety of renewable energy projects, including solar, wind, fuel cell, and waste to energy technologies. ODOD issued a Request for Proposals for the "Deploying Renewable Energy in Ohio" sub-program and used the following criteria for selection: project readiness; matching capabilities, financing, and cost effectiveness; economic impact on Ohio; project characteristics and potential for innovation; and a project's ability to (1) provide emission-free energy, and (2) create jobs during the construction of the project.

## 1.5 Public and Agency Involvement

### 1.5.1 DOE'S PUBLIC SCOPING PROCESS

On August 19, 2010, DOE sent postcards announcing the public scoping process and directing stakeholders to the DOE Golden Field Office Public Reading Room, where the scoping letter was available for review. DOE sent notices of public scoping to stakeholders and interested parties including local, State, and Federal agencies, the tribal representatives that are regularly notified regarding Federal actions in the state of Ohio, organizations, and the general public, to solicit public comments (see Appendix D, Attachment D1). The scoping letter described the proposed project and requested assistance in identifying potential issues to be evaluated in this EA. The public scoping period closed on September 9, 2010.

In response to the scoping letter, DOE received a letter from the U.S. Fish and Wildlife Service (USFWS) that was part of the ongoing consultation between DOE and USFWS and is discussed in detail in Section 3.2.2.6 of this EA. This letter (dated September 2, 2010; see Appendix C, Attachment C3) concluded the USFWS consultation for the proposed project and indicated that the USFWS determined the proposed project is not likely to adversely affect the Indiana bat (*Myotis sodalis*).

### 1.5.2 PUBLIC INVOLVEMENT

Pettisville has provided opportunities for public involvement since August 12, 2008, in an attempt to educate the public about this project and provide an opportunity for public comment.

The opportunities have included public meetings, school newsletter articles, and a survey, as well as coverage of the project in local media outlets (media coverage is included in Appendix D, Attachment D2).

Because the wind turbine was part of a $7.86 million school bond for a new building that was passed on the first try in November of 2008, the proposed project was discussed at all of the public sessions held regarding the bond, featured in several school newsletters (which is sent via bulk mail to residents in the school district), included as part of regular and special School Board meetings, and discussed at public meeting at the Rotary Club in the neighboring town of Archbold. Pettisville also sent a survey to the families of students and nearby residents. Of the 300 surveys that were distributed, a total of 249 were returned in support of the proposed project.

The following information itemizes specific public involvement efforts Pettisville made.

Public meetings for the school that included discussions of the proposed wind turbine:

- August 12, 2008
- August 14, 2008
- August 15, 2008
- September 8, 2008

School Newsletter articles:

- 2008 Pettisville School Newsletter
- 2009 Pettisville School Newsletter
- 2010 Pettisville School Newsletter

The proposed wind turbine was also part of 12 School Board Meeting Superintendent's reports:

- January 10, 2011
- December 13, 2010
- November 1, 2010
- September 13, 2010
- July 8, 2010
- June 14, 2010
- June 4, 2010
- May 10, 2010
- April 29, 2010
- March 10, 2010
- February 8, 2010
- January 13, 2010

Other Public Meetings:

- January 14, 2011 – Archbold Rotary Club

- March 1, 2010 – Special Combined Board Meeting with Archbold and Pettisville Schools Special Report – Wind Turbine Projects

Public Survey:

In September 2009, of the approximately 300 surveys regarding the wind turbine and use of the DOE grant, 249 were returned and all were in support of the proposed project. Table 1-1 lists the summary of the respondents.

**Table 1-1. Summary of Respondents**

| Description of Respondent | Number |
|---|---|
| Adjacent to site | 22 |
| Within 0.25 mile of site | 12 |
| Lives in the city of Pettisville | 19 |
| Attends Pettisville Pre-Kindergarten through Twelfth Grade School | 168 |
| Other Supports the Project | 28 |
| **Total Numbers of Support** | **249** |

In addition, DOE contacted the following agencies and organizations:

- USFWS
- Federal Aviation Administration (FAA)
- U.S. Department of Commerce, National Telecommunications and Information Administration (NTIA)
- Ohio Historic Preservation Office (OHPO)
- Ohio Department of Natural Resources (ODNR), Division of Wildlife (ODOW)
- Ohio Department of Transportation, Office of Aviation

### 1.5.3 DRAFT ENVIRONMENTAL ASSESSMENT

DOE issued the Draft EA for comment on February 10, 2011, and posted it 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 sent postcards to the individuals listed in Appendix D, Attachment D9 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 newspapers, the *Archbold Buckeye* and the *Crescent News,* and on the Pettisville Local Schools Website and newsletter (see Appendix D, Attachments D10 and D11). The comment period ended on February 25, 2011. DOE received no comments on the Draft EA.

# 2. PROPOSED ACTION AND ALTERNATIVES

## 2.1 DOE's Proposed Action

DOE is proposing to authorize ODOD's expenditure of Federal SEP funding through a sub-grant to Pettisville to design, permit, and construct a 750-kilowatt wind turbine to provide renewable energy to the Pettisville Pre-Kindergarten through Twelfth Grade School (Proposed Action).

DOE authorized ODOD and Pettisville to use a percentage of the Federal funding for preliminary activities, which include EA preparation and studies. These activities are associated with the Proposed Action and would not significantly impact the environment nor represent an irreversible or irretrievable commitment of resources in advance of DOE completing the NEPA process for the Proposed Action.

## 2.2 Ohio's Proposed Project

This proposed project was chosen based on the following ODOD criteria: project readiness; cost effectiveness; economic impact for Ohio; project characteristics and potential for innovation; and its ability to (1) provide emission-free energy, and (2) create jobs during the construction of the project. For this proposed project, DOE is the Federal agency whose Proposed Action is to authorize the expenditure of funding. ODOD is the recipient of Federal funding and Pettisville is the sub-recipient of this funding. The project would be implemented on the Pettisville Pre-Kindergarten through Twelfth Grade School campus in Pettisville, Ohio.

The proposed project would include the installation, operation, and eventual decommissioning[1] of a single 750-kilowatt wind turbine on the Pettisville Pre-Kindergarten through Twelfth Grade School campus. The turbine model selected is an Aeronautica 54-750 with a 177-foot rotor diameter and a 213-foot tower height. Overall, the turbine would stand 302 feet at its tallest blade tip extent. The turbine would be mounted on a monopole made up of tubular conical steel segments. This design would eliminate the need for guy wires for support of the wind turbine. Guy wires can be a challenge for birds and bats to locate and maneuver around, which can lead to injury or death. The proposed design would not include the use of lattice towers for support, which have been found to be roosting sites for birds at other wind project sites.

Approximately 1,000 linear feet of associated underground electrical transmission equipment would be installed to connect the wind turbine to the existing school switchgear across County Road D to the north. No new access roads or improvements to existing roads would be required for this project.

### 2.2.1 PROPOSED PROJECT LOCATION

The turbine would be located south of the Pettisville Pre-Kindergarten through Twelfth Grade School campus in what is currently a construction site for a future parking lot (previously an

1. DOE's Proposed Action includes provision of partial funding for the design, permitting, and construction of the Pettisville Wind Energy Project, whereas the proposed project also includes the operation and decommissioning of the project. While the DOE Proposed Action does not include authorizing Federal funding for operation and decommissioning, this EA analyzed those actions as connected actions.

agricultural field) (Figure 2-1 and Appendix A, Figures 1a, 1b, 2, and 3). The approximate center point of the turbine would be located at 41°31′40.68″ north latitude and 84°13′31.51″ west longitude and 748 feet above mean sea level. The turbine site is approximately 350 feet south of County Road D and 1,030 feet east of County Road 19 (see Appendix A, Figure 4). The site is surrounded by residential areas to the north, northwest, and to the west-southwest, with the nearest homes approximately 650 feet northeast and approximately 685 feet northwest. The high school building is approximately 790 feet north of the turbine site. Cultivated agricultural fields are south and east of the turbine location. The final footprint of the turbine base once the project is installed would be approximately 256 square feet.

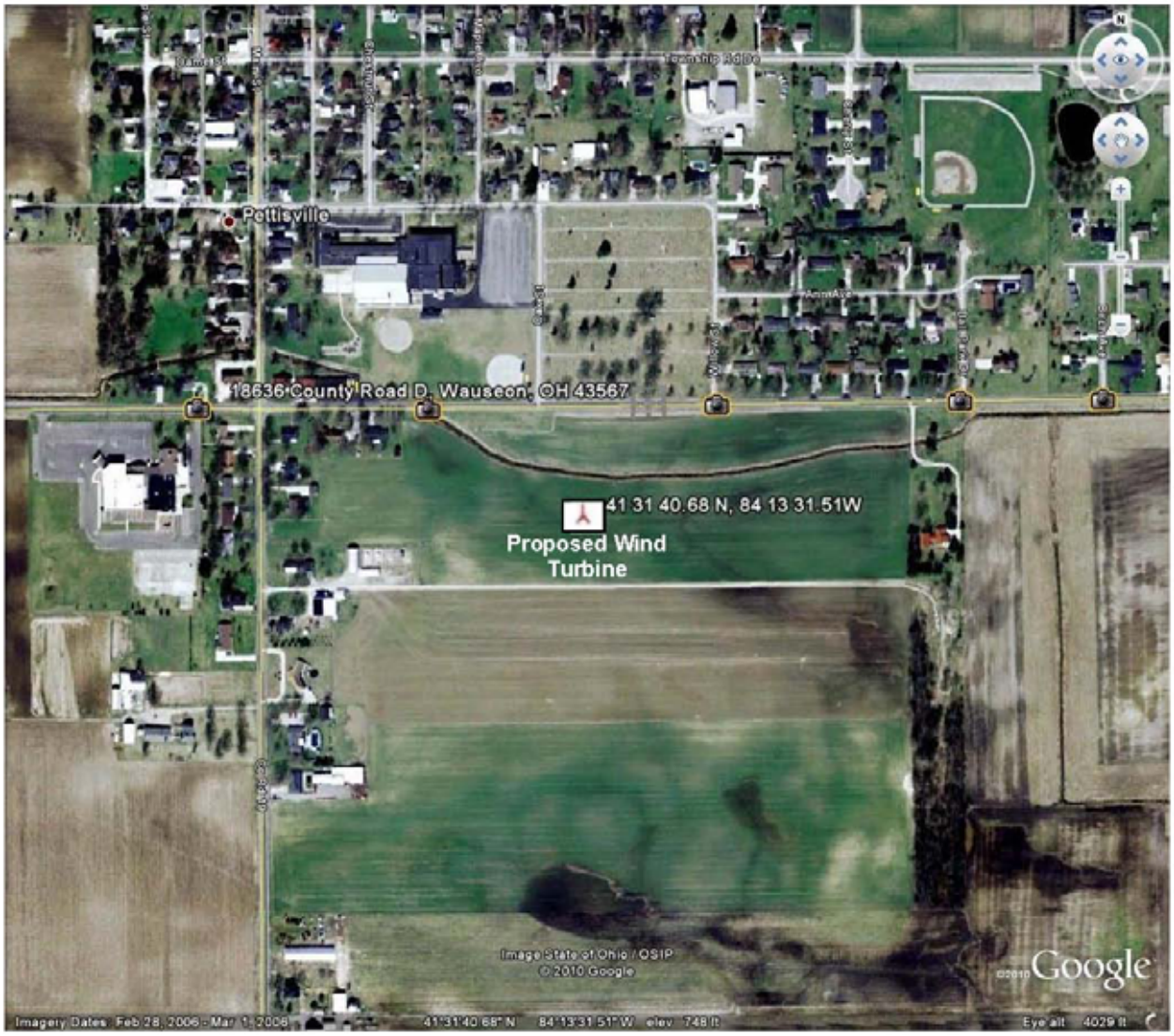


**Figure 2-1. Pettisville Project Site and Vicinity**

### 2.2.2 CONSTRUCTION AND INSTALLATION

Site construction would include installation of the foundation, turbine, transformer, electrical distribution wiring, and switchgear (see Figure 2-2 and Appendix A, Figure 5).

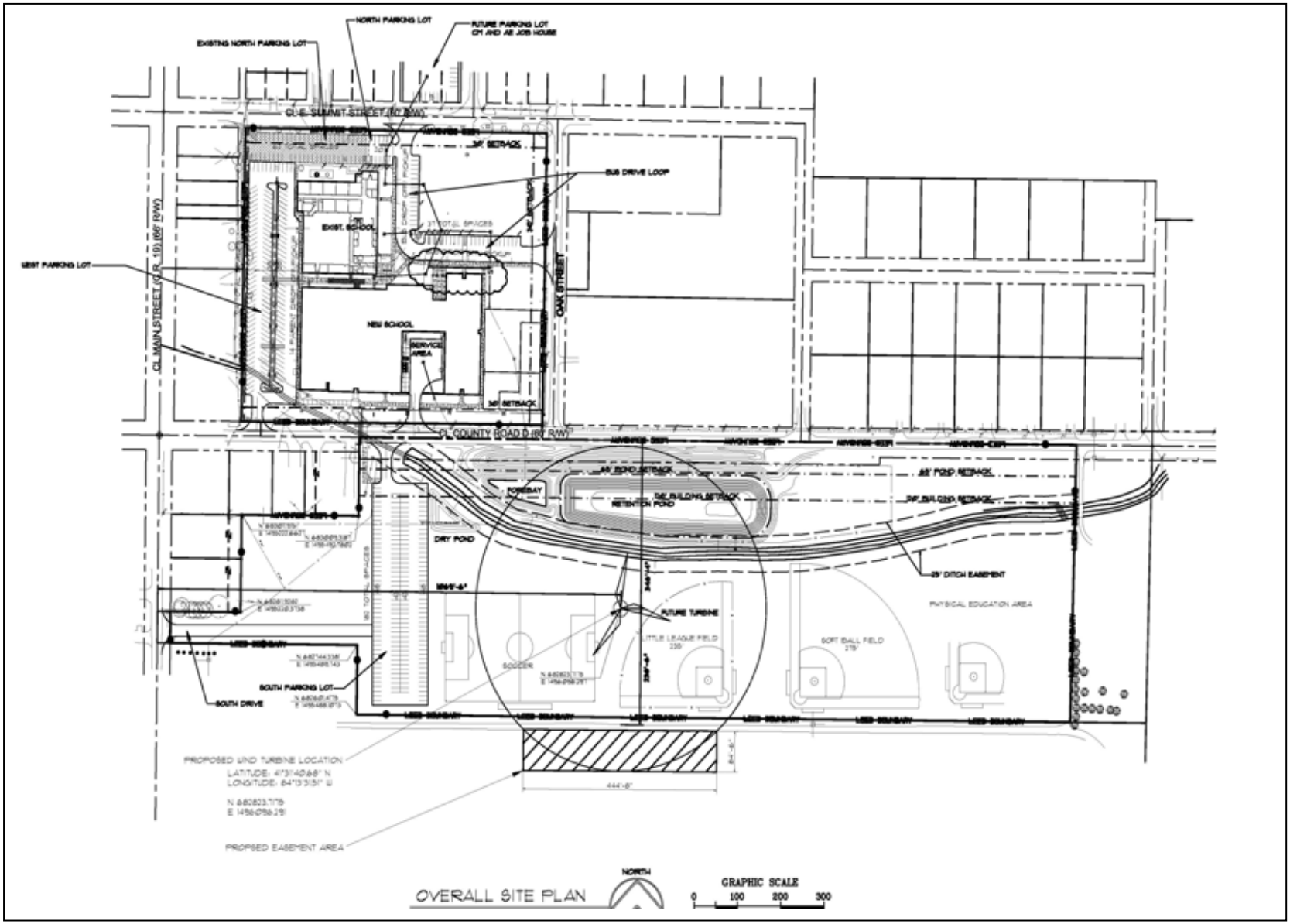


**Figure 2-2. Site Plan**

The turbine nacelle, blades, and tower would be staged on the Pettisville Pre-Kindergarten through Twelfth Grade School campus in what is currently a construction site for a future parking lot (previously an agricultural field).

An area equal to the possible fall zone (335-foot radius) would be closed during the erection phase of the project. Crane pads would be used during erection as needed to protect the existing school roadways and ground surfaces. The foundation for the turbine would be composed of approximately 300 cubic yards of reinforced concrete. The foundation would be buried 10 feet underground and would require approximately 23,000 pounds of reinforcing steel.

The electrical grid interconnect of the turbine would be composed of the turbine's controller (contained within the turbine tower base section), approximately 1,000 linear feet of buried 4-inch electrical conduits, including the portions of the run embedded within the turbine tower foundation, a 690- to 12,470-volt transformer, an automatic disconnect switch, a UL1741-compliant monitoring and control device, and a fused disconnect within the school's existing switchgear. The system would also have a parallel run of 2-inch conduit for data transfer and control runs. The full system would meet all local, State, and Federal codes and regulations.

Construction would use best management practices (BMPs) and be performed in accordance with an approved erosion and sedimentation control plan and in compliance with other applicable local, State, and Federal requirements. Construction activities for wind turbine foundation, tower erection, turbine nacelle placement, and blade installation would be contingent on temperature and weather conditions. The turbine nacelle and blades would be installed during calm wind periods. The foundation would not be installed during cold winter months. These and similar factors would determine the final construction timeline. The proposed project temporary disturbance area would not exceed 1 acre; thus, it would not exceed the threshold for National Pollutant Discharge Elimination System (NPDES) permitting.

The installation of the wind turbine and its related infrastructure, including site preparation, erection, final commissioning, generator installation, and overall systems tie-in and startup is scheduled to be completed within approximately 10 months of groundbreaking.

Temporary and permanent soil disturbance would affect less than 1 acre of earth. During construction, the construction area would be closed with secured fencing and locked gates to prevent unauthorized individuals from entering the work zone. The permanent disturbed ground area would be equal to the wind turbine foundation, approximately 256 square feet.

#### Aviation Lighting

Aviation lighting would be in compliance with the FAA standards (FAA 2007). The project has been reviewed by and received a favorable aeronautical determination from the FAA (see Appendix C, Attachment C5). White strobe lights at the minimum number, minimum intensity, and minimum number of flashes per minute allowable by the FAA would be used.

### 2.2.3 OPERATIONS AND MAINTENANCE

Pettisville would operate and maintain the wind turbine and its related infrastructure according to operating, maintenance, and safety procedures and requirements specifically recommended by the turbine's manufacturer, Aeronautica. Routine preventive maintenance and inspection of the

turbine would be necessary to maximize performance and identify potential problems or escalating maintenance issues. The turbine would be remotely monitored daily to ensure operations were proceeding efficiently. This monitoring would occur through the use of trained onsite staff and remote monitoring via a service provider contract. The turbine would have equipment installed with the ability to monitor and report faulty operations both locally and remotely, as well as the ability to automatically shut itself down if a fault should occur outside the normal operating parameters of the turbine per the manufacturer's specifications. The turbine would also have the ability for local remote shutdown by authorized personnel.

For the first 5 years of operation, Pettisville would contract out all formal service and maintenance functions to a nationally experienced firm. During this period, local staff and resources would be trained and gain experience in the maintenance and service procedures for the machine. A 5-year extended warranty would also be included in the initial purchase contract of the turbine from the original provider to optimize performance and safety. After this 5-year period, the service and maintenance plans and providers would be reevaluated and contracted as necessary. Most servicing would be performed up-tower by a maintenance crew who would not need to use a crane to remove the turbine from the tower. In addition, pads, and trenched areas would be regularly inspected and maintained.

### 2.2.4 DECOMMISSIONING

Impacts from decommissioning the turbine would be similar to those related to construction. The turbine and other infrastructure are expected to have a useful life of at least 20 years. Retrofitting the turbine with upgrades may allow the turbine to produce efficiently for many years after the original useful life. When the project is terminated, Pettisville would be responsible for decommissioning the turbine and other infrastructure and removing all facilities to a depth of approximately 3 feet below grade. Pettisville would restore the soil surface as closely as possible to its original condition. Pettisville would either remove underground facilities or they would be 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. Pettisville would perform all decommissioning construction activities in accordance with the manufacturer's guidelines as well as all applicable Federal, State, and local regulations.

## 2.3 Alternatives

### 2.3.1 DOE ACTION ALTERNATIVE

The Ohio SEP funds are from a formula grant in which the amount granted to the State is determined pursuant to a formula established in DOE's SEP grant procedures (10 CFR 420.11). Allocation of funds among the states is based on population and other factors. Recipients of these formula grants have broad discretion in how they use these funds.

This EA examines the potential environmental impacts of DOE's Proposed Action (authorizing the expenditure of Federal funds for the design, permitting, and construction of the Pettisville Wind Energy Project) and the No-Action Alternative. This EA also describes options that Pettisville (sub-recipient) considered during development of its application to the State of Ohio,

(direct SEP recipient). This EA will provide DOE with the information needed to make an informed decision about whether authorizing the State of Ohio to provide a portion of its Federal funds for the design, permitting, and construction of the proposed project might result in significant environmental impacts.

### 2.3.2 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, DOE would not authorize Ohio to use SEP funds for the design, permitting, and construction of the Pettisville Wind Energy Project. DOE assumed for purposes of this EA that the project would not proceed without SEP 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, Pettisville Pre-Kindergarten through Twelfth Grade School operations would continue as otherwise planned, but without the installation or operation of the proposed wind turbine.

### 2.3.3 SITING OPTIONS CONSIDERED BY PETTISVILLE

Pettisville considered only one site for installing the wind turbine at the Pettisville Pre-Kindergarten through Twelfth Grade School, as only one viable option on the property met the basic set-back requirements of the turbine. Pettisville owns the site, and it is compatible with such environmental considerations as avoiding wildlife, wetlands, and streams. Further, the property is compatible with existing zoning and land uses.

## 2.4 Permits, Approvals, and Notifications

Prior to construction, Pettisville would obtain all required Federal, State, and local permits and approvals. The required permits and approvals are listed in Table 2-1. All permit documentation and approval letters are contained in Appendix C of this EA.

**Table 2-1. Federal, State, and Local Permits, and Notifications**

| Agency | Permit Approval / Type |
|---|---|
| **Federal** | |
| FAA | FAA Aeronautical Determination (issued August 19, 2010) |
| NTIA | Radio Frequency Transmission Approval (received October 18, 2010) |
| USFWS | Compliance with the *Endangered Species Act*, the *Migratory Bird Treaty Act*, and the *Bald and Golden Eagle Protection Act* (letter issued September 2, 2010) |
| **State** | |
| OHPO | Compliance with the *National Historic Preservation Act* (letter issued February 7, 2011) |
| ODOW | Concurrence that the proposed project does not pose a substantial risk to State-protected species, including birds (pursuant to Ohio Revised Code Chapter 1531). |
| **Local** | |
| Clinton Township Planning & Zoning Commission | Building Zoning Permit (received November 23, 2009) |

## 2.5 Project Proponent-Committed Practices

Pettisville has committed to the following measures and procedures to minimize or avoid environmental impacts if the proposed project is implemented.

### 2.5.1 BIRD, BAT, AND RAPTOR AVOIDANCE AND MINIMIZATION MEASURES

Project coordination occurred with USFWS and ODOW concerning the project's location and potential impacts on birds, bats, and other wildlife; rare, threatened, and endangered species; and other protected natural features. There are no known bald eagle nests in Fulton County and the proposed project does not provide suitable habitat for migratory birds. The USFWS issued letters for the proposed project on September 18, 2009 and on September 2, 2010, wherein they determined it is unlikely that the Pettisville Local Schools Wind Energy Project would adversely affect Federally listed species (see Appendix C, Attachments C2 and C3). The ODOW issued a letter on August 27, 2010 indicating that State-listed species whose range coincides with the proposed project were not anticipated (see Appendix C, Attachments C1).

Pettisville considered the USFWS *Interim Guidelines to Avoid and Minimize Wildlife Impacts* (USFWS 2003) and would take actions to minimize any potential adverse effects on wildlife through the following actions: use of a previously developed site, a smooth monopole tower, wildlife-friendly FAA obstruction lighting equipment and operation procedures, soil erosion/run-off prevention measures, and proper recycling and waste management procedures; and minimization of construction areas.

### 2.5.2 HEALTH, SAFETY AND NOISE

Pettisville has prepared a health and safety plan, and would follow this plan, as well as all Occupational Safety and Health Administration (OSHA) requirements and Aeronautica 54-750 guidelines. Therefore, all facilities would include high-voltage warning signs. All construction activities would occur during normal working hours (7 a.m. to 7 p.m. Monday through Saturday) to avoid noise disturbances to surrounding areas. The construction of the proposed project would comply with all applicable Federal, State, and local requirements.

### 2.5.3 SOIL

Temporary and permanent soil disturbance would not exceed 1 acre and would not require an NPDES permit under the *Clean Water Act*. Pettisville's Sediment and Erosion Control Plan would identify BMPs during construction and operation to protect topsoil and minimize soil erosion. BMPs would include, at a minimum, the following: containing excavated material, using silt fences, protecting exposed soil, stabilizing restored material, and revegetating disturbed areas with native plant species.

### 2.5.4 WASTE MANAGEMENT

Any waste generated during construction, operation, and decommissioning, including used lubricants, would be handled, collected, transferred, and reused/recycled in accordance with applicable Federal, State, and local regulations.

### 2.5.5 CULTURAL RESOURCES

Based on the archaeological study results, encountering archaeological resources during excavation activities is not anticipated. However, if archaeological resources were identified in areas that would be excavated, all ground-disturbing activities would be halted immediately and OHPO would be consulted for resolution.

### 2.5.6 FLICKER EFFECTS

Based on the shadow flicker assessment prepared for this project (Appendix B, Attachment B2), shadow flicker is not expected to have more than a minimal impact on any potential receptors (e.g., private residences or businesses). However, the analysis indicates that shadow flicker effects would be noticeable on Pettisville's future ball fields. If the future ball fields are constructed and, based on additional analysis, if it is found that shadow flicker affects participants or spectators, Pettisville would temporarily shut down the turbine to lessen the shadow's impact during periods when shadowing events would overlap scheduled sporting or other use events. Additionally, Pettisville would use commercially reasonable efforts to remedy any potential problems due to shadow flicker on a case-by-case basis by undertaking measures such as planting trees or installing blinds or awnings to impacted residences.

### 2.5.7 ICING AND FIRE

The turbine system would have an automated system fault shut-off triggered at a minimum by the following sensors: system temperature, power quality, vibration, over-speed, fire, and icing (vibration caused by blade icing-induced imbalances automatically shut down the turbine). This system is designed to automatically send fault codes to preauthorized personnel through a web interface. The turbine's nacelle would have a cold-weather package including nacelle heaters. All icing-related turbine shutdowns would require a direct inspection and an on-site manual restart. The site personnel and the system maintenance personnel would shut down the turbine in the event of an icing condition. The site would adopt an ice safety zone around the turbine for implementation during icing events. Further discussion of this topic can be found in Section 3.2.2.7.

# 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This chapter of the EA examines in detail the potential environmental impacts of the proposed project and the No-Action Alternative on the affected environmental resource areas.

## 3.1 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the use of Federal funds for the design, construction, and operation of the Pettisville Wind Energy Project and assumes, for purposes of this EA, that the project would not go forward without SEP funding. Therefore, there would not be any impacts to the resource areas analyzed in this EA; however, the school would continue to use energy generated from primarily fossil fuels and no additional jobs would be created.

If the proposed project is not implemented, 1,390,127 kilowatt-hours of the school's electrical power that the proposed project could provide would continue to be purchased from First Energy Solutions. In 2009, First Energy Solutions generated electricity using coal (72.8 percent), oil (0.4 percent), natural gas (2.7 percent), nuclear (22.3 percent), and renewable energy sources (1.1 percent), which is similar to the overall national composition and includes emissions of carbon dioxide, nitrogen oxides, and sulfur dioxide (EPA 2010a). Thus, carbon dioxide emissions from electricity generation to serve the school would be higher under the No-Action Alternative and ODOD would not meet its objective of deploying emission-free energy.

## 3.2 Ohio's Proposed Project

### 3.2.1 CONSIDERATIONS NOT CARRIED FORWARD FOR FURTHER ANALYSIS

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

#### 3.2.1.1 Water Resources

**Floodplains and Wetlands**

Pursuant to 10 CFR Part 1022, DOE reviewed USFWS National Wetlands Inventory maps (USFWS 2010) and Federal Emergency Management Agency floodplain maps (see Appendix A, Figures 6 and 7) and identified no floodplains, wetlands, or surface-water sources, such as streams or drainage channels, that are located on the proposed project site or that could be affected by the construction and operation of the proposed project.

In compliance with the *Clean Water Act*, the project site was investigated for the presence of wetlands. Although no wetlands were listed on USFWS's National Wetlands Inventory map, the jurisdictional wetlands delineation, which was completed in October 2009 as part of the new ball field construction project (see Section 2.2.2), found jurisdictional wetlands in the vicinity of the proposed project site. However, the construction and operation of the proposed project is not

sited in or adjacent to any wetlands and would avoid these areas. Therefore, the proposed project would not affect floodplains or jurisdictional wetlands.

#### Wild and Scenic Rivers

No Ohio Scenic Rivers or waterways included in the National Wild and Scenic River System occur in the proposed project vicinity (see Appendix A, Figure 8). The closest Ohio Scenic River is the Maumee, located in Henry County, approximately 14.5 miles southeast of the proposed project site (ODNR 2010). The closest National Scenic River is the Big and Little Darby Creek system, located in Union, Madison, Franklin, and Pickaway Counties and about 99 miles southeast of the proposed site (USDA Forest Service 2009). The proposed project would not affect Federal or State wild and scenic rivers.

#### Groundwater

Based on the review of existing Ohio Environmental Protection Agency and ODNR groundwater resource maps, the proposed project area is not located in an endorsed well head protection area, where certain activities are restricted within an Ohio Environmental Protection Agency-designated protection area. Additionally, the proposed project area is not located within any designated Public Water System supply areas (sole-source aquifer, community/non-community systems, drinking water source protection areas using groundwater/surface water). Groundwater is generally not a source of drinking water in this part of Fulton County. There are no private well-water supplies on or near the project site. The proposed project would have no adverse effect on any groundwater resources.

#### Surface Water

In compliance with the *Clean Water Act*, the proposed project site was investigated for surface water. There are several small ponds located within 0.25 mile of the project site. The majority of these ponds are to the northeast of the school and are privately owned or adjacent to residential areas. The nearest stream is an unnamed tributary to Flat Run located immediately to the north of the project site, which is part of the Lake Erie drainage system. No runoff or discharges from the proposed project construction area would directly enter neighboring bodies of water, including the series of small ponds to the northeast or the unnamed stream to the south. Because ground-disturbing activity would affect less than 1 acre, a NPDES permit would not be required prior to any construction-related earthwork. However, Pettisville has committed to using sediment and erosion pollution control BMPs in conformance with a plan specific to the proposed project.

### 3.2.1.2 Waste Management

Solid wastes that are anticipated to be generated during construction include equipment packaging materials and construction-related material debris. Solid wastes generated during operation of the turbines would be minimal. Solid wastes that are anticipated to be generated during decommissioning include dismantled equipment, which would likely be recycled, and construction-related material debris. Hazardous, regulated nonhazardous, and universal wastes are not anticipated to be generated during construction, operation, or decommissioning. All wastes generated over the life of the proposed project would be handled, collected, transferred, reused/recycled, and disposed of in accordance with all applicable Federal, State, and local regulations. Used oil (e.g., spent gear box oil, hydraulic fluid, and gear grease) would not be

considered a waste because it can be reused and/or recycled. Used oil would be generated during operation of the proposed project and recycled utilizing a qualified recycling facility.

#### 3.2.1.3 Intentional Destructive Acts

DOE considers intentional destructive acts (i.e., acts of sabotage or terrorism) in all its EAs and environmental impact statements. Construction and operation of the proposed project would not involve the transportation, storage, or use of radioactive, explosive, or toxic materials. The proposed project would not offer any particularly attractive targets of opportunity for terrorists or saboteurs to inflict adverse impacts on human life, heath, or safety.

### 3.2.2 CONSIDERATIONS CARRIED FORWARD FOR FURTHER ANALYSIS

This section of the EA examines in detail the potential environmental impacts of the proposed project on the following resource areas.

- Land use
- Visual quality
- Noise
- Cultural resources
- Geology and soils
- Biological resources
- Human health and safety
- Transportation
- Socioeconomics and environmental justice
- Air quality and climate change
- Utilities and energy

#### 3.2.2.1 Land Use

The proposed project site is located on the Pettisville Pre-Kindergarten through Twelfth Grade School campus. Land use surrounding the turbine site is mainly rural residential and agricultural. The turbine would be located approximately 350 feet south of County Road “D” and 1,030 feet east of County Road 19. The residential areas are to the north and to the west-southwest, with the nearest homes approximately 650 feet northeast and approximately 685 feet northwest. Cultivated agricultural fields are located due south and east of the turbine location (see Appendix A, Figure 3 for aerial view).

The majority of land in the immediate vicinity of the school is zoned as Residential (R-1) and Agricultural/Rural Estate (see Figure 3-1 and Appendix A, Figure 9). In addition to Residential and Agricultural, the following zoning areas exist within a 1-mile radius of the proposed turbine location: Residential (R-2), Residential (R-3), General Business (C-3), and Light Industrial (M-1) (FCRPC 2008).

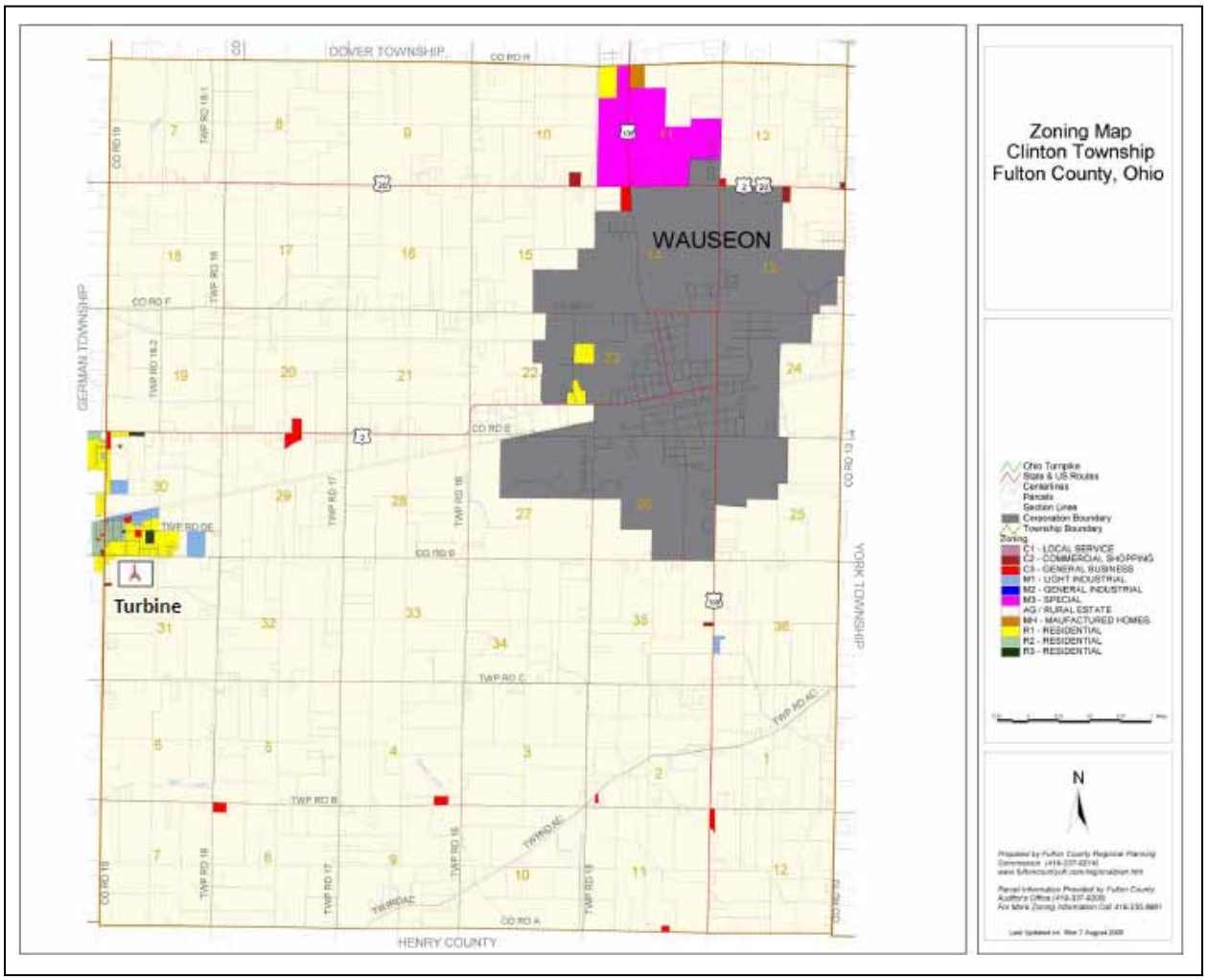


**Figure 3-1. Clinton Township Zoning Map**

## Direct and Indirect Impacts

Construction activities would result in temporary ground disturbance of 1,600 square feet of previously disturbed, developed, and agricultural land for the turbine foundation (ultimately a 256-square-foot permanent footprint) and 2,000 square feet of temporary ground disturbance associated with installation of the underground electrical wires. The proposed project received approval from the Clinton Township Zoning Board on November 23, 2010 (Appendix C, Attachment C7). The overall use of the general area would not change as a result of construction and operation of the proposed project.

Neither direct nor indirect impacts on land use are expected to occur outside of the immediate project site. Land-disturbing activities would be relegated to the area needed for construction and operation of the proposed project. No other lands, including natural or residential areas, would be affected.

### 3.2.2.2 Visual Resources

#### Local Viewshed

The Village of Pettisville is a rural community comprising the developed town area with residential development located north, northeast and west/southwest of the site and cultivated agriculture to the south and to the east. The landscape surrounding the school property is generally flat. Residential development, and associated landscaping, act to limit views and residents on the outer edges of development that are nearest to the school have the most direct, ground level views of the project site. Expansive views over agricultural lands are often present because there are few tree to obscure views. Trees vary in height, but tend to range from 18 to 70 feet tall, and features taller than this would be visible above the tree line.

Vertical elements present in the landscape include farm silos, buildings, industrial facilities, power line poles, and communication towers (see Figures 3-2 and 3-3); however, only silos and communication towers, one which measures over 365 feet tall, are most often seen rising above

**Figure 3-2. Nearby Communication Tower and Power Lines**

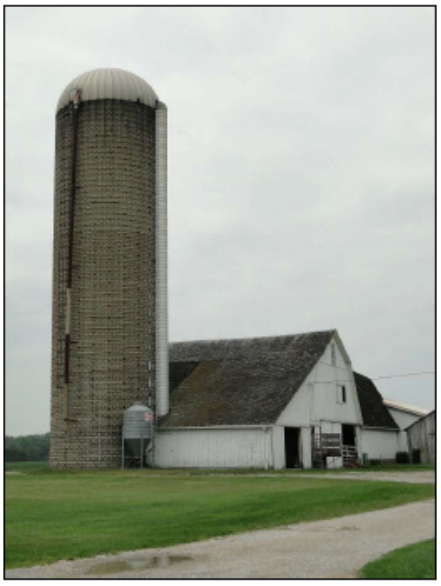

**Figure 3-3. Nearby Farm Silo**

the tree line. A number of these communication towers are located within 4 miles of the proposed project site (Figure 3-4). Existing viewer groups in the area include residents, roadway users, recreationists, and occupants of nearby commercial facilities and educational facilities.

A visual analysis was conducted for the proposed project area to assess potential impacts on the local viewshed (Appendix B, Attachment B1). The results of a visual analysis are intended to give a sense of how the proposed wind turbine would appear to potential receptors in the surrounding landscape. The actual visibility of a wind turbine in the surrounding area is affected by many factors: the size of the machine, the number of machines; tower and blade tip heights; turbine color; distance to the viewer; obstructions such as trees, hills, and buildings; atmospheric conditions; sun angle; and the curvature of the Earth. Of these factors, the overall height of a turbine, obstructions in the sightline between the viewer and the turbine, and the distance between the machine and the viewer have the greatest impact. Visual simulations were used to

illustrate the effect of the proposed project from vantage points that are representative of typical views that would be affected and include the 213-foot tower and blades, for a combined total height of 302 feet to the tallest blade.

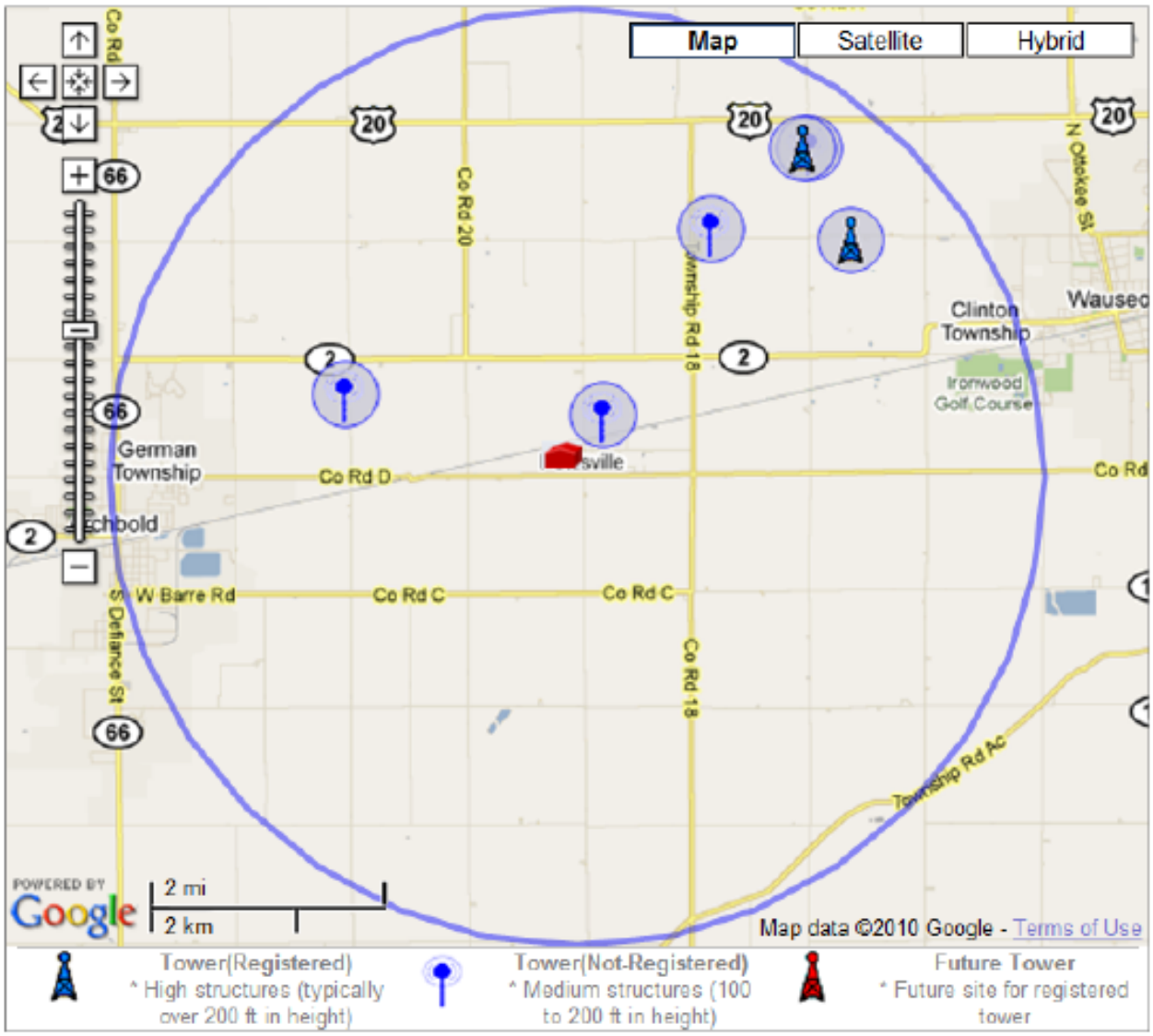


**Figure 3-4. Existing Tall Towers within 4 Miles of the Proposed Turbine Site**

Visual simulations and an overview of photo locations for the properties listed in Table 3-1 are located in Appendix B, Attachment B1. Table 3-1 shows readings from the visualization log.

**Table 3-1. Pettisville Visualization Receptor Locations**

| Set Number | Picture Number | Distance from Turbine (miles) | Site Description | Latitude | Longitude | Direction |
|---|---|---|---|---|---|---|
| P-V-1 | 2309 | 1.38 | State Route 2 – School House (NE) | 41°32'37.38"N | 84°12'34.13"W | 225° |
| P-V-2 | 2311 | 1.82 | County Road 17 – Between State Route 2 and County Road D | 41°32'09.69"N | 84°11'31.08"W | 255° |
| P-V-3 | 2316 | 1.55 | County Road C – Between Township Road 17 and County Road 17 | 41°30'51.65"N | 84°12'08.17"W | 314° |
| P-V-4 | 2321 | 0.11 | Corner Willow and County Road D Northwest of the Turbine | 41°31'44.46"N | 84°17'25.80"W | 228° |
| P-V-5 | 2323 | 0.24 | Corner of Ballpark and County Road D | 41°31'44.52"N | 84°13'15.99"W | 252° |
| P-V-6 | 2324 | 0.21 | Corner of Summit and Willow | 41°31'50.84"N | 84°13'26.65"W | 199° |
| P-V-7 | 2327 | 0.35 | Corner of Main and Dame | 41°31'55.67"N | 84°13'45.87"W | 144° |
| P-V-8 | 2336 | 1.11 | 5037 County Road 19 Driveway | 41°32'37.83"N | 84°13'46.32"W | 164° |
| P-V-9 | 2337 | 0.35 | Parking Lot of Pettisville Missionary Church | 41°31'43.55"N | 84°13'55.25"W | 95° |
| P-V-10 | 2343 | 2.21 | Corner of County Road 21 and County Road D | 41°31'43.98"N | 84°16'04.57"W | 91° |
| P-V-11 | 2347 | 1.20 | Historic Home – 4208 County Road 20 | 41°31'55.22"N | 84°14'52.04"W | 102° |
| P-V-12 | SSS002 | 0.12 | County Road D North West of the Turbine | 41°31'43.61"N | 84°13'39.09"W | 115° |

Source: Appendix B, Attachment B1 of this EA.

Figures 3-5 and 3-6 depict the wind turbine views from the nearest receptors which are the closest residences along County Road D directly across from the proposed turbine site.

**Figure 3-5. Visual Simulation Depicted from Residence at Corner of Willow and County Road D Northwest of the Turbine**

**Figure 3-6. Visual Simulation Depicted from Residence at County Road D Northwest of the Turbine**

The simulations depict the turbine being readily seen in the foreground from some vantages and would be a prominent visual element to the few residents near the proposed project site. Figure 3-7 displays the result of a visual simulation of how the proposed project would look from the corner of Ballpark and County Road D.

Figure 3-8 displays the result of a visual simulation of how the proposed project would look from the Pettisville Missionary Church and the turbine rising over the tree line. Note that atmospheric conditions allow the turbine to recede, somewhat, into the view. The turbine appears to be slightly taller than the trees and other infrastructure, such as signage, utility poles and lines, and the church.

**Figure 3-7. Visual Simulation Depicted from the Intersection of Ballpark and County Road D**

**Figure 3-8. Visual Simulation Depicted from Pettisville Missionary Church**

### Direct and Indirect Impacts to the Local Viewshed

Visual resource impacts associated with installation of the turbine including construction equipment, excavated ground, and construction fencing would result in temporary impacts while the turbine is under construction. Residents, roadway users, recreationists, and occupants of nearby facilities would have a prominent view of the construction activities including site preparation, erection of the turbine, and the staging areas of the turbine nacelles, blades, and tower during the 10 month period of construction. Many of the surrounding farms would be able to see the proposed project due to the general openness of the region's farming landscape and the overall flat terrain surrounding the project site. Similar views would be present from within the town where open vantages present views of the turbine.

The results of the visual analysis indicate that the proposed project would be visible to some of the local residents especially those in close proximity to the school and projects site, i.e., along County Road "D". The proposed turbine's light-colored surface makes it stand out against its surroundings. While the turbine appears to be of similar height to the parking lot lighting standards, the turbine is much wider, which creates a larger visual massing. This, combined with the light coloring, makes the turbine stand out as a contrasting, dominant visual element in the landscape for the few residents located less than 0.25 mile from the project site.

The visibility of the proposed project to residents would be reduced as the distance from the proposed site location increased due to local obstruction proximities and densities to typical sightlines such as trees and buildings. Due to perspective, the turbine would appear as a very small element of the skyline for most locations, similar to the region's existing communication towers and granaries. However, because of trees, buildings and other tall structures in the vicinity of the proposed project, there would be a minimal impact to the local viewshed and much of the broader community would not be able to see the turbine. However, the turbine would be a dominant feature in the viewshed to the adjacent property owners.

Safety lighting in accordance with standards (FAA 2007) would be required on the turbine. Residential structures, public facilities, and commercial buildings are located close together within the town. Orientation of buildings and the presence of neighboring structures limit views to the immediate surroundings for most viewers, precluding views of the proposed project. In addition, existing trees within the town further act to limit views. Because of these factors, most views of the proposed project are seen by residents adjacent to the school while entering or exiting buildings and most of these viewers are often focused on their immediate surroundings. For those few that do have views of the site, safety light intensity and the number of lights being installed would not distract viewers in the project vicinity. Accordingly, the safety lights would not adversely affect viewers.

### Shadow Flicker

Shadow flicker is the moving/flickering shadows produced when sunlight passes through the spinning rotor blades of a turbine. This phenomenon can become an annoyance to nearby residents when the shadows pass directly over their line of sight, i.e., windows or other transparent surfaces. While the adverse effects of shadows can be subjective, the shadows themselves can be precisely modeled for location and duration. For shadow receptor sites within a turbine's shadow's reach, not all would receive shadow due to existing obstructions that block the shadow's path such as other buildings, hills, or trees.

While evergreen trees would fairly consistently block shadows year-round, deciduous trees would have a lesser impact in the winter months when they have no leaves. Additionally, the farther an observer is from the wind turbine, the smaller the portion of the sun being blocked, and this distance allows the shadow to diffuse (weaken). Although no official U.S. policy has been adopted, international standards appear to be in consensus that flickering shadows in excess of up to 30 hours per year is a tolerable threshold.

A shadow flicker analysis (see Appendix B, Attachment B2) was completed for the proposed project to evaluate the amount of shadow flicker that local residents would experience. The analysis considered several aspects affecting the casting of shadows and potential impacts on local receptors, including the distance to receptors, angle of incoming solar insolation, and the amount of sunlight experienced at the project site during each of the four seasons. Below are the closest receptors to the proposed project:

<u>Receptor A</u>: 112 Main St, approximately 960 feet from turbine. Shadows would be highly diffused, if visible at all, as the receptor is substantially blocked by trees and other structures, but shadow flicker may be possible in an open landscape from mid-February to early-March

mornings and mid-October to early-November mornings with a total average of less than 7 hours of shadow flicker per year.

Receptor B: 18372 County Road D, approximately 1,950 feet from turbine. Shadows would be highly diffused, if visible at all, as the receptor is well outside 10 rotor diameters and likely substantially blocked by trees, but shadow flicker may be possible for very short durations during portions of late-February to early-March and mid-October evenings with an average of less than 3 hours of shadow flicker per year.

Receptor C: 3770 County Road 19, approximately 1,238 feet from turbine. Site would receive 0 hours of shadow flicker.

Receptor D: 18519 County Road D, approximately 1,080 feet from turbine. Shadows would be diffused, as the receptor is substantially blocked by evergreen trees, but shadow flicker may be possible during portions of April, August, and early-September evenings with an average of less than 9 hours of shadow flicker per year.

Receptor E: 18636 County Road D, approximately 646 feet from turbine. Shadows would be diffused, as the receptor is shaded by trees, but shadow flicker may be possible during portions of January, February, October, November, and very early-December evenings with an average of less than 19 hours of shadow flicker per year.

Receptor F: Pettisville is proposing to construct ball fields on its property, which would be located approximately 175 feet east from the turbine. Shadows would be distinct late-April through mid-September afternoons and evenings with a total average of 159 hours of shadow flicker per year. If the shadows were found to affect participants or spectators, Pettisville would temporarily shut down the turbine.

Receptor G: Pettisville is proposing to construct ball fields on its property, which would be located approximately 175 feet west from the turbine. Shadows would be distinct mid-April through mid- to late-August mornings with a total average of 85 hours of shadow flicker per year. If the shadows were found to affect participants or spectators, Pettisville would temporarily shut down the turbine.

Receptor H: 3902 County Road 19, approximately 897 feet from turbine. Shadows would be substantially blocked by the farm's outbuildings, but shadow flicker may be possible during portions of mid-April to late-June and mid-July to late-August early mornings with an average of less than 17 hours of shadow flicker per year.

Receptor I: 18863 County Road D, approximately 686 feet from turbine. Shadows may be diffused due to existing trees, but shadow flicker may be possible during portions of late-February to late-March and mid-September to mid-October mornings with a total average of less than 13 hours of shadow flicker per year.

Receptor J: 8578 County Road D, approximately 888 feet from turbine. Shadows would be diffused, if visible at all, as the receptor is shaded by existing trees, but shadow flicker may be possible during portions of late-January to early-March and mid-October to mid-November evenings with an average of less than 12 hours of shadow flicker per year.

Receptor K: 18520 County Road D, approximately 1,181 feet from turbine. Shadows would be highly diffused, if visible at all, due to distance and existing trees, but shadow flicker may be possible during portions of mid-February to mid-March and mid-October evenings with an average of less than 7 hours of shadow flicker per year.

Receptor L: 3940 County Road 19, approximately 896 feet from turbine. Shadows would be visible through one window during portions of late-March to late-April and late-August to mid-September mornings with a total average of less than 11 hours of shadow flicker per year.

Although there is no established maximum standard for acceptable levels of exposure to shadow flicker, the Danish Wind Industry Association cites a court case in which the judge determined that 30 hours of shadow flicker per year as a tolerable level of shadow flicker (DWIA 2003). Therefore, shadow flicker effects would be below the threshold of potential concern at the closest receptor locations.

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 Aeronautica 750 wind turbine proposed for this project operates at 25.3 revolutions per minute (Appendix D, Attachment D3). This would indicate a flicker frequency created by this wind turbine at less than one-half the rates identified with photosensitivity issues.

Some data suggest that shadow flicker has the potential to cause a disorienting effect on a small segment of the population. The data also suggest that rotor rotation below 2.5 hertz can avoid such effects (BLM 2005). As stated above, the rotor speeds involved with the project would be well below this level.

### Direct and indirect impacts from Shadow Flicker

Results of the shadow flicker analysis indicate that no homes or occupied business structures outside the school would receive flickering shadows of over 30 hours per year. Parts of the farm to the southwest (Receptor H) would receive summer morning shadows; however, the farm's outbuildings would block most of the shadows from reaching the farmhouse. The planned playing fields on the Pettisville school property to the east and west of the site would also receive shadows year-round. Based on additional analysis, if the shadows were found to affect participants or spectators, Pettisville would temporarily shut down the turbine. No occupied receptors would receive an excess of 30 hours of shadow flicker per year. However, should a local resident find shadow flicker to be an annoyance, Pettisville would plant screening trees or purchase window coverings for the resident.

### 3.2.2.3 Noise

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

Sound is the 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 levels) 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 de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear [i.e., using the A-weighting filter adjusts certain frequency ranges (those that humans detect poorly)] (Colby et al. 2009). Table 3-2 shows some sound pressure levels associated with common activities measured in dBA.

**Table 3-2. Typical Sound Pressure Levels Measured in the Environment and Industry**

| Noise Source At a Given Distance | A-Weighted Sound Level in Decibels | Qualitative Description |
|---|---|---|
| Carrier deck jet operation | 140 | |
| | 130 | Pain threshold |
| Jet takeoff (200 feet) | 120 | |
| Auto horn (3 feet) | 110 | Maximum vocal effort |
| Jet takeoff (1000 feet)<br>Shout (0.5 feet) | 100 | |
| N.Y. subway station<br>Heavy truck (50 feet) | 90 | Very annoying<br>Hearing damage (8-hour, continuous exposure) |
| Pneumatic drill (50 feet) | 80 | Annoying |
| Freight train (50 feet)<br>Freeway traffic (50 feet) | 70 to 80 | |
| | 70 | Intrusive<br>(Telephone use difficult) |
| Air conditioning unit (20 feet) | 60 | |
| Light auto traffic (50 feet) | 50 | Quiet |
| Living room<br>Bedroom | 40 | |
| Library<br>Soft whisper (5 feet) | 30 | Very quiet |
| Broadcasting/Recording studio | 20 | |
| | 10 | Just audible |

Adapted from Table E, "Assessing and Mitigating Noise Impacts", NY DEC, February 2001.
Table 3-2 is cited in Colby et al. 2009.

For a point source such as a stationary compressor or construction equipment, sound attenuates based on geometry at rate of 6 dBA per doubling of distance. For a line source such as free flowing traffic on a freeway, sound attenuates at a rate of 3 dBA per doubling of distance. Atmospheric conditions including wind, temperature gradients, molecular absorption, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation for sources located close to the ground. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically about 1.5 per doubling of distance (Caltrans 2009). Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

Table 3-3 provides definitions of commonly used acoustical terms.

**Table 3-3. Definitions of Commonly Used Acoustical Terms**

| Sound Measurements | Definition |
|---|---|
| Decibel | A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals. |
| A-Weighted decibel (dBA) | An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear. |
| Maximum Sound Level ($L_{max}$) | The maximum sound level measured during the measurement period. |
| Minimum Sound Level ($L_{min}$) | The minimum sound level measured during the measurement period. |
| Equivalent Sound Level ($L_{eq}$) | The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy as a time-varying sound level. |
| Percentile-Exceeded Sound Level ($L_{xx}$) | The sound level exceeded "×" percent of a specific time period. $L_{10}$ is the sound level exceeded 10 percent of the time. $L_{90}$ is the sound level exceeded 90 percent of the time. $L_{90}$ is often considered to be representative of the background ambient noise level in a given area. |
| Day Night Average Sound Level (DNL or $L_{dn}$) | The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 decibels added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m. |
| Frequency: hertz | The number of complete pressure fluctuations per second above and below atmospheric pressure. |

## Noise Guidelines and Regulations

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). This criteria document recommends an exterior Day Night Average Sound Level (DNL) of 55 dBA for residential uses. However, the document contains recommendations only and the levels are not Federally enforceable. Furthermore, in 1981 the Federal Government concluded that noise issues were best handled at the State or local government level. As a result, EPA phased out Federal oversight of noise issues to transfer the primary responsibility of regulating noise to the State and local governments. However, EPA recommendations are useful for assessing the affected environment.

EPA has also evaluated general public response to changes in noise levels. In general, an increase to ambient or average noise levels of 5 dBA would be noticeable to most people and may elicit widespread complaints. An increase of 20 dBA would likely result in vigorous community response. An increase of ambient noise levels of less than 3 dBA is generally considered minute.

Section 100-5.9 of the Pettisville (Clinton Township) zoning ordinance relates to wind turbines and states:

> Decibel levels for the system shall not exceed 60 decibels (dBA) measured at the closest neighboring inhabited dwelling, except during short-term events such as utility outages and severe windstorms (see Appendix D, Attachment D6).

### Background Information on Wind Turbines

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

Wind turbines produce a broad-band sound; that is, the sound occurs over a wide range of frequencies, including low-frequencies. Low-frequency sounds are in the range of 20 to 100 hertz and infrasonic sound (or infrasound) is low-frequency sound of less than 20 hertz. 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 human 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 as a result of the tower blocking wind flow. Modern, upwind turbines produce a broad band sound emission that includes low-frequency sounds, but not at the levels produced by older wind turbines. 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 and this can be aggravated by unusually turbulent wind conditions.

The University of Massachusetts at Amherst reported (Rogers 2006) on noise measurements made at four different wind turbines ranging in size from 450 kilowatts to 2 megawatts. The results indicated that at distances of no more than 118 meters (387 feet) from the turbines, all infrasound levels were below human perception levels. The report further states that there is “no reliable evidence that infrasound below the hearing threshold produces physiological or psychological effects.” This lack of effects at levels below the hearing threshold was supported by a scientific advisory panel comprised of medical doctors, audiologists, and acoustic professionals established by the American and Canadian Wind Energy Associations to review

wind turbine sound and health effects (Colby et al. 2009). It was also supported by the findings from Canadian and Australian government reviews of available scientific literature (CMOH 2010; Australia NHMRC 2010).

### 3.2.2.3.1 Existing Noise Conditions

Ambient noise monitoring was conducted to establish baseline sound conditions in the area of the proposed wind turbine. Ambient noise monitoring was conducted at three locations indicated in Figure 3-9 and Appendix A, Figure 10. The monitoring sites surround the proposed wind turbine site and were selected to be representative of several residential receptor areas near the wind turbine. The measurement positions were as follows:

Position 1: 18636 County Road D; Position 2: 3800 County Road 19; Position 3: 3960 County Road

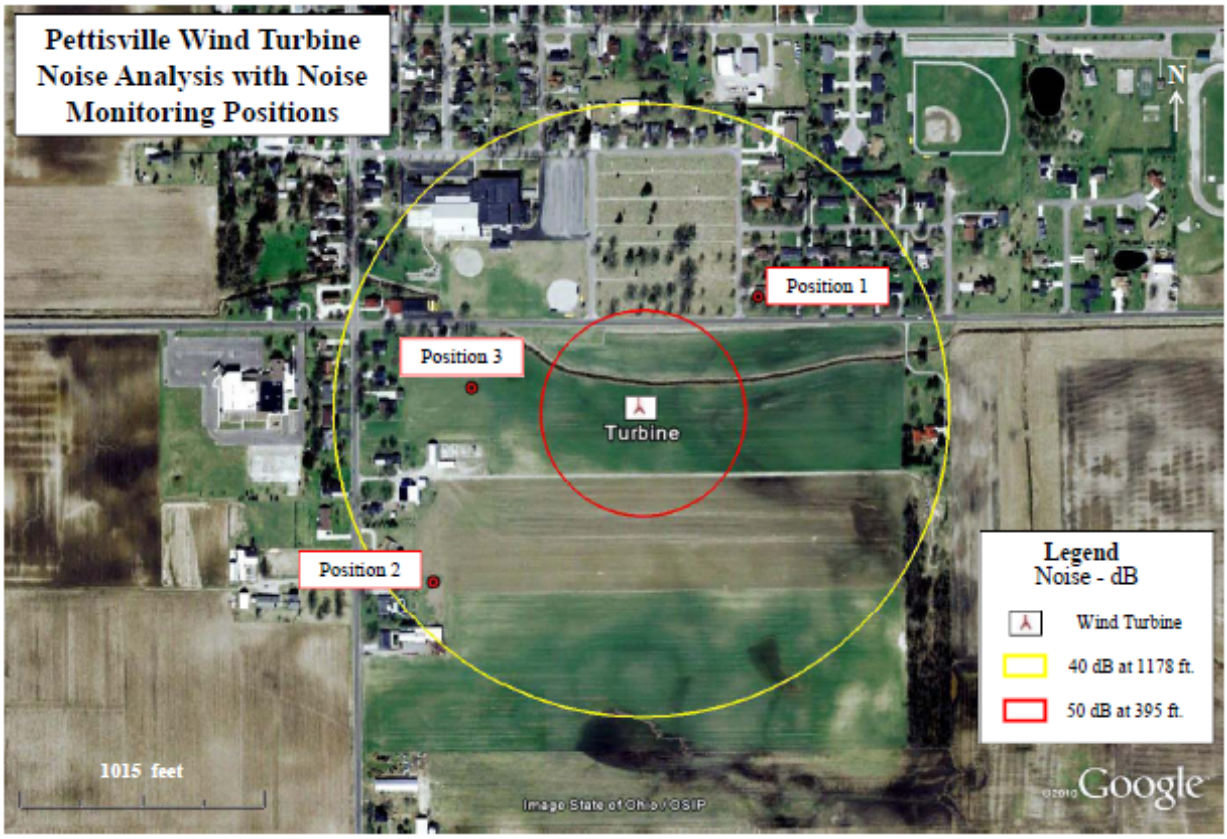


**Figure 3-9. Monitoring Sites for Measuring Baseline Sound Conditions and Predicted Turbine Sound Level Contours**

Measurements were conducted using Larson-Davis Model 820 Type I sound level meters. Data at each site were collected between the hours of 2 p.m. on Saturday, November 13, 2010, and 2 p.m. on Sunday, November 14, 2010. Table 3-4 provides a summary of the baseline sound monitoring results.

**Table 3-4. Summary of Baseline Sound Monitoring Results in A-weighted Decibels**

| Monitoring Site | Distance to Turbine Site (feet) | $L_{eq}$ 24 Hours | Hourly $L_{90}$ Range | $L_{eq}$ Daytime | $L_{eq}$ Nighttime | DNL |
|---|---|---|---|---|---|---|
| Position 1 | 615 | 54.8 | 30.8 to 51.2 | 55.6 | 53.0 | 59.9 |
| Position 2 | 1,015 | 56.9 | 29.7 to 42.9 | 58.7 | 46.7 | 58.1 |
| Position 3 | 650 | 50.5 | 26.8 to 46.0 | 50.1 | 51.1 | 57.4 |

Daytime: 7 a.m. to 10 p.m.
Nighttime: 10 p.m. to 7 a.m.
DNL = Day Night Average Sound Level.

Noise sources in the project area include auto and truck traffic, air-conditioning units, insects, birds, trains on the track north of the site, and activities at the school.

### *Direct and Indirect Impacts*

Construction of the wind turbine would temporarily result in increased noise and vibration. Operation of the wind turbine would be a permanent source of noise until the turbine is decommissioned.

Construction of the turbine would involve the use of heavy construction including the equipment listed in Table 3-5. Table 3-5 also presents typical noise levels produced by this equipment. $L_{max}$ sound levels at 50 feet are shown along with the typical acoustic use factor. The acoustic use factor is the percentage of time each piece of construction equipment is assumed to be operating at full power (i.e., its noisiest condition) during construction and is used to estimate $L_{eq}$ values from $L_{max}$ values. For example the $L_{eq}$ value for a piece of equipment that operates at full power 50 percent of the time (acoustical use factor of 50) is 3 decibels less than the $L_{max}$ value.

**Table 3-5. Typical Construction Noise Emission Levels**

| Equipment | Typical Noise Level ($L_{max}$)[a] | Acoustical Use Factor | Typical Noise Level ($L_{eq}$)[a] |
|---|---|---|---|
| Compactor (ground) | 83 | 20 | 76 |
| Dozer | 82 | 40 | 78 |
| Dump Truck | 76 | 40 | 72 |
| Excavator | 81 | 40 | 77 |
| Generator | 81 | 50 | 78 |
| Grader | 85 | 40 | 81 |
| Pickup Truck | 75 | 40 | 71 |
| Warning Horn | 83 | 5 | 70 |
| Crane | 81 | 16 | 73 |

Source: US DOT 2006.
a. A-weighted decibel level, measured at 50 feet.

The three noisiest pieces of equipment likely to operate at the same time include a grader, a dozer, and a generator. Simultaneous operation of this equipment would result in a noise level of 84 dBA ($L_{eq}$) at 50 feet. Based on the assumed simple geometric attenuation of 6 decibels per doubling of distance the noise level at the nearest residences (at about 600 feet) would be 62 dBA ($L_{eq}$). Because construction noise would be temporary and intermittent during daytime hours, no adverse effect from construction noise is expected. With regard to vibration no highly dynamic equipment such as a pile driver would be used. Given this and the fact that residences

are about 600 feet from the turbine site, no adverse vibration impacts from construction activity would occur.

Pettisville has selected the Aeronautica 54-750 wind turbine,[2] and it has several characteristics that reduce aerodynamic sounds levels in comparison with other and primarily older wind turbine designs. The Aeronautica 54-750 is an upwind turbine, meaning the turbine faces into the wind and the wind encounters the rotor blades before the tower and the nacelle, which makes 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. Complete technical information including sound data is provided in Appendix D, Attachment D3.

Figure 3-10 shows A-weighted wind turbine sound pressure levels at 1.5 meters (5 feet) above the ground calculated by the wind turbine manufacturer at a wind speed of 8 meters (26 feet) per second.

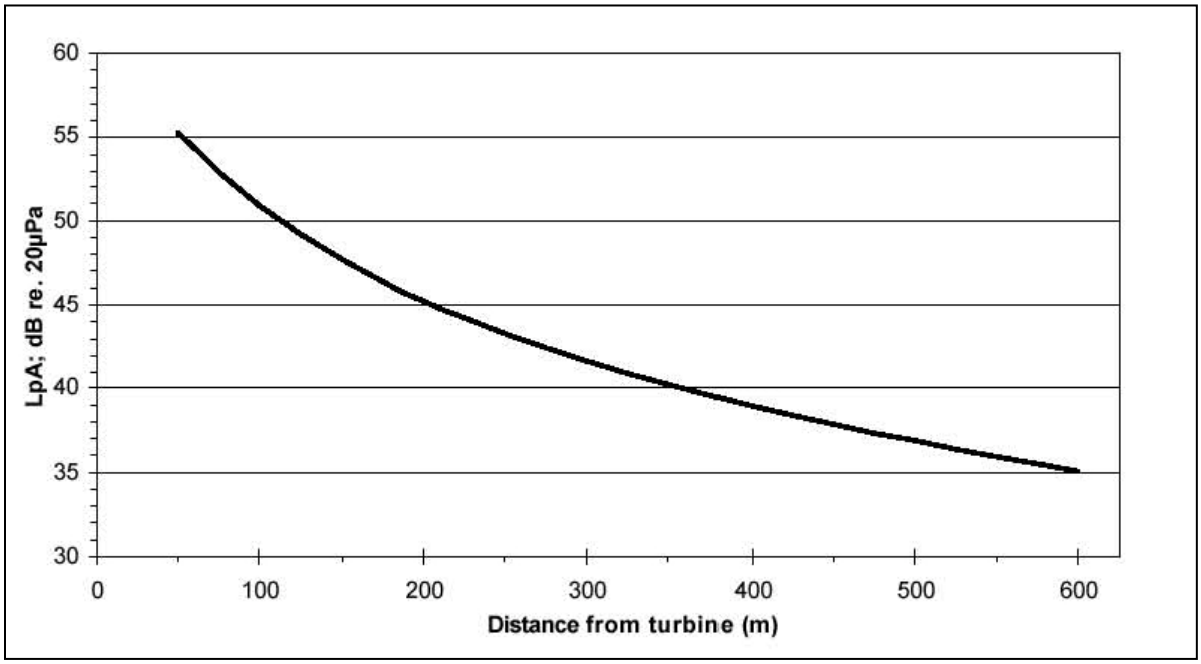


**Figure 3-10. Aeronautica 54-750 Sound Pressure Level as a Function of Distance**

Table 3-6 presents sound level values that have been provided by the manufacturer.

**Table 3-6. Turbine Sound Levels at Various Distances**

| Distance (feet) | A-Weighted Sound Level |
|---|---|
| 1,992 | 35 |
| 1,178 | 40 |
| 676 | 45 |

2. The noise analysis presented in this EA represents data for the Aeronautica 47-750 turbine. However, both the 54-750 and 47-750 are reported to have an A-weighted sound power level of 100.0 decibels. Accordingly, data for the Aeronautica 47-750 are considered to be representative of the Aeronautica 54-750, which is the turbine Archbold has selected.

Table 3-7 summarizes the predicted steady state turbine sound level and the corresponding DNL value at each receptor location. Measured DNL values are also shown. DNL can be calculated from the steady state sound level value assuming that the turbine operates continuously over a 24-hour period. The conversion between a steady state sound level and DNL is 6.4 dBA. For conservative purposes, 7 dBA has been added to the steady state sound level to estimate DNL.

The predicted turbine sound levels in the range of 42 to 47 dBA are below the Pettisville wind turbine noise standard of 60 dBA and the DNL values in the range of 49 to 54 dBA are below the EPA recommended sound level of 55 DNL.

**Table 3-7. Predicted Turbine DNL Sound Levels**

| Monitoring Site | Distance to Turbine Site (feet) | Predicted Turbine Steady State Sound Level (dBA) | Predicted Turbine DNL | Measured DNL |
|---|---|---|---|---|
| Position 1 | 615 | 47 | 54 | 59.9 |
| Position 2 | 1,015 | 42 | 49 | 58.1 |
| Position 3 | 650 | 45 | 52 | 57.4 |

DNL = Day Night Average Sound Level.

Figure 3-9 (above) shows the estimated 40 dBA and 50 dBA wind turbine noise contours. These contours indicate that no off- campus receptors or school buildings would be included within the 60 DNL or the 50 dBA (equivalent to 55 DNL) noise contours. Table 3-8 compares predicted steady state turbine sound levels to the range of $L_{90}$ values measured at each site.

**Table 3-8. Comparison of Predicted Turbine Noise Levels to Measured $L_{90}$ Values**

| Monitoring Site | Distance to Turbine Site (feet) | Predicted Turbine Steady State Sound Level (dBA) | Hourly $L_{90}$ Range |
|---|---|---|---|
| Position 1 | 615 | 47 | 30.8 to 51.2 |
| Position 2 | 1,015 | 42 | 29.7 to 42.9 |
| Position 3 | 650 | 45 | 26.8 to 46.0 |

dBA = A-weighted decibel.

Table 3-9 indicates that predicted wind turbine noise levels are expected to be at or above many of the hourly $L_{90}$ values measured at each site. Therefore, turbine sound may be audible at nearby residences. Audibility does not necessarily mean an adverse noise effect would occur. The magnitude of the increase in noise level relative to ambient noise conditions is evaluated to determine the severity of the noise impact.

An adverse noise impact is considered to occur if the wind turbine noise is predicted to increase the ambient daytime or nighttime Leq value at residences by more than 3 dBA. Tables 3-9 and 3-10 summarize the noise impact analysis.

**Table 3-9. Daytime Noise Impact Analysis**

| Site | Daytime Ambient $L_{eq}$ (dBA) | Turbine Sound (dBA) | Daytime Ambient plus Turbine Sound | Increase (dBA) |
|---|---|---|---|---|
| 1 | 55.6 | 47 | 56.2 | 0.6 |
| 2 | 58.7 | 42 | 58.8 | 0.1 |
| 3 | 50.1 | 45 | 51.3 | 1.2 |

dBA = A-weighted decibel; $L_{eq}$ = equivalent continuous sound level.

**Table 3-10. Nighttime Noise Impact Analysis**

| Site | Nighttime Ambient $L_{eq}$ (dBA) | Turbine Sound (dBA) | Nighttime Ambient plus Turbine Sound | Increase (dBA) |
|---|---|---|---|---|
| 1 | 53.0 | 47 | 54.0 | 1.0 |
| 2 | 46.7 | 42 | 48.0 | 1.3 |
| 3 | 51.1 | 45 | 52.1 | 1.0 |

dBA = A-weighted decibel; $L_{eq}$ = equivalent continuous sound level.

The results in Tables 3-9 and 3-10 indicate that operation of the proposed wind turbine would not result in noise increases greater than 3 dBA at residences in the project vicinity. Operation of the proposed wind turbine is, therefore, not expected to result in an adverse noise impact.

The proposed wind turbine would be located in close proximity to the Pettisville Pre-Kindergarten through Twelfth Grade School. As indicated in Figure 3-9, turbine sound levels are predicted to be less than 50 dBA across the school campus. Speech communication capabilities when background noise levels are greater than 50 dBA could require raised voices for distances up to 20 feet. Normal voice communications can occur when background noise levels are at or below 50 dBA (Nelson 1987). Therefore, normal speech communication would be maintained and individuals would be able to communicate with normal outdoor voices in the areas surrounding the school. In addition, the school buildings would provide further noise attenuation and turbine noise would not be audible by occupants of the buildings (students and teachers).

Based on the results presented above, operation of the proposed wind turbine would not result in adverse noise impacts.

### 3.2.2.4 Cultural Resources

The *National Historic Preservation Act* (16 U.S.C. 470 *et seq*.; NHPA) is the primary Federal law protecting cultural, historic, American Indian, and Native Hawaiian resources. Section 106 of the NHPA (36 CFR Part 800) requires Federal agencies to assess and determine the potential effects of their proposed undertakings on prehistoric and historic resources (e.g., sites, buildings, structures, and objects) and to develop measures to avoid or mitigate any adverse effects. Compliance with Section 106 requires consultation with a State Historic Preservation Officer (SHPO). On October 25, 2010, DOE requested Ohio SHPO consultation and submitted a Section 106 Compliance Report to OHPO (Appendix E, Attachments E1, E2, and E3).

The Renaissance Group conducted analyses and data retrieval for historic properties located within 2 miles of the proposed turbine site. These underlying data were reviewed and analyzed by a senior architectural historian who meets the Secretary of the Interior's Professional Qualification Standards (36 CFR Part 61) in architectural history, history or archaeology.

In addition, pursuant to Section 106, DOE is required to consult with American Indian tribes about the potential effects of DOE's proposed undertakings on prehistoric and historic resources and to develop measures to avoid or mitigate any adverse effects. DOE uses a list maintained by the U.S. Bureau of Indian Affairs, entitled "Indian Entities Recognized and Eligible to Receive Services from the U.S. Bureau of Indian Affairs" (72 FR 13648, March 22, 2007), to determine which tribes to contact. Based on this document, DOE determined that there are no Federally recognized tribes in the state of Ohio. Moreover, there is no Tribal Historic Preservation Officer

for the state of Ohio according to the National Association of Tribal Historic Preservation Officers. However, DOE provided the Notice of Scoping and the Draft EA to 57 Tribal Nation representatives that are regularly notified of Federal actions in the State of Ohio.[3] To date, none of the tribes contacted has responded to DOE's scoping letter. DOE will continue its outreach to these tribal representatives by providing them with the Notice of Availability of this Final EA. On February 7, 2011, OHPO issued a response and concurrence letter to DOE (Appendix E, Attachment E4).

### Consulting Party Participation

As part of DOE's responsibilities under NHPA, DOE sent a copy of the Draft EA and appendices for comment to the following organizations, which were also notified of the project through the DOE EA scoping process:

- Fulton County Historical Society
- Fulton County Commissioners
- Western Reserve Historical Society
- Western Reserve Heritage Association
- The Clinton Township Trustees

Prior to the OHPO submission, the project was reviewed and made available for public comment in both School Board and Village Planning and Zoning meetings. The project has also been extensively covered in the local media. Appendix D, Attachment D2 contains a list of public meetings and newspaper articles related to the proposed project. Although Pettisville has conducted public outreach for the proposed project, to ensure DOE compliance with NHPA, the public was afforded the opportunity to comment on historic resources via the same method for commenting on the Draft EA.

### Archaeological and Aboveground Areas of Potential Effect

The direct area of potential effect (APE) is defined as the area disturbed for construction of a project. However, there is no definitive rule for determining an indirect APE for a wind turbine, which can create both visual and audible effects on the adjacent properties (the aboveground APE).

### Clarification of the Archaeological APE

The APE determined for archaeological resources focuses on the zone of direct ground disturbance associated with the construction of the proposed project. The installation of the proposed project would result in temporary ground disturbing activities to 1,600 square feet for the turbine foundation (ultimately a 256-square-foot permanent footprint) and 2,000 square feet of temporary ground disturbance associated with installation of the underground electrical wires (1,000 linear feet by 2 feet wide). The final permanent footprint of the turbine would be 256 square feet. The wind turbine foundation would extend approximately 10 feet below the ground surface.

2. List used by the U.S. Army Corps of Engineers Buffalo District for actions occurring in the State of Ohio.

### Clarification of the Aboveground APE

In defining the aboveground APE, both direct and indirect effects were considered. As a conservative measure, a 2-mile APE for indirect effects was established based on the height of the proposed wind turbine, the surrounding topography, tree cover and urban forest in the vicinity of the proposed tower and simulated visualizations of the proposed wind turbine. Noise and flicker effects are quite localized and do not extend far beyond the school property, and, therefore, did not affect the indirect APE. Visual effects became the driver for selecting the APE. The 2-mile APE was selected as the maximum distance in which the tower would be seen (see Appendix E, Attachment E2 and E3). In determining the APE for indirect effects, the visual character and the setting of the surrounding area was considered, especially the presence of existing vertical structures in the viewshed. A computer-generated visual simulation of the proposed project as it would be viewed from public spaces was analyzed to determine an appropriate APE as well as potential impacts on the visual character of the community and the region's associated landscape. These are discussed in greater detail in Section 3.2.2.2 of this EA.

The likelihood of a clear, unobstructed view of the proposed project beyond 2 miles is small and diminishes rapidly as one travels farther away from the site. Varied topography, such as elevation changes, and other site-specific characteristics, such as power line corridors, structures associated with human development, tall towers, the tree canopy, and other natural areas all serve as common visual obstructions that block expansive views of a given project site from various directions. In particular, the extent to which a single turbine dominates the landscape diminishes with distance. A 2-mile APE was identified by the project proponent for determining the effects, including visual effects, of the proposed project because it represented a reasonable effort to assess visual effects of the project based on available technology and the existing physical character of the area.

### Identification of Historic Aboveground Properties in APE

No properties listed on the *National Register of Historic Places* were identified within the APE. No properties listed on the Ohio State Register of Historic Places in accordance with ORC 149.30 were found to be located within the 2-mile APE. No archaeological sites exist within or adjacent to the APE. No American Indian sites are listed, reported, or found within or near the APE. However, the absence of designated properties, does not indicate that no properties could be listed or determined eligible. Pettisville is a small farming community of about 2,000 people and has likely been bypassed by the types of activities from which determinations of eligibility typically arise, such as Federally funded highway projects.

Because the APE for this undertaking is so large—a 2-mile radius around the turbine site—there were found to be hundreds of potentially eligible properties within the APE. For the purpose of analyzing potential effects to historic properties, the Section 106 submission assumed that all pre-1960s properties were eligible for listing in the *National Register of Historic Places*. The assumption applied only to the proposed project.

The Renaissance Group inventoried all buildings and structures built before 1960, located within the 2-mile radius indirect APE. The results of this inventory are presented in Appendix E, Attachment E3. In all, 140 properties were found to be constructed prior to 1960 within the 2-mile radius. These properties fall into two basic categories: urban use properties (almost all of them single-family homes) found in the Central Quadrant; and rural properties (nearly all of

them farmhouses and farm structures) located within the other four quadrants. The qualities of these properties differ considerably from one quadrant to the next.

#### Identification of Historic Below-Ground Properties in APE

There are no National Register-listed properties within the direct APE for this undertaking. The direct APE, as discussed earlier, is limited to the area zone where ground-disturbing activities would occur for the proposed project. The direct APE is in an area that is currently under construction for the development of a ball field and associated facilities. This property was farmed up until a year ago. There are no buildings on the site. In terms of potential for buried properties (e.g., archaeological sites), the parcel is so extensively modified, that no suspected, intact archaeological sites are believed to exist at the location.

#### *Direct and Indirect Impacts*

As discussed in Section 3.2.2.3, no property adjacent to the project site would be adversely affected by noise above or near the local ordinance levels or above the existing ambient levels. Further, no property adjacent to the project site would be affected by shadow flicker at or near internationally accepted thresholds and no listed or potentially listed historical property would receive any shadow (see Section 3.2.2.2). No direct impacts (ground-disturbing impacts) on listed or potentially listed historic properties or cultural assets are anticipated.

Visual impacts to historic properties are diminished greatly by the three variables which affect the potential for such impact: distance from the source; intervening barriers, and the degree to which the significance of historic properties depends upon an unobstructed setting. The closest properties—those within the community of Pettisville—are shielded from visual impacts by the urban forest. The rural properties do not benefit from the urban forest but are generally at such a distance as to make the visual impact insignificant. Finally, the presence of other vertical elements (granaries, silos, communication towers, and others) indicate that the potential significance of these properties does not derive from a pristine setting. Rather, these tall elements, particularly silos and granaries, have been around for as long as most of the potential historic properties. Considering these elements of visual impacts, DOE concluded that the undertaking would result in No Adverse Effect to any of the assumed historic properties within the APE and, therefore, the project would have minimal impacts to any potential historic properties within the direct and indirect APE. However, if archaeological resources were encountered during construction, activities would cease, and the OHPO would be contacted for further instruction regarding additional studies and/or potential mitigation measures required in accordance with the NHPA.

### 3.2.2.5 Geology and Soils

The majority (about 70 percent) of the soil found within the project site consists of Ottokee fine sand, Gilford fine sandy loam, and Colonie fine sand (NRCS 2010; Appendix D, Attachment D8). Although in certain areas Gilford fine sandy loam is considered prime farmlands, it is not a prime farmland soil here due to the site's developed nature. No other soils listed by the U.S. Department of Agriculture as prime farmlands or unique or rare soils exist within the project area (NRCS 2010). Table 3-11 shows a complete list of soils present within the project site.

The nearest county for which seismic activity is available is Shelby County, located approximately 100 miles south of Fulton County and is not considered a significant seismic risk. Shelby County, has experienced more earthquakes than any other area in the state of Ohio, most of which were small (ODNR 2007). Approximately 40 felt earthquakes have occurred in this part of western Ohio, although most caused little to no damage.

**Table 3-11. Fulton County, Ohio Project Area Soil Composition**

| Map Unit Symbol | Map Unit Name | Acres in Area of Interest | Percent of Area of Interest |
|---|---|---|---|
| ByA | Brady sandy loam, 0 to 3 percent slopes | 6.1 | 5.3 |
| CoB | Colonie fine sand, 1 to 6 percent slopes | 13.4 | 11.6 |
| DtA | Dixboro fine sandy loam, 0 to 3 percent slopes | 6.0 | 5.1 |
| Gf | Gilford fine sandy loam | 23.2 | 20.0 |
| KfA | Kibbie loam, 0 to 3 percent slopes | 7.1 | 6.1 |
| Mf | Mermill loam | 2.7 | 2.3 |
| OtB | Ottokee fine sand, 0 to 6 percent slopes | 43.5 | 37.5 |
| Pm | Pewamo clay loam | 8.1 | 7.0 |
| TdA | Tedrow loamy fine sand, 0 to 3 percent slopes | 6.0 | 5.2 |
| **Totals for Project Site** | | **116.0** | **100.0** |

### Direct and Indirect Impacts

Soil disturbance would occur as a result of site preparation and project construction. As part of project construction, approximately 1,600 square feet of current open space would be temporarily disturbed for the foundation (ultimately a permanent 256 square foot foundation) and another approximately 2,000 square feet of open space would be temporarily disturbed for the electrical interconnecting trench, for a total of approximately 3,600 square feet of ground disturbance. Ultimately only 256 square feet would be permanent disturbed for the foundation, all other areas would be returned to their previous state. Temporary and permanent ground-disturbing activities would be less than 1 acre and not require an NPDES Storm Water Program Permit. However, Pettisville has committed to using sediment and erosion pollution control BMPs in conformance with a plan specific to the proposed project.

## 3.2.2.6 Biological Resources

Biological resources include native or naturalized plants and animals and the habitats that support their various life stages. Species that are considered sensitive, either under pertinent Federal or State agencies, are specifically addressed in this section.

### Project Site

The proposed project site is surrounded by residential areas to the north-northwest and to the west-southwest, with the nearest homes approximately 650 feet northeast and approximately 685 feet northwest. The high school is approximately 790 feet north of the turbine site. Cultivated agricultural fields are to the south and east of the turbine location. The site is currently under construction for a new stadium and associated parking lot. The nearest stand of trees is approximately 1,465 feet southeast of the turbine site, and it is isolated from any other stand or tree grouping by approximately 980 feet. This wooded lot is completely isolated and lacks

connectivity to any other wooded areas. The nearest stream corridor is approximately 1 mile northwest of the site and does contain a riparian canopy, except in a few scattered reaches of the stream.

### Federally and State-Listed Species

Information regarding the potential occurrence of Federally listed species was reviewed using the USFWS Endangered Species website and a list of potentially occurring listed species for Fulton County, Ohio (USFWS 2010). Federally listed species potentially occurring in Fulton County include Indiana bat (*Myotis sodalis*), endangered; Eastern Massasauga (*Sistrurus catenatus*), candidate species; and rayed bean mussel (*Villosa fabalis*), proposed as endangered.

The Renaissance Group requested that ODNR complete a review of the proposed project. According to the letter received from ODNR dated August 27, 2010, its review was conducted by an interdisciplinary team within ODOW in accordance with its authority under the *Fish and Wildlife Coordination Act* (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq*.), NEPA, the *Coastal Zone Management Act*, Ohio Revised Code, and other applicable laws and regulations (see Appendix C, Attachment C1).

ODOW, a division under ODNR, identified State-listed species that may occur within the vicinity of the proposed project site and the project's potential impacts on wildlife species. The ODOW Ohio Biodiversity Database contains no data at this project site. ODOW's letter indicated that the project lies within the range of the Indiana bat, a State- and Federally endangered species. Indiana bat habitat consists of suitable trees that include dead and dying trees of the species listed below with exfoliating bark, crevices, or cavities in upland areas or riparian corridors and living trees of the species listed below with exfoliating bark, cavities, or hollow areas formed from broken branches or tops. ODOW identified the following species of trees as having relatively high value as potential Indiana bat roost trees: shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), shingle oak (*Quercus imbricaria*), northern red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), sassafras (*Sassafras albidum*), post oak (*Quercus stellata*), and white oak (*Quercus alba*).

ODOW also identified the project site as being within the range of the rayed bean (*Villosa fabalis*), a State-endangered and Federal candidate mussel species. This species requires small headwater streams or sometimes large rivers for its habitat. The project site does not contain either small headwater streams or large rivers.

The project site also lies within the range of the Eastern Massasauga rattlesnake (*Sistrurus catenatus*), a State-endangered and a Federal candidate snake species that is typically found near sedge meadows, peatlands, wet prairies, open woodlands, and shrublands, none of which exist within the project area.

### Migratory Birds and Bald Eagle

The *Migratory Bird Treaty Act* (16 U.S.C. 703-7012; MBTA) implements four international conventions that provide for international protection of migratory birds. The MBTA prohibits

taking, killing, possessing, transporting, or importing migratory birds, their eggs, parts, and nests, except when specifically authorized by the U.S. Department of the Interior. While the MBTA has no provision for allowing unauthorized take, USFWS recognizes that some migratory birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid a take have been implemented.

Bald and golden eagles are included under the MBTA, and are afforded additional legal protection under the *Bald and Golden Eagle Protection Act* (16 U.S.C. 668-668d). Both USFWS and ODNR reviewed the proposed project for potential adverse environmental impacts. USFWS indicated in its letter dated September 2, 2010, that it has no records of bald eagle nesting within 5 miles.

The proposed project site is located in an area that is predominantly cultivated crops, which do not provide suitable nesting habitat for migrating birds or suitable stopover habitat for migrating birds that may move across the project area. The nearest Audubon-designated Important Bird Area is over 18 miles northeast, at the Oak Openings Park in Swanton, Ohio.

### *Direct and Indirect Impacts*

The USFWS and ODOW determined that, due to the location of the proposed project and lack of suitable habitat, it was not likely to affect the Eastern Massasauga rattlesnake (see Appendix C, Attachments C1 and C3). Additionally, no in-water work is proposed; therefore, the UFSWS and ODOW determined the proposed project is not likely to affect the rayed bean mussel and ODOW further determined that a rayed bean survey would not be necessary.

ODOW determined that no effects to the Indiana bat would occur as a result of the proposed project unless potential tree habitat would be affected. The proposed project site is surrounded by residential and agricultural lands with a few scattered trees in yards of the residences, and the nearest small stand of trees is approximately 0.5 mile to the south. No suitable trees occur within the project site and no trees would be cut or affected by the construction and installation of the proposed project.

The USFWS provided a response to DOE's Notice of Scoping in which it stated that the proposed project lies within the range of the Indiana bat, but is not within 20 miles of hibernacula nor within 1,000 feet of a wooded lot. Based on this, the USFWS determined that the proposed wind turbine would not affect maternity, roosting, foraging, or commuting habitats and, thus, would not adversely affect the Indiana bat (see Appendix C, Attachment C3). The USFWS determined in its letter date September 2, 2010, that although the project lies within the range of the bald eagle, the site did not provide high-quality bald eagle habitat and, coupled with the small rotor sweep area of the single turbine, led to the determination that a take of a bald eagle as a result of the proposed project was unlikely (see Appendix C, Attachment C3). Both ODNR and USFWS determined that the proposed project was not anticipated to impact any Federally or State-listed species.

During turbine siting, design, and installation of the proposed wind project, Pettisville will give consideration to the recommendations contained within the *Interim Guidelines to Avoid and Minimize Wildlife Impact from Wind Turbines* (USFWS 2003) and will incorporate those recommendations to avoid and minimize potential impacts to migratory birds and bald and

golden eagles. The project is a single wind turbine located in already disturbed habitat. The proposed turbine design is a monopole, with no external features, and all electrical lines would be underground. The area around the proposed turbine location is mainly residential and agricultural and does not provide significant bird habitat nor does the project fragment any such habitat.

Any impacts to migratory birds are anticipated to be minor as a result of the proposed project. Additionally, because bald eagles are not known to nest within 5 miles of the turbine site and the turbine was sited in an area that does not provide high-quality bald eagle habitat, take of bald eagles is unlikely.

#### 3.2.2.7 Human Health and Safety

Workers have the potential to be injured or killed during construction, operation, and decommissioning of wind turbines through industrial accidents such as falls, fires, and dropping or collapsing equipment. Such accidents are uncommon in the wind industry and are avoidable through implementation of proper safety practices and equipment maintenance.

Collapse of a turbine or breakage (and throwing) of one or more turbine blades is possible, but both are very unlikely occurrences. Debris falling from these occurrences would likely be limited to a calculated fall zone, which is defined to approximate the area around the base of the turbine that would likely receive the tower and turbine if it were to fall. The calculated fall zone for the project site was determined as an area equal to 1.1 times the total turbine height or a radius of approximately 335 feet (see Appendix A, Figure 4). No structures or buildings exist within this fall zone; however, the school ball fields that are under construction on Pettisville property are approximately 175 feet east and 175 feet west of the turbine site. Portions of these fields would be within the 335-foot fall zone. Estimates of blade throw vary, but MacQueen et al. (1983) estimate the probability of being struck outside the fall zones (i.e., within one blade diameter of the tower base) is about $10^{-7}$ per year (or one chance in 10 million) for a fixed building, and substantially less for people who are mobile.

Other potential source of accidents are ice shedding and lightning. Ice shedding, or ice throw, refers to the phenomenon that can occur when ice accumulates on rotor blades and subsequently breaks free or melts and falls to the ground. Although a potential safety concern, it is important to note that, while more than 90,000 wind turbines have been installed worldwide, there has been no reported injury caused by ice thrown from a turbine (Tetra Tech EC, Inc. 2007). The proposed project is to be supplied with ice sensors on the turbine blades. When ice forms, the sensors would engage and the turbine would not be permitted to rotate until the ice had melted. This technology is intended to prevent ice throws. Ice that has accumulated on the blades would fall to the foot of the turbine as it melts. To prevent accident or injury from ice that falls as it melts, the turbine manufacturer requires the area directly underneath to be a clear zone (equal to the fall zone).

A study conducted for the National Renewable Energy Laboratory was successful in identifying damage mechanisms due to direct and indirect effects of lightning strikes on wind turbines. Lightning strikes can cause extensive damage to the turbine blades, controllers, and power electronics (NREL 2002). However, this damage can be reduced by protection from tall nearby

communication towers, integral blade protection in the form of conductors, bonding to minimize arcing, good turbine grounding, controller cable and controller shielding, and transient voltage surge suppression. The amount of lightning damage is a factor of the lightning activity in the area, the height and prominence of the turbine, the terrain, and the lightning protection system in place. According to the National Oceanic and Atmospheric Administration, Ohio has mid-range lightning activity (an average of 40 annual thunderstorm days).

According to the FAA, no airports are within the impact range of less than 10 miles (see Appendix C, Attachment C5). The Ohio Department of Transportation Aviation issued its letter clearing the proposed project from requiring a permit on August 5, 2010 (Appendix C, Attachment C4).

The term electromagnetic field (EMF) refers to electric and magnetic fields that are present around any electrical device. Electric fields arise from the voltage or electrical charges and magnetic fields arise from the flow of electricity or current that travels along transmission lines, collector lines, substation transformers, house wiring, and electrical appliances. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors (wire). EMF can occur indoors and outdoors. While the general consensus is that electric fields pose no risk to humans, the question of whether exposure to magnetic fields potentially can cause biological responses or even health effects continues to be the subject of research and debate. However, wind turbines are not considered a significant source of EMF exposure since emissions levels around wind farms are low (CMOH 2010).

Because no fuel is used in wind energy projects, there would be no process waste streams generated during operation of the wind turbine that could cause health and safety concerns. Some lubricants are used in wind turbines, including gearbox oil, hydraulic fluid, and gear grease, that require periodic replacement. These lubricants would be managed in accordance with Federal, State, and local regulations.

### Direct and Indirect Impacts

No adverse public health and safety impacts are anticipated from the proposed project. Safety signage would be posted around the tower (where necessary); transformers and other high-voltage facilities would be in conformance with applicable Federal, State, and local regulations.

All contractors, subcontractors, and their personnel would be required to comply with all Federal and State worker safety requirements, specifically all of the applicable requirements of OSHA. Safety procedures specific to the Aeronautica 54-750 turbine would be observed whenever work is done on the turbine.

The soil sample collected as part of the initial soil field and laboratory study did not exhibit concentrations of volatile organic compounds, semivolatile organic compounds, and metals above or even close to Ohio Voluntary Action Program standards. Therefore, excavation of the soils would pose no risks to contractor health or to the environment in general (TTL 2009).

During construction, the project site would be secured as described in *Turbine Use, Safety Policies and General Background* (see Appendix D, Attachment D5). In addition, the Aeronautica 54-750 would not allow opportunities for outside climbing.

As described earlier, risk of turbine collapse is very rare (Klepinger 2007). Based on the extreme rarity of tower collapse or blade throw and the fact that people would not be located within the fall zone for extended periods of time, the risk to public safety due to such occurrences would be negligible.

The turbine system would have an automated system fault shut-off triggered, at a minimum, by the following sensors: system temperature, power quality, vibration, over-speed, fire and icing (vibration caused by blade icing-induced imbalances would automatically shut down the turbine). This system would also automatically send fault codes to preauthorized personnel through a web interface. The turbine's nacelle would have a cold-weather package including nacelle heaters. These heaters are designed to maintain nacelle temperatures above the dew-point and well above freezing. This system would automatically melt snow and ice accumulation on top of the nacelle. The turbine system would have a staff-accessible emergency shut-off. All icing-related turbine shutdowns would require a direct inspection and an onsite manual restart. The site personnel and the system maintenance personnel would shut down the turbine in the event of an icing condition. The site would adopt an ice safety zone around the turbine for implementation during icing events. If climatic conditions create or increase risk, Pettisville would ensure the area is cleared

The FAA issued a Determination of No Hazard to Air Navigation on August 19, 2010, for the proposed project. Based on this determination, the proposed project would not have more than a negligible effect on the safe and efficient use of navigable airspace by aircraft or on the operation of air navigation facilities. Aviation lighting would be in compliance with FAA standards (FAA 2007).

Based on the most current research on EMFs, the proposed wind turbine would not impact public health and safety due to EMF because wind turbines are not considered a significant source of EMF.

#### 3.2.2.8 Transportation

The project site is served locally by County Road 19, County Road D, and Township Road 18. Direct access to the turbine site is available from County Road D. No new access or other roads would be required for construction and operation of the proposed project. Construction equipment would travel to the project site via Interstate (I)-80/I-90, to County Road 24, and then take U.S. Highway 20 East to County Road 2. From County Road 2 direct access to the school is via County Road D (see Appendix D, Attachment D4).

##### Direct and Indirect Impacts

During the construction phase of the project, a minor increase in vehicular traffic on the local roads surrounding the project site is anticipated. This traffic increase would occur for a total of approximately 6 to 8 weeks during the entire 10-month construction timeline. It is doubtful that this increase would be noticeable over the present traffic generated on a daily basis with the

school's normal activities. No long-term or permanent impacts on the local transportation systems would occur as a result of the proposed project. No new access or other roads would be required for construction and operation of the proposed project.

#### 3.2.2.9 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." The racial makeup of Fulton County in the 2000 Census was 97.6 percent white, compared with 84.7 percent for the state of Ohio as a whole, with the remainder of both populations constituting minorities. The median household income for a household in Fulton County in 2008 was $51,772, compared with $48,011 for the state of Ohio as a whole. About 7.8 percent of individuals were below the poverty level in 2008, compared with 13.3 percent for the state of Ohio as a whole (Bureau of the Census 2010).

##### Direct and Indirect Impacts

No potential high and adverse impacts to socioeconomics or environmental justice would occur as a result of the proposed project. Therefore, there would be no disproportionately high and adverse socioeconomics- or environmental justice-related impacts on minority or low-income populations.

The construction of the proposed project is expected to generate a small, short-term increase in employment from the temporary construction-related jobs for the wind turbine. Operation of the proposed project is not anticipated to generate new jobs, as it would be maintained by the school district.

#### 3.2.2.10 Air Quality and Climate Change

The affected air environment can be characterized in terms of concentrations of the criteria pollutants carbon monoxide, sulfur dioxide, particulate matter, nitrogen oxides, ozone, and lead. EPA has established National Ambient Air Quality affected environment and environmental impacts 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 ($PM_{10}$) and one for particulates with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$). Fulton County is an attainment area for all criteria pollutants, which means the levels of these pollutants in the air are all below the EPA standards (EPA 2010b). The EPA has found that the "aggregate group of the well-mixed greenhouse gases" constitutes an air pollutant that contributes to climate change (EPA 2010a). Carbon dioxide is a greenhouse gas and the Pettisville wind turbine would have an indirect impact on reducing carbon dioxide emissions from fossil fuel sources.

First Energy Solutions provides electricity to the Pettisville Pre-Kindergarten through Twelfth Grade School. First Energy Solutions currently has a mix of fuel sources, as shown in Table 3-12. First Energy Solutions reports an average estimated grid line loss of 6.14 percent, resulting in higher realized grid power offsets for renewable energy generating sites than their actual onsite production (EPA 2010b).

**Table 3-12. First Energy Solutions Fuel Mix**

| Source Fuel Mix (percent) | |
|---|---|
| Coal | 72.8 |
| Oil | 0.4 |
| Natural Gas | 2.7 |
| Nuclear | 22.3 |
| Renewable | 1.1 |

### Direct and Indirect Impacts

The proposed project would be an emissions-free energy generation project that would not degrade air quality. Grading and construction for the proposed project would result in short-term air quality impacts, such as dust generated by clearing and grading activities, exhaust emissions from gas- and diesel-powered construction equipment, and vehicular emissions associated with the commuting of construction workers. Emissions from construction would be minimized to the extent practicable (for example, by watering dry roads) by following BMPs.

The proposed wind energy project is expected to generate approximately 1,390,127 kilowatt-hours per year, offsetting approximately 98 percent of electricity used by Pettisville Pre-Kindergarten through Twelfth Grade School.

The information reported from the EPA's eGRID database for calendar year 2005 shows the fuel mix for the Pettisville area as 72.8 percent coal, 2.7 percent natural gas, and 0.4 percent oil, resulting in 75.9 percent fossil fuel use (EPA 2010a). Therefore, the annual carbon dioxide reduction associated with the proposed project is calculated as follows:

> 75.9 percent fossil fuel use × 2.0562 pounds of carbon dioxide per kilowatt-hour × 1,390,127 kilowatt-hours per year = 2,169,509 pounds of carbon dioxide per year.

The proposed project would reduce Pettisville's carbon footprint by reducing its reliance on fossil fuels.

### 3.2.2.11 Utilities and Energy

The Pettisville Pre-Kindergarten through Twelfth Grade School is well served by utility infrastructure, including electric power transmission and municipal potable water and sanitary sewer. Electricity is provided to the school by First Energy Solutions.

The National Telecommunications and Information Administration (NTIA) is responsible for managing the Federal spectrum and is involved in resolving technical telecommunications issues for the Federal Government and private sector. This information aids in siting wind turbines, so they do not cause interference in radio, microwave, radar, and other frequencies, disrupting critical lines of communication. Upon submittal by a wind project proponent, the NTIA provides project specific information to the members of the NTIA's Interdepartment Radio Advisory Committee for review and comment on whether the proposed project could potentially interfere with Federal radio communication links.

### Direct and Indirect Impacts

The proposed project would have a nameplate capacity of 750 kilowatts and would generate approximately 1,390,127 kilowatt-hours per year on average, or enough electricity to supply up to 141 homes each year (DOE 2010). The energy generated from the proposed project would meet approximately 98 percent of the school's annual electricity needs. The proposed project is anticipated to produce a total of 31,181,320 kilowatt-hours of clean electricity for the 20-year design life of the proposed project.

On October 18, 2010, NTIA issued a letter indicating that no Federal agencies identified any concerns regarding the blockage of their radio frequency transmissions (see Appendix C, Attachment C6). No microwave communications exist in the areas surrounding the project site.

## 3.3 Irreversible/Irretrievable Commitment of Resources

A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource or limit those factors that are renewable only over long periods of time. Examples of nonrenewable resources are minerals, including petroleum. An irretrievable commitment of resources refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. Examples of irretrievable resources are the loss of a recreational use of an area. While an action may result in the loss of a resource that is irretrievable, the action may be reversible. Irreversible and irretrievable commitments of resources are primarily related to construction activities.

For the proposed project, resources consumed during construction of the project, including labor, fossil fuels, and construction materials, would be committed for the life of the project. Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline- and diesel-powered construction equipment during construction. Approximately 256 square feet of land would be irreversibly committed during the functional life of the project. The expenditure of Recovery Act funding from DOE would also be irreversible.

## 3.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts associated with the proposed project include:

- Long-term loss of approximately 256 square feet of vegetation resulting from the construction of the tower foundation;
- A minimal increase in noise levels during construction and noise during operation;
- Introduction of an additional vertical element into the existing viewshed; and
- Shadow flicker impacts to the future ball fields.

These impacts are both temporary, in the case of the construction noise, and long-term, in regard to the loss of vegetation, and visual and shadow flicker impacts.

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

Short-term use of the environment, as the term is used in this document, is that used during the life of the project, whereas long-term productivity refers to the period of time after the project has been decommissioned, the equipment removed, and the land reclaimed and stabilized. The short-term use of the project area for the proposed project would not affect the long-term productivity of the area. If it is decided at some time in the future that the project has reached its useful life, the turbine, tower, and foundation could be decommissioned and the site reclaimed and revegetated to resemble the pre-disturbance conditions (agricultural field). The installation of a wind turbine at this site would not preclude using the land for purposes that were suitable prior to this project.

# 4. CUMULATIVE IMPACTS

Cumulative impacts are those potential environmental impacts that result "from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) 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).

## 4.1 Reasonably Foreseeable Projects

DOE examined several other proposed wind turbine projects for which Recovery Act grants have been sought in Ohio. DOE also examined other proposed wind turbine projects in the vicinity of the proposed project with respect to potential cumulative impacts. There are two non-DOE-funded wind turbine projects within 50 miles of Pettisville: (1) the proposed Timber Road II 98-megawatt wind turbine project in Paulding County, Ohio, and (2) the recently expanded 1.8-megawatt Bowling Green wind turbine facility in Bowling Green, Ohio. According to the Ohio Siting Board (http://www.opsb.ohio.gov/Opsb/), there are two additional proposed wind turbine projects in the State of Ohio, both of which are over 100 miles from the Pettisville site. The following list includes Recovery Act SEP-funded projects and reflects the status of NEPA documentation being developed (information related to these projects is located on the Golden Reading Room website at http://www.eere.energy.gov/golden/Reading_Room.aspx):

Green City Growers Wind Development – DOE/EA-1817
(Notice of Scoping issued August 2010)
1.5-megawatt wind turbine
Inner City of Cleveland Greenhouse 55th St. and Woodland Ave, Cleveland, Ohio 44104

Archbold Area Schools Wind Energy Project – DOE/EA-1820
(Final EA and FONSI issued February 2011)
500-kilowatt wind turbine
600 Lafayette Street, Archbold, Ohio 43502

Toledo Joint Apprenticeship and Training Committee
(Categorical Exclusion issued February 2010)
100-kilowatt wind turbine
803 Lime City Road, Rossford, Ohio, 43460

Lincoln Electric – DOE/EA-1777
(Final EA and FONSI issued August 2010)
2.5-megawatt wind turbine
22800 St. Clair Ave, Euclid, OH

Cuyahoga County Agriculture Society – DOE/EA-1815
(Final EA and FONSI issued February 2011)
600-kilowatt wind turbine
Cuyahoga County Fairgrounds, 164 Eastland Road, Berea, Ohio 44017

City of Toledo
(Categorical Exclusion issued December 2010)
1- megawatt Wind Turbine at Collins Park Wastewater Treatment Facility
Toledo, Ohio

Kilowatts for Kenston – DOE/EA-1819
(Final EA and FONSI issued February 2011)
600-kilowatt wind turbine
9500 Bainbridge Road, Chagrin Falls, Ohio 44023

Each of the DOE-funded projects includes the construction and operation of a single wind turbine. Of these projects, only the Archbold Area Local Schools Wind Energy Project is located within Fulton County. The three projects closest to the Pettisville Wind Energy Project are DOE-funded single turbines. The Archbold project is just over 5 miles southwest of the Pettisville project site. The Toledo Joint Apprenticeship and Training Committee and the City of Toledo projects are approximately 35 miles to the northeast of Pettisville in Wood County, Ohio. The Bowling Green wind turbine facility is approximately 40 miles east of the Pettisville Wind Energy Project. Finally, the Timber Road II Wind Project is located approximately 45 mile southwest of the Pettisville Wind Energy Project. All other listed DOE Recovery Act-funded wind projects, Cuyahoga County Agricultural Society Project, Green City Growers, and Kilowatts for Kenston, are well over 100 miles east of the proposed project.

The closest projects, Toledo Joint Apprenticeship, City of Toledo, Timber Road II, and Bowling Green, do not share a known migratory bird pathway with the proposed Pettisville project. The proposed project is not located within a known major migratory bird pathway, and areas between these projects are mainly cultivated fields or small- to medium-sized towns. Agricultural areas do not generally provide high-quality habitat for migratory birds. The USFWS determined that the proposed project was not likely to adversely affect the Indiana bat, but it is within the overall range of migrating Indiana bats. Although impacts to migrating Indiana bats as a result of the proposed project are unlikely, the proposed project may add to the overall small potential cumulative impact to migrating Indiana bats. DOE considers the proposed project's potential to add to cumulative impacts to migratory birds to be minimal.

## 4.2 Summary of Cumulative Impacts

### 4.2.1 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 greenhouse gases 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 proposed project would not have direct greenhouse gas emissions but would result in the reduction of emissions of greenhouse gases associated with electricity previously generated from fossil fuel sources. The Pettisville Wind Energy Project would generate 1,390,127 kilowatts of emission-free electricity per year, corresponding to a reduction of 2,169,509 pounds per year of carbon dioxide-equivalent emissions. There would be small amounts of greenhouse gases emitted as a result of construction and transportation activities related to the proposed project.

### 4.2.2 VISUAL RESOURCES

The only other turbine visible from the Pettisville location would be the proposed turbine in Archbold, and it would only be visible in a few isolated locations. None of the other projects can be seen from Pettisville. Thus, no cumulative impacts on visual resources are expected. The closest communication tower is approximately one-half mile from the proposed project, is approximately 200 feet tall, and can be seen from the proposed project site and surrounding area. The addition of the proposed wind turbine would provide an additional vertical structure within the viewshed. Overall, there would be a minimal cumulative impact on visual resources.

### 4.2.3 BIOLOGICAL RESOURCES

All of the DOE-funded wind turbine projects are reasonably foreseeable single wind turbine projects. Almost all of the listed projects (with the exception of the City of Toledo Project and the Toledo Joint Apprenticeship project, which received categorical exclusions) have received a letter from the USFWS and ODNR indicating that the Indiana bat is not likely to be adversely affected as a result of the turbines individually. ODOW and USFWS would require all of the above-referenced wind projects to consider or have considered the recommendations contained in the *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003) as part of their siting, design, and installation, thereby reducing potential impacts to migratory birds and other species. The two non-DOE-funded wind turbine projects (Timber Road II and Bowling Green) do not share a known migratory bird pathway with the proposed project, and the areas between these projects are mainly used for agricultural purposes. The potential to cumulatively impact migratory birds is minimal. The installation of the single wind turbine at the nearby Archbold site and other projects in eastern Ohio (Bowling Green, Toledo, and Timber Road II) would negligibly increase a potentially low cumulative impact on migrating Indiana bats.

Because of the small scale of each individual project and the sufficient distance between projects, there are no other reasonably foreseeable potential cumulative impacts.

# 5. REFERENCES

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

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