Application for a Certificate of Environmental Compatibility and Public Need

Republic Wind Farm

Townships of Adams, Pleasant, Reed, Scipio, Thompson, and York – Seneca and Sandusky Counties, Ohio
Case No. 17-2295-EL-BGN

Respectfully Submitted to:

Ohio Power Siting Board
180 East Broad Street
Columbus, Ohio 43215

Prepared by:

Environmental Design and Research,
Landscape Architecture, Engineering, & Environmental Services D.P.C.
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P. 315.471.0688

Applicant:

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Bellevue, Ohio 44811
Contact: John Arehart, Project Manager
P. 434.220.6122

February 2018

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February 2, 2018

Via Hand Delivery

Ms. Barcy McNeal
Administration/Docketing
Ohio Power Siting Board
180 East Broad Street, 11th Floor
Columbus, Ohio 43215-3793

Re: Republic Wind, LLC
Case No. 17-2295-EL-BGN

Dear Ms. McNeal:

Enclosed for filing in the above-referenced case is a copy of the Application of Wind, LLC for a Certificate of Environmental Compatibility and Public Need for a wind-powered generating facility in Seneca and Sandusky Counties, Ohio. In addition, we have provided Staff of the Ohio Power Siting Board ("Board") ten disks and five hard copies of the Application. Pursuant to Ohio Administrative Code Rule 4906-2-04(A)(3), the Applicant makes the following declarations:

Name of Applicant:	Republic Wind, LLC whose authorized representative is John P. Arehart, III 310 4th St NE Suite 200 Charlottesville, VA 22902
Name/Location of Proposed Facility:	Republic Wind, LLC Seneca and Sandusky Counties, Ohio
Authorized Representative Technical:	John P. Arehart, III Development Manager Republic Wind, LLC 310 4th St NE Suite 200 Charlottesville, VA 22902 Telephone: (434) 220-6122 E:mail: john.arehart@apexcleanenergy.com

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Since the pre-application notification letter was filed, there have been no revisions that appear in the application.

Notarized Statement: See Attached Affidavit of Mark Goodwin, on behalf of Republic Wind, LLC

Sincerely on behalf of
REPUBLIC WIND, LLC

Sally W. Bloomfield

Sally W. Bloomfield

Enclosure

BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of **REPUBLIC WIND, LLC** for a Certificate of Environmental Compatibility and Public Need for a Wind-Powered Electric Generating Facility in Seneca and Sandusky Counties, Ohio	)))))	17-2295-EL-BGN

AFFIDAVIT OF MARK GOODWIN

STATE OF VIRGINIA :
: ss.
COUNTY OF ALBEMARLE :

I, Mark Goodwin, being duly sworn and cautioned, state that I am over 18 years of age and competent to testify to the matters stated in this affidavit and further state the following based upon my personal knowledge:

1. I am the Chief Executive Officer and an Authorized Representative of Republic Wind, LLC ("Republic"). I am the primary individual in charge of the development of Republic.

2. I have reviewed Republic's Application to the Ohio Power Siting Board for a Certificate of Environmental Compatibility and Public Need for Republic.

3. To the best of my knowledge, information, and belief, the information and materials contained in the above-referenced Application are true and accurate.

4. To the best of my knowledge, information, and belief, the above-referenced Application is complete.

M Goodwin
Mark Goodwin

Sworn to before and signed in my presence this 1 day of February 2018.

Kristina Parker
Notary Public

[SEAL] KRISTINA GREGORIO PARKER
NOTARY PUBLIC
REGISTRATION # 7712199
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
MARCH 31, 2021

12440461v1

APPLICATION

TO THE

OHIO POWER SITING BOARD

FOR A

CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY & PUBLIC NEED

FOR THE

REPUBLIC WIND FARM

Townships of Adams, Pleasant, Reed, Scipio, Thompson, and York
Seneca and Sandusky Counties, Ohio

Case No. 17-2295-EL-BGN
February 2018

Applicant: Republic Wind LLC, a subsidiary of Apex Clean Energy
122 East Main Street
Bellevue, Ohio 44811
Contact: John Arehart, Project Manager
434.220.6122

Prepared By: Environmental Design and Research,
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Contact: Benjamin Brazell, Principal
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EXHIBITS

COMMONLY USED ACRONYMS and ABBREVIATIONS

amsl	Above Mean Sea Level
ASTM	American Society for Testing and Materials
BBS	North American Breeding Bird Survey
dBA	Decibels, A-weighted
EDR	Environmental Design & Research, Landscape Architecture, Engineering, & Environmental Services
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Administration
GIS	Geographic Information System
Hz	Hertz
kV	Kilovolt
kW	Kilowatt
MW	Megawatts
MWh	Megawatt hours
NAAQS	National Ambient Air Quality Standards
NAIP	National Agricultural Imagery Program
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NREL	National Renewable Energy Laboratory
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
NSPS	New Source Performance Standard
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OPSB	Ohio Power Siting Board
ORAM	Ohio Rapid Assessment Method
ORC	Ohio Revised Code
SPCC	Spill Prevention Control and Countermeasure Plan
SWP3	Stormwater Pollution Prevention Plan
SWPA	Source Water Protection Area
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VIA	Visual Impact Assessment

4906-4-01 INTRODUCTION

(A) REQUIREMENTS FOR FILING CERTIFICATE APPLICATIONS

Republic Wind LLC (hereafter referred to as the "Applicant"), is proposing to construct the Republic Wind Farm (the "Facility"), a wind-powered electric generation facility located in rural portions of Seneca and Sandusky Counties. The materials contained herein and attached hereto constitute the Applicant's submittal ("Application") for a Certificate of Environmental Compatibility and Public Need (hereafter referred to as the "Certificate"), prepared in accordance with the requirements for the filing of standard certificate applications for electric transmission facilities, as prescribed in Chapter 4906-4 of the Ohio Administrative Code (OAC). This Application has been prepared by the Applicant, with support from Environmental Design & Research, Landscape Architecture, Engineering, & Environmental Services (EDR) of Syracuse, New York. EDR has 20 years of experience with siting and permitting wind-powered electric generation facilities.

(B) WAIVERS

The Ohio Power Siting Board (OPSB) may, upon an application or motion filed by a party, waive any requirement of this chapter other than a requirement mandated by statute. No waivers have been requested in this case, and as such, this section is not applicable.

4906-4-02 PROJECT SUMMARY AND APPLICANT INFORMATION

(A) PROJECT SUMMARY AND FACILITY OVERVIEW

The Applicant is proposing to construct the Facility in a rural portion of Seneca and Sandusky Counties. The Facility will consist of up to 58 wind turbine generators, along with access roads, electric collection cables, a Facility substation, a laydown yard for construction staging, an operations and maintenance (O&M) facility, and up to two meteorological towers. The energy generated at the Facility will deliver power to a single point of interconnection (POI) on the existing Fremont Center – Tiffin Center 138 kilovolt (kV) transmission line.

(1) General Purpose of the Facility

The general purpose of the Facility is to produce wind-powered electricity that will maximize energy production from Project Area wind resources in order to deliver clean, renewable electricity to the Ohio bulk power transmission system to serve the needs of electric utilities and their customers. The electricity generated by the Facility will be transferred to the transmission grid operated by PJM Interconnection, LLC ("PJM") for sale at wholesale or under a power purchase agreement.

(2) Description of the Facility

The Project Area consists of approximately 35,000 acres of private land in Adams, Pleasant, Reed, Scipio, and Thompson Townships (Seneca County) and Green Creek and York Townships (Sandusky County). The Facility presented herein consists of up to 58 wind turbine generators[1], each with a nameplate capacity rating of 3.3 to 3.63 megawatts (MW), depending on the final turbine model selected. The total generating capacity of the Facility will not exceed 200 MW. Therefore, the number of turbines to be constructed will range between 55 and 58, depending on the model of turbine selected (i.e., if a 3.3 MW turbine is selected, it is expected that up to 58 turbines will be constructed, and if a 3.6 or 3.63 MW turbine is selected, it is expected that up to 55 turbines will be constructed). The Facility is expected to operate with an average annual capacity factor of 32% to 38%, generating a total of approximately 560,000 to 665,000 megawatt-hours (MWh) of electricity each year, depending on the final turbine model selected for the Facility. Figure 03-2 depicts the proposed Facility. A detailed description of the Facility, including each Facility component, can be found in Section 4906-4-03(B) of this Application.

[1] Although this Application evaluates 58 proposed turbine sites, the total generating capacity of the Facility will not exceed 200 MW. Therefore, depending on the model of turbine selected, all 58 turbine sites may not actually be utilized. However, to allow for flexibility on final site selection (e.g., selecting one turbine site over another based on additional site-specific wind data and/or if a cultural resource is discovered upon excavation), the Applicant seeks approval for all 58 turbine sites presented herein.

(3) Description of the Suitability of the Site for the Proposed Facility

A suitable potential site for wind power facilities must have adequate wind resource, be located proximate to electric transmission lines with available capacity, and be situated in locations which can accommodate setback, land use, and environmental considerations. Once a project site has been selected (macro-siting), there is some ability to alter turbine and other component locations on the properties that are participating in the project (micro-siting) within the confines of the private agreements that the Applicant has obtained. The micro-siting of project components within a given project site has been governed by site-specific factors, including land use constraints, noise constraints, wind resource constraints, wetland constraints, agricultural constraints, and landowner considerations.

The primary factors evaluated to determine the suitability of the Project Area for the Facility are described briefly below:

- Adequate wind resource – the Applicant determined through initial screening and on-site measurements that the Project Area has an adequate wind resource (see Exhibit A).
- Adequate access to the bulk power transmission system – from the standpoints of proximity and ability of the system to accommodate the interconnection, and to accept and transmit the power from the Facility at a reasonable cost, the Applicant determined that the existing transmission infrastructure was adequately accessible (see Exhibit B, C, and D).
- Willing land lease participants and host communities – the Applicant has obtained private lease agreements, and the Applicant has engaged local and state stakeholders and the local community to educate and share information. A public information meeting was held near the Project Area on November 29, 2017 to share information and gather feedback.
- Site accessibility – the Project Area is served by an existing network of public roads (see Exhibit E).
- Appropriate geotechnical conditions – significant geotechnical constraints for the planned construction of the Facility are not anticipated (see Exhibit F).
- Limited population/residential development – the Project Area and the surrounding communities have a low population density as compared to statewide estimates. Areas with limited residential development generally have more available space for siting wind turbines once constraints related to setbacks, sound levels, and shadow flicker are taken into account. See Section 4906-4-08(C)(3)(e) and Exhibit G of this Application for additional detail on demographics in the vicinity of the Project Area. For additional information on noise, see Section 4906-4-08(A)(3) and Exhibit H. For additional information on shadow flicker, see Section 4906-4-08(A)(9) and Exhibit I.

- Compatible land use – the Project Area is predominantly rural agricultural land, which is compatible with the proposed Facility. See Section 4906-4-08(C) of this Application.
- Limited sensitive ecological resources – the proposed Facility is not expected to result in significant adverse impacts to ecological resources. See Section 4906-4-8(B) of this Application, and Exhibits J, K, L, M, N, O, P, Q, and R.
- Cultural resources – the proposed Facility is not expected to physically impact any identified existing cultural resources. For additional information on cultural resources, see Section 4906-4-08(D) and Exhibit S of this Application.

Additional information about the site selection process and the suitability of the Project Area for the Facility can be found in Section 4906-4-04 of this Application.

(4) Project Schedule

Acquisition of land and land rights began in August 2010 and will continue through June 2018. A public information meeting was held on November 29, 2017 to facilitate public interaction with the Applicant and expert consultants, and included information on visual/aesthetics, ecological studies, and wind turbine technology. This Certificate Application was officially submitted in early February 2018, and it is anticipated that the Certificate will be issued in the third quarter of 2018. Final designs will be completed in summer 2018. Construction is anticipated to begin in the second quarter of 2019 and be completed within 12 months, at which point the facility will be placed in service. Additional information about the Project schedule can be found in Section 4906-4-03(C)(1) of this Application.

(B) APPLICANT INFORMATION

(1) Plans for Future Generation Capacity at the Site

Although the Facility presented herein includes up to 58 turbine sites, depending on the turbine model selected, the number of turbines actually constructed may be as low as 55. The Project will have the capacity to generate up to 200 MW of emissions-free electricity that will be delivered to the grid at an electric substation in Pleasant Township, Seneca County. This point of interconnection has a maximum capacity of 200 MW. Therefore, although the Applicant is developing other wind generation projects in Ohio, there are no future plans with respect to this point of interconnection.

(2) Description of Applicant and Operator

Republic Wind LLC, a wholly owned subsidiary of Apex Clean Energy (Apex), will both construct and operate the proposed Facility. Founded in 2009 by a team of successful energy executives, Apex is an independent renewable energy company focused on building utility-scale generation facilities. Apex is building one of the nation's largest, most diversified portfolios of renewable energy resources, capable of producing over 12,000 MW of clean energy. Apex already has a strong track record of success, with wind and solar energy projects successfully operating in Illinois, Oklahoma, Texas, and Colorado.

In 2000, prior to founding Apex Clean Energy, the company's leadership team created Greenlight Energy, Inc. This independent wind energy company was responsible for developing $750 million of facilities now in commercial operation, with a combined generating capacity of 450 MW. Following the 2006 sale of Greenlight Energy, Inc., to BP Alternative Energy, the leadership team reinvested in the clean energy industry through a new venture, Greenlight Energy Resources. In 2006, Greenlight Energy Resources founded Columbia Power Technologies, followed by Axio Power in 2007. Columbia Power, a leader in direct-drive wave energy systems, is commercializing a patented, next-generation solution that delivers survivability with a competitive cost of energy and a low environmental and stakeholder impact. Axio Power was a successful developer of utility-scale solar PV facilities, assembling a large portfolio of projects in the United States and Canada. In just four years, the company had secured power sales contracts for over 100 MW of solar capacity. These projects were subsequently financed and built by SunEdison, which acquired Axio Power in late 2011.

4906-4-03 PROJECT DESCRIPTION AND SCHEDULE

(A) PROJECT AREA DESCRIPTION

The following sub-sections provide information on the Project Area's geography, topography, population centers, major industries, and landmarks.

(1) Geography and Topography Map

Figure 03-1 depicts the geography and topography of the Project Area, and the surrounding area within a 2-mile radius. This mapping was developed from the United States Geological Survey (USGS) topographic maps via ESRI's "USA Topo Maps" Map Service, which provides seamless, scanned images of USGS 7.5 minute, 1:24,000 paper topographic maps. The mapping used in Figure 03-1 consists of digital versions of the Attica, Bellevue, Bloomville, Clyde, Fireside, Flat Rock, Fremont East, Fremont West, Tiffin North, and Watson quadrangles. Among other information, Figure 03-1 shows the following features:

(a) *The Proposed Facility*

(b) *Population Centers and Administrative Boundaries*

(c) *Transportation Routes and Gas and Electric Transmission Corridors*

(d) *Named Rivers, Streams, Lakes, and Reservoirs*

(e) *Major Institutions, Parks, and Recreation Areas*

(2) Area of All Owned and Leased Properties

Of the approximately 32,478-acre Project Area, a total of 24,221 acres are owned and/or under lease by the Applicant for construction and operation of the proposed Facility. This acreage represents a total of 451 properties. However, the Facility footprint will occupy a much smaller area. Table 03-1 presents the estimated area of disturbance for each Facility component, based on the Applicant's experience with the construction and operation of other wind power facilities. The construction impacts presented throughout this Application were calculated using these assumptions.

Table 03-1. Impact Assumptions

Facility Components	Typical Area of Vegetation Clearing	Area of Total Soil Disturbance (temporary and permanent)	Area of Permanent (fill/structures) Disturbance
Wind Turbines and Workspaces	300-foot radius per turbine	300-foot radius per turbine	0.03 acre per turbine (pedestal plus crane pad)
Access Roads	36 feet wide per linear foot of road	36 feet wide per linear foot of road	16 feet wide per linear foot of road
Buried Electrical Collection Cable[1]	20 feet wide per linear foot of cable	20 feet wide per linear foot of cable	none
O&M Buildings (and associated storage yard)	5 acres	5 acres	5 acres
Laydown Yards[2]	10-12 acres	10-12 acres	none
Substation	5 acres	5 acres	5 acres
Meteorological Towers[3]	1 acre per tower	0.03 acre per tower	0.0002 acre per tower

[1] These values represent averages for clearing and soil disturbance. Some sections of buried electrical cable will be wider than 20 feet because of the number of collection circuits that need to convene near the collection substation. However, in many other locations the disturbance will be less than 20 feet, resulting in an overall average of 20 feet across the Project Area.

[2] As described below in Section 4906-4-03(B)(2)(j), the Facility will require a temporary laydown yard for construction staging. This Application seeks approval for three laydown yard sites; however, only one laydown yard will ultimately be constructed. The laydown yard will not exceed 12 acres in size.

[3] As described below in Section 4906-4-03(B)(2)(h), the Facility will require up to two permanent meteorological towers. This Application seeks approval for six meteorological tower sites; however, only two will ultimately be constructed. While the impact assumptions in Table 03-1 are per tower, all impacts presented in this Application account for two meteorological towers.

Approximately 702.1 acres of land will be disturbed during construction. Much of this disturbance will be temporary, and subject to restoration activities at the end of Facility construction. Following restoration, the permanent operating footprint of the Facility will be approximately 55.9 acres of built facilities, or approximately 0.2% of the total leased lands.

(B) DETAILED DESCRIPTION OF PROPOSED FACILITY

(1) Description Details for the Project

(a) *Type and Characteristics of Turbine*

Each wind turbine consists of three major components: the tower, the nacelle, and the rotor. The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. "Hub height" is the height of the center of the rotor, as measured from the base of the tower (excluding the subsurface foundation), while total turbine height is the height of the entire turbine, as measured from the tower base to the tip of the highest blade when rotated to the highest position. Facility construction is not scheduled to begin until 2018, and due to market factors such as availability and cost, a specific turbine model has not yet been selected for the Facility. However, turbine models that have been determined to be suitable for this site include the Acciona AW132 (3.3 MW), Vestas V136 (3.6 MW), and General Electric GE 3.6-137 (3.63 MW).

(b) *Turbine Dimensions*

Table 03-2 presents the dimensions in feet and meters for each of the turbine models under consideration.

Table 03-2. Approximate Turbine Dimensions by Model

Turbine Model	Rated Power	Hub Height	Rotor Diameter	Maximum Total Height
Acciona AW132	3.3 MW	84 meters (276 feet)	132 meters (433 feet)	150 meters (492 feet)
Vestas V136	3.6 MW	82/105/112 meters (269/344/367 feet)	136 meters (446 feet)	180 meters (591 feet)
General Electric GE 3.6-137	3.63 MW	110 meters (361 feet)	137 meters (449 feet)	178.5 meters (586 feet)

(c) *Fuel Quantity and Quality*

Wind turbines generate electricity without burning fuels. Therefore, this section is not applicable to the Facility.

(d) *List of Pollutants Emissions and Quantities*

Wind turbines generate clean, emission-free electricity without releasing airborne pollutants. Therefore, this section is not applicable to the Facility.

(e) *Water Requirement, Source, and Discharge Information*

Wind turbines generate electricity without the use of water. Therefore, no water is treated or discharged, and this section is not applicable to the Facility.

(2) Description of Major Equipment

As previously indicated, the Facility evaluated herein consists of up to 58 wind turbines. In addition to the turbines, the Facility will include up to approximately 23 miles of access roads, up to approximately 111 circuit miles[2] of buried 34.5 kV electrical collection cable, a collection substation, a temporary laydown yard for construction staging, an O&M building, and up to two permanent meteorological towers. Additional information about each of these Facility components is presented below.

(a) *Wind Turbines, Including Towers and Foundations*

Once the access roads are complete for a particular group of turbine sites, construction of the respective turbine foundation will commence on that completed access road section. Foundation construction occurs in several stages, as dictated by the type of foundation to be used. These stages could include hole excavation, outer form setting, rebar and bolt cage assembly, casting and finishing of the concrete, removal of the forms, backfilling and compacting, and site restoration. Excavation and foundation construction will be conducted in a manner that will minimize the size and duration of excavated areas required to install foundations.

Initial activity at each tower site will involve removing vegetative cover as necessary and grading topsoil within a 300-foot radius workspace around each tower (the exact placement of this workspace can be adjusted to avoid sensitive ecological resources). In agricultural land, the topsoil within a 300-foot radius of each tower will be stripped and stockpiled. An excavator will then be used to dig a foundation hole. Excavated subsoil and rock will be segregated from topsoil. Encountering bedrock is unlikely; however, if bedrock is encountered, it is anticipated to be rippable (i.e., excavated using mechanical means). If the bedrock is not rippable, it will be excavated by pneumatic jacking, hydraulic fracturing, or blasting. It is highly unlikely that blasting would be necessary; however, if it is required, blasting would be conducted in accordance with all applicable laws and regulations. If necessary, dewatering of foundation holes will involve pumping the water to a discharge point, which will include measures to slow water velocities and trap any suspended sediment. Dewatering activities will not result in the direct discharge of water into any streams or wetlands.

Upon completion of the detailed geotechnical exploration, suitable foundation systems will be designed. Two possible types are currently under consideration: spread footing foundations and rock anchored pile-supported foundations. The excavation area around and over the foundation will be backfilled with material excavated from on-site. The top of the foundation will be a nominal 18-foot diameter pedestal that typically extends 6 to 8 inches above grade and is surrounded by a 10-foot wide gravel ring. At the

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2 In many areas, multiple circuits will be buried in parallel; in such cases, each circuit was summed separately to arrive at the total of 111 circuit miles. The linear distance where one or more circuits will be installed consists of approximately 84 miles.

base of each tower, an area approximately 100 feet by 60 feet will be developed as a level, compacted stone crane pad.

The Applicant has not made a final determination of the wind turbine model or manufacturer. Included in Table 03-2 are dimensions of the Acciona AW132, Vestas V136, and GE 3.6-137, which represent the range of turbines types anticipated to be used for the Facility. These models represent the tallest class of turbines under consideration at the time of this Application. Because Facility construction is not scheduled to begin until the second half of 2018, market factors such as availability and cost will affect this determination and could dictate use of an alternate turbine. However, any turbine ultimately selected will be essentially equivalent to those referenced above in terms of its dimensions, appearance, and electrical output. Each wind turbine results in an operational footprint of approximately 0.03 acre (see Table 03-1 above) and consists of three major components: the tower sections, the nacelle, and the rotor with blades. The hub height will be a maximum of 367 feet (112 meters). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The rotor diameter will be a maximum of 449 feet (137 meters). The maximum total turbine height (i.e., the height at the highest blade tip position) of 591 feet (180 meters) is associated with the Vestas V136 model. Descriptions of each of the turbine components are provided below.

Tower: The tubular towers used for megawatt-scale turbines are tubular conical steel structures manufactured in multiple sections. Each tower will have an access door in the base section and internal lighting, along with an internal ladder and/or mechanical lifts to access the nacelle. The towers will be painted white or off-white in accordance with Federal Aviation Administration (FAA) regulations designed to make the structures more visible to aircraft when viewed from above, as light colors contrast sharply against the dark-colored ground. This also has the benefit of reducing visibility from ground vantage points, by making them less visible against the pale background of the sky.

Nacelle: The main mechanical components of the wind turbine are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is housed in a steel reinforced fiberglass shell that protects internal machinery from the environment and dampens noise emissions. The housing is designed to allow for adequate ventilation to cool internal machinery. The nacelle is equipped with an external anemometer and a wind vane that signals wind speed and direction information to an electronic controller. Attached to the top of the nacelles, per specifications of the FAA, will be one or two medium intensity aviation warning lights[3]. These lights are anticipated to be flashing red strobes (L-864) that operate only at night. The nacelle is mounted on a yaw ring bearing that allows it to rotate ("yaw") into the wind to maximize wind capture and energy production.

Rotor: A rotor assembly is mounted to the nacelle to operate upwind of the tower. Each rotor consists of three (3) composite blades that will be up to 220 feet (67.2 meters) in length, with a maximum rotor diameter of up to 449 feet (137 meters). The rotor attaches to the drive train at the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds. The rotor can spin at varying speeds to operate more efficiently. Depending on the turbine model selected, the wind turbines will begin generating energy at wind speeds as low as 3 meters per second (m/s) [6.7 miles per hour (mph)] and cut out at maximum wind speeds of 25 m/s (55.9 mph). Rotor speed will be in the range of 5.6 to 15.3 revolutions per minute.

Beyond the tower, nacelle, and rotor blades, other smaller wind turbine components include hubs (center portion of the rotor assembly), cabling, control panels, and internal facilities such as lighting, ladders, etc. All turbine components will be delivered to the Facility on transport trucks, with the main components typically off-loaded at the individual turbine sites. However, if required due to schedule or weather issues, some turbine components may be delivered to the laydown yards. Turbine erection is performed in multiple stages including setting of the bus cabinet and ground control panels on the foundation; erection of the tower sections; erection of the nacelle; assembly and erection of the rotor; connection and termination of the internal cables; and inspection and testing of the electrical system prior to energization.

Turbine assembly and erection involves mainly the use of large track-mounted cranes, smaller rough terrain cranes, boom trucks, and rough terrain fork-lifts for loading and off-loading materials. The tower sections, rotor components, and nacelle for each turbine will be delivered to each site by specialized trailers and unloaded by crane. A large erection crane will set the tower segments on the foundation, place the nacelle on top of the tower, and following ground assembly, place the rotor onto the nacelle. The erection crane(s) will move from one tower to another along Facility access roads or temporary crane paths.

[3] The exact lighting configuration is to be determined and will depend on the final turbine model selected. The Facility will fully comply with all relevant FAA obstruction lighting requirements.

(b) *Fuel, Waste, Water, and Other Storage Facilities*

Fuel tanks will be stored in the laydown yards during Facility construction. In addition, the O&M building will store lubricants and other fluids used in turbine maintenance. However, wind turbines generate electricity without the use of fuel or water, and without generating waste. As such, the proposed Facility does not include any significant facilities for fuel, waste, water, or other storage.

(c) *Fuel, Waste, Water, and Other Processing Facilities*

Wind turbines generate electricity without the use of fuel or water, and without generating waste. Therefore, the proposed Facility does not include any fuel, waste, water, or other processing facilities.

(d) *Water Supply, Effluent, and Sewage Lines*

The O&M facilities will use water and generate sewage and wastewater comparable to a typical small business office. Waterborne wastes will be disposed of through use of a septic system, and if necessary, the Applicant will obtain a permit to install on-site sewage treatment under OAC 3745-42. No other Facility components will use measurable quantities of water or discharge measurable quantities of wastewater.

(e) *Associated Electric Transmission and Distribution Lines and Gas Pipelines*

The generator lead line and POI substation will be permitted separately, and hence are not addressed in detail within this Application. There are no electric distribution lines or gas pipelines associated with the proposed Facility.

(f) *Electric Collection Lines*

The wind turbine transformer will raise the voltage of electricity produced by the turbine generator up to the 34.5 kV voltage level of the collection system. From the transformer, cables will join the collection circuit and turbine communication cables to form the electrical collection system. Collection cables will be buried to a minimum depth of 36 inches below the surface. The location of the proposed collection system is depicted on Figure 03-2. This 34.5 kV collection system will connect the individual turbines to the collection substation. The total length of the buried 34.5 kV collection lines carrying electricity to the Project substation will be up to 111 circuit miles[4], buried on privately owned land leased by the Applicant, and to a lesser extent, in public road rights-of-way (i.e., when crossing public roads between two participating parcels).

[4] In many areas, multiple circuits will be buried in parallel. The linear distance where one or more circuits will be installed consists of approximately 84 miles.

With each circuit, collection lines generally run between turbines and back to the substation following the straightest, most direct route. Where buried cable is proposed to cross active agricultural fields, an attempt will be made to determine the location of any subsurface drainage tiles through consultation with the landowner and/or review of public records. Any drainage tiles damaged during construction will immediately be identified, documented, and repaired. It is anticipated that a local drain tile contractor or the farmer tending the land will be involved in repair activities.

Direct burial methods through the use of a trencher will be used during the installation of underground collection lines. The trencher uses a large blade or "saw" to excavate an open trench. A trench, generally 24 to 36 inches wide, is opened with a sidecast area immediately adjacent to the trench. Direct burial installs the cable between 36 inches and 48 inches deep and requires only minor clearing and surface disturbance (up to 20 feet wide for the installation machinery and access).

Installation of collection lines in an open trench will be used in areas where the previously described direct burial methods are not practicable. Areas appropriate for open trench installation will be determined at the time of construction and may include areas with unstable slopes, excessive unconsolidated rock, standing or flowing water, and/or suspected drainage tiles. Open trench installation is generally performed with a backhoe and generally results in a disturbed trench approximately 18 inches wide and a maximum of 48 inches deep. However, the overall temporary footprint of vegetation and soil disturbance will average 20 feet in width[5], due to machinery dimensions and backfill/spoil pile placement during installation. In agricultural areas, all topsoil within the work area will be stripped and segregated from excavated subsoil. Replacement of spoil material will occur immediately after installation of the buried collection lines. Subgrade soil will be replaced around the cable, and topsoil will be replaced at the surface. Any damaged tile lines will be repaired, and all areas adjacent to the open trench will be restored to original grades and surface condition. Restoration of these areas will be completed through seeding and mulching of all exposed soils, or by other appropriate farming methods in active agricultural fields.

[5] Some sections of buried electrical cable will be wider than 20 feet because of the number of collection strings that need to convene (run parallel) near the Project substation. However, in many other locations the disturbance will be substantially less than 20 feet, resulting in an overall average disturbance width of 20 feet across the Project Area.

(g) *Substations, Switching Substations, and Transformers*

The collection substation will be located south of Hoppes Road and west of Town Highway 175 in Adams Township in Seneca County. The substation will step up voltage from 34.5 kV to 138 kV, so it can be delivered to the POI substation via the Project generator lead line (to be permitted separately). The substation will include dead-end structures, circuit breakers, air break switches, metering units, relaying, communication equipment, and a control house. The collection substation will be approximately 467 by 467 feet in size and enclosed by a chain link fence. It will be accessed via a 0.1-mile, gravel-surfaced access road from Town Highway 175.

(h) *Temporary and Permanent Meteorological Towers*

Two 295-foot (90-meter) permanent meteorological wind measurement towers will be installed to collect wind data and support performance testing of the Facility. These towers will be galvanized steel structures equipped with wind velocity directional measuring instruments at three different elevations and a red aviation warning lighting mounted at the top. Each tower will be self-supporting (i.e., they will be non-guyed, free standing structures). Six possible locations for the meteorological towers have been identified and are depicted on Figure 03-2; all these sites are in cultivated agricultural land.

(i) *Transportation Facilities, Access Roads, and Crane Paths*

The Facility will require the construction of new or improved roads to provide access to the proposed turbines. The proposed location of Facility access roads is shown on Figure 03-2. The total length of private access roads required to service all proposed wind turbine locations is approximately 22.7 miles. The roads will be gravel-surfaced and typically 16 feet in finished width.

Wherever feasible, existing roads and farm drives will be upgraded for use as Facility access roads, in order to minimize impacts to active agricultural areas, natural communities, and wetland/stream areas. Where an existing road or farm drive is unavailable or unsuitable, new gravel-surfaced access roads will be constructed, also in locations selected to minimize potential impacts. Road construction will involve topsoil stripping and grubbing of stumps, as necessary. Stripped topsoil will be stockpiled along the road corridor for use in site restoration. Any grubbed stumps will be removed, chipped, or buried. Following removal of topsoil, subsoil will be graded, compacted, and surfaced with gravel or crushed stone (depth to be determined on a case by case basis), and a geotextile fabric or grid will be installed beneath the road surface if necessary, to provide additional support. To the extent practicable, local sources will be used to obtain gravel and other construction materials that may be needed (e.g., sand) in support of Facility construction.

The typical finished access road will be no greater than 16 feet in width with occasional wider pull-offs to accommodate passing vehicles, and temporary earthen shoulders on either side to accommodate crane traffic. Although there will be no temporary or permanent crossings of streams due by access roads, up to five ditch crossings will be required. Each ditch crossing will utilize a standard culvert with rock fill to create stable road crossing. The Applicant will design these crossing to allow adequate flow and not affect the flow of water within the Project Area. Where access roads are adjacent to (or cross) wetlands, streams, or drainage ditches/swales, appropriate sediment and erosion control measures (e.g., silt fence) will be installed.

During construction, access road installation and use could result in temporary soil disturbance of a maximum width of 36 feet. In agricultural areas, topsoil will be stripped and wind-rowed along the access road to prevent construction vehicles from driving over undisturbed soil and adjacent fields. Once construction is complete, temporarily disturbed areas will be restored, including removal of excess road material and rocks greater than 12 inches, and returned to their approximate pre-construction contours.

(j) *Construction Laydown Areas*

Facility construction will require the development of a temporary laydown yard for construction staging, to be located on leased private lands (see Figure 03-2 for potential laydown yard locations). The laydown yard will accommodate material and equipment storage, parking for construction workers, and construction management trailers. The area of the laydown yards will not exceed approximately 12 acres. No lighting of the laydown areas is currently proposed, but may be added as needed (e.g., to resolve safety issues due to poor visibility [i.e., collision risk] or if other problems such as vandalism arise). Three possible locations for the laydown yard have been identified and are depicted on Figure 03-2; these sites are all located in cultivated agricultural land.

(k) *Security, Operations, and Maintenance Facilities or Buildings*

An O&M building and associated storage yard will be required to house operations personnel, equipment, and materials, and to provide operations staff parking. It is anticipated that an existing structure in the vicinity of the Facility will be purchased or leased and refurbished for O&M activities. If a new building is needed, it is not expected to exceed 6,000 square feet or permanently disturb an area of greater than 3 acres.

(l) *Other Pertinent Installations*

There are no additional Facility components beyond those already described in in the previous subsections of 4906-4-03(B)(2).

(3) Need for New Transmission Lines

The Applicant will construct approximately 7.1 miles of new 138 kV overhead generator lead line, to transmit electricity from the Project collection substation to the POI substation, adjacent to the existing Fremont Center – Tiffin Center 138 kV transmission line. The new line will be located within leased agricultural land and will be permitted separately.

(4) Project Area Map

The proposed layout of all Facility components is illustrated on Figure 03-2. Prepared at a 1:12,000 scale, Figure 03-2 illustrates the Project Area, along with the following information:

(a) *Aerial Photograph*

This mapping was developed using 2015 aerial photographs from the U.S. Department of Agriculture (USDA) National Agricultural Imagery Program (NAIP) Ohio 0.5-meter orthoimagery map service.

(b) *The Proposed Facility*

This mapping illustrates Facility components, as discussed above in Section 4906-4-03(B)(2).

(c) *Road Names*

(d) *Property Lines*

(C) DETAILED PROJECT SCHEDULE

(1) Schedule

A Gantt-style chart is presented below, illustrating major activities and milestones including:

(a) *Acquisition of Land and Land Rights*

Acquisition of land and land rights began in August 2010 and will continue through June 2018.

(b) *Wildlife Surveys/Studies*

Wildlife surveys/studies began in the spring of 2011 and continued through the fall of 2017.

(c) *Receipt of Grid Interconnection Studies*

Grid interconnection studies were initiated in 2009. The Feasibility Study was completed in April 2010. The Impact Study was completed in November 2011. The Facilities Study was completed in September 2015. The Interconnection Service Agreement (ISA) was executed November 12, 2015.

(d) *Preparation of the Certificate Application*

Preparation of the Application occurred in 2016,2017, and 2018, with data and analyses added as various studies were completed. A public information meeting was held November 29, 2017.

(e) *Submittal of the Application for Certificate*

This Application was officially submitted in early February 2018.

(f) *Issuance of the Certificate*

It is anticipated that the Certificate will be issued in the third quarter of 2018.

(g) *Preparation of the Final Design*

It is expected that final designs and detailed construction drawings will be completed in summer 2018.

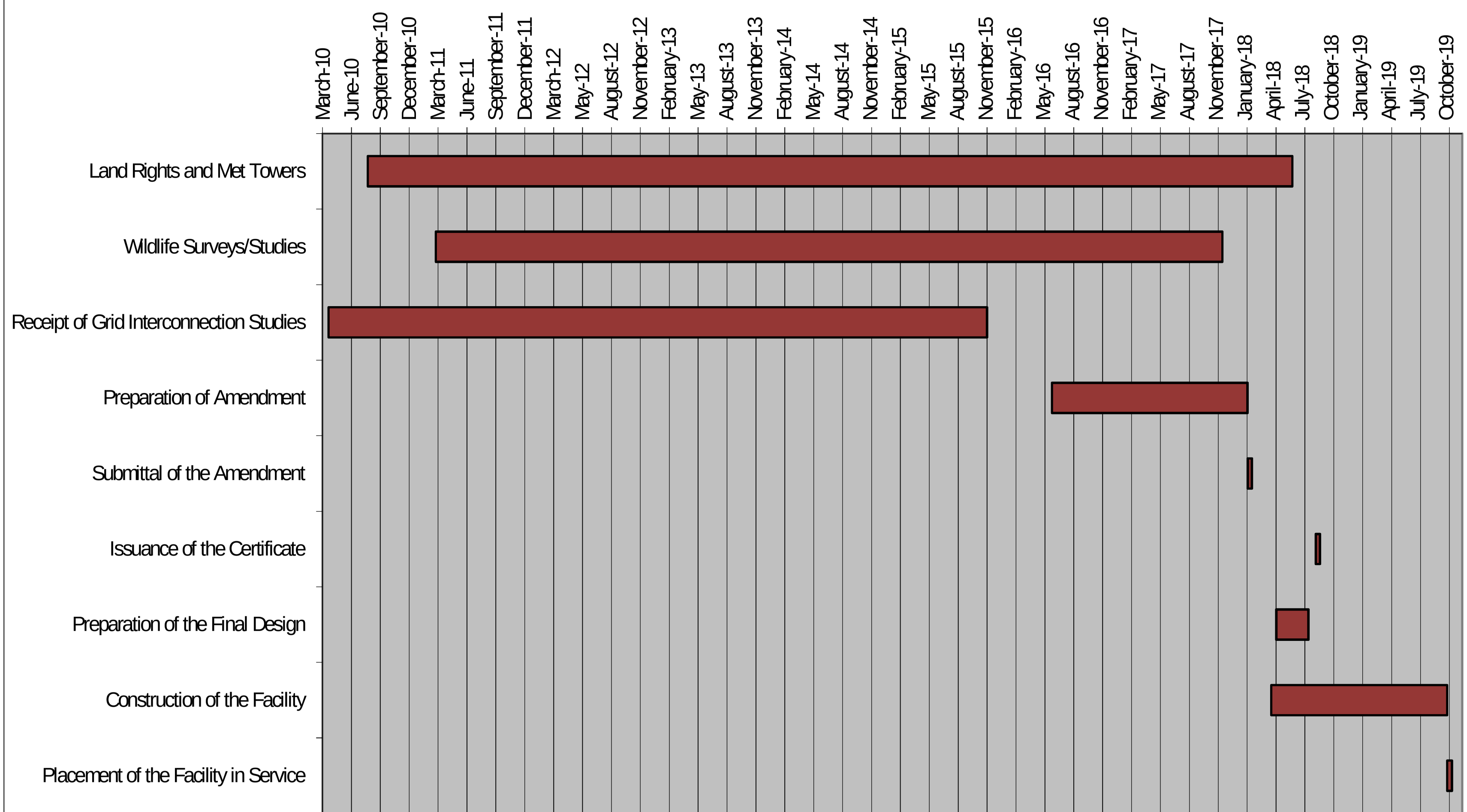
(h) *Construction of the Facility*

Construction is anticipated to begin in the second quarter of 2019 and be completed within 18 months.

(i) *Placement of the Facility in Service*

The Facility will be placed in service upon completion of construction, anticipated for the fourth quarter of 2019.

Estimated Project Schedule



(2) Construction Sequence

Project construction is anticipated to proceed in the following sequence, with multiple activities being performed concurrently:

- Grading of the field construction office, laydown yards, and substation areas;
- General clearing and construction of access roads, crane pads, and turn-around areas;
- Construction of turbine tower foundations;
- Assembling and erection of the wind turbines;
- Installation of the electrical collection system;
- Construction and installation of the substations;
- Plant commissioning and energization;
- Final grading and drainage; and
- Restoration activities.

Facility construction will be initiated by clearing (as necessary) all tower sites, access roads, and interconnect routes. As described in Table 03-1, it is assumed that up to a 300-foot radius will be cleared around each tower, a 40-foot-wide corridor will be cleared along access roads, and a 20-foot-wide corridor will be cleared along all underground electric interconnect routes that do not parallel access roads. The actual cleared area will vary on a case-by-case basis depending on factors such as topography and vegetation, and where possible, adjusted to avoid sensitive ecological resources. In addition, approximately 5 acres will be cleared for the substation, a total of up to 2 acres for the meteorological towers, 10-12 acres for the laydown yard, and up to 5 acres for the O&M building. Section 4906-4-08(B)(2) of this Application quantifies anticipated temporary and permanent impacts from construction activities, including vegetation removal, to ecological communities in the Project Area.

Graded areas will be smoothed, compacted, freed from irregular surface changes, and sloped to drain. Final earth grade adjacent to equipment and buildings will be below the finished floor slab and sloped away from the building to maintain proper drainage. Slopes of embankments shall be protected against rutting and scouring during construction in a manner similar to that required for excavation slopes. Site grading will be compatible with the general topography and use of adjacent properties, right-of-way, setbacks, and easements.

In addition, a stringent soil erosion and sedimentation control plan will be developed and implemented as part of the Stormwater Pollution Prevention Plan (SWP3) required by the National Pollutant Discharge Elimination System (NPDES) General Permit for the Facility. To protect surface waters, wetlands, groundwater, and storm water quality, erosion and sediment control measures will be installed and maintained throughout site development. Such measures could include silt fence, hay bales, and/or temporary siltation basins. The location of these features will be detailed on the construction drawings, approved by the Ohio Environmental Protection Agency (EPA) as part of the NPDES review, and reviewed by the contractor prior to construction. A duly qualified individual will also inspect these features throughout the period of construction to assure that they are functioning properly until completion of all restoration work (final grading and seeding). Based upon field conditions, additional sediment and erosion control measures may be required, beyond what is depicted on the drawings. Further information on storm water drainage can be found in Section 4906-4-07(C).

Construction of turbine tower foundations, turbine erection and assembly, access road construction, and installation of collection lines are described above in Section 4906-4-03(B)(2).

Project construction will generate some solid waste, primarily plastic, wood, cardboard, and metal packing/packaging materials, construction scrap, and general refuse. This material will be collected from turbine sites and other Project work areas and disposed of in dumpsters located at the laydown yards. A private contractor will empty the dumpsters on an as-needed basis and dispose of the refuse at a licensed solid waste disposal facility.

Once construction is complete, temporarily disturbed areas will be restored (including removal of excess road material, de-compaction, and rock removal in agricultural areas) and returned to their approximate pre-construction contours. Exposed soils at restored turbine sites and along Facility access roads will be stabilized by seeding, mulching, and/or agricultural planting.

(3) Impact of Critical Delays

Critical delays may have material, adverse effects on Facility financing, including the Applicant's ability to procure turbines and other Facility components. Such delays may push the in-service date back. In addition, considerable costs would be incurred if the delays prevented the Facility from meeting deadlines for federal incentive programs such as the Production Tax Credit.

4906-4-04 PROJECT AREA SELECTION AND SITE DESIGN

The selection of appropriate sites for a wind-powered electric generation facility is constrained by numerous factors that are essential considerations for the Facility to operate in a technically and economically viable manner. This section describes the general site selection process, along with associated siting constraints and requirements.

(A) PROJECT AREA SELECTION

The general purpose of the Facility is to produce wind-powered electricity that will maximize energy production from Project Area wind resources in order to deliver clean, renewable electricity to the Ohio bulk power transmission system to serve the needs of electric utilities and their customers. The electricity generated by the Facility will be transferred to the transmission grid operated by PJM for sale at wholesale or under a power purchase agreement.

(1) Description and Rationale for Selecting Project Area

Availability/quality of wind resource and proximity to the bulk power transmission system are the initial screening criteria evaluated in the site selection process for any wind power project. The Applicant's initial evaluation was based on publicly available data, such as the Wind Resource of Ohio map (AWS, 2007), along with site visits and capacity analysis for nearby transmission lines.

The wind resource map (see Exhibit A) suggests a suitable wind resource in southeastern Sandusky County and northeastern Seneca County. Adequate access to the bulk power transmission system is also an important siting criterion, as the system must be able to accommodate the interconnection and accept and transmit power from the Facility. As depicted on the wind resource map in Exhibit A, existing bulk transmission lines occur in both Seneca and Sandusky Counties.

Land use in Seneca and Sandusky Counties is primarily agricultural and characterized by open spaces suitable for hosting a wind power project. Initial site visits to the area provided visual verification that the study area is dominated by agricultural use, and that the land use would be compatible with wind project development.

Proximity to major transportation routes is another consideration in identifying a site for the Facility. Located approximately 37 miles southeast of Toledo, and approximately 12 miles southwest of Sandusky, the Project Area is in close proximity to I-80 to the north, US-20 to the north and east, US-6 to the north, US-250 to the east, and State Routes (SR) 4 to the east. These major roads provide accessibility for the transportation of turbine components, construction equipment, and staff.

(2) Map of Study Area

A map of the Study Area evaluated for the Facility is included as Figure 04-1. In addition, a statewide wind resource map, which is typical of the type of data used in initial screening evaluations, is included in Exhibit A. The wind resource map illustrates why this area was initially identified as a potential project site.

(3) List and Description of all Qualitative and Quantitative Siting Criteria

The Applicant does not have the unfettered ability to locate projects in any area or on any parcel of land; facilities can only be sited on private property where the landowner has agreed to allow such construction. Moreover, private landowner agreements strictly limit the use of land to a wind power project, and as such, do not allow for the siting of other alternative energy production facilities (e.g., solar, hydro, biomass, or fossil fuel). Accordingly, other power generation technologies are not reasonable alternatives, and do not warrant consideration in this Application.

Siting criteria used for the selection of a particular area to host a viable wind power project, such as the Facility proposed herein, include a number of factors/requirements, which are presented below:

- Adequate wind resource – the Applicant determined through an initial screening process utilizing a statewide wind resource map (see Exhibit A), and subsequent on-site measurements, that the Project Area has an adequate wind resource.
- Adequate access to the bulk power transmission system – the Applicant determined that the existing transmission infrastructure was adequately accessible from the standpoints of proximity and ability of the system to accommodate the interconnection, as well as the ability to accept and transmit the power from the Facility at a reasonable cost. This determination was made through an initial internal preliminary assessment and subsequent interconnect request filed with PJM. See Section 4906-4-05 of this Application for additional detail.
- Willing land lease participants and host communities – the Applicant obtained private lease agreements, which constitute contiguous areas of land necessary to support the Facility. See Section 4906-4-06(A) of this Application for additional detail. In addition, the Applicant has engaged local and state stakeholders and the local community to educate and share information. To share information and gather feedback, a well-attended public information meeting was held in the Project Area on November 29, 2017, at the Veterans of Foreign Wars (VFW) post in Green Springs, Ohio. See Section 4906-4-06(F)(1) of this Application for additional detail on public interaction.

- Site accessibility – the Project Area is served by an existing network of public roads, which will facilitate component delivery, construction, and operation and maintenance activities (see Figure 03-2 and Exhibit E).
- Appropriate geotechnical conditions - the Applicant determined that significant geotechnical constraints for the planned construction of the Facility are not anticipated (see Exhibit F).
- Limited population/residential development – the Project Area and the surrounding communities have a low population density as compared to statewide estimates. Areas with limited residential development generally have more available space for siting wind turbines once constraints related to setbacks, sound levels, and shadow flicker are taken into account. See Section 4906-4-08(C)(3)(e) and Exhibit G of this Application for additional detail on demographics in the vicinity of the Project Area. For additional information on noise, see Section 4906-4-08(A)(3) and Exhibit H of this Application. For additional information on shadow flicker, see Section 4906-4-08(A)(9) and Exhibit I of this Application.
- Compatible land use – the Project Area is predominantly rural agricultural, which is compatible with the proposed Facility. See Section 4906-4-08(C) of this Application.
- Limited sensitive ecological resources – the proposed Facility is not expected to result in significant adverse impact to ecological resources. See Section 4906-4-08(B) and Exhibits J, K, L, M, N, O, P, Q, and R of this Application.
- Cultural resources – the proposed Facility is not expected to physically impact any identified existing cultural resources. For additional information on cultural resources, see Section 4906-4-08(D) and Exhibit S of this Application.

Once the Applicant determined that the Project Area was suitable for development of a wind power facility, various siting factors and constraints were identified and evaluated in order to appropriately site the Facility components. These efforts are discussed in detail below in 4906-4-04(B).

(4) Description of Process by Which Siting Criteria Were Used

As noted above, the selection of possible sites for development of wind power facilities is constrained. Particularly, projects must be located in areas with adequate wind resource proximate to electric transmission lines with unused capacity sufficient to accept energy from the facility, and situated in locations that can accommodate setback, land use, and environmental restrictions imposed by local, state and federal laws. Once a project area has been selected, there is some ability to alter turbine and other component locations on the properties that are participating in the project within the confines of the private agreements that the Applicant has obtained. The Facility layout design process is described below in 4906-4-04(B).

(5) Description of Project Area Selected for Evaluation

Based on the criteria listed in rule 4906-4-04(A)(3), the Project Area site selection analysis concluded that the site presented herein meets all the factors necessary to support a viable wind energy facility. The proposed site possesses some of the best terrestrial wind resource in the state, manageable access to the bulk power transmission system, sufficiently low population density, positive feedback from landowners and local officials, highly compatible land-use characteristics, and few environmentally sensitive areas.

(B) FACILITY LAYOUT DESIGN PROCESS

(1) Constraint Map

A constraint map of the Project Area showing setbacks, public roads, utility corridors, streams, and wetlands is included as Figure 04-2.

(2) Criteria Used to Determine Site Layout and Comparison of Alternative Site Layouts

The siting of project components within a given project area is governed by site-specific factors, including land use constraints, noise constraints, wind resource constraints, shadow flicker constraints, environmental constraints, agricultural constraints, and landowner considerations. Once it was determined that the general project site was adequate, the Applicant worked with various consultants to conduct detailed assessments, which identified and defined the siting factors and constraints discussed below. Through the use of geographic information system (GIS) tools and consultant assessments, the Applicant performed numerous layout design iterations to develop the proposed Facility layout as presented and described in this Application. The constraints used in designing the Facility layout are discussed in additional detail below.

Land Use Constraints

A graphic study of turbine siting constraints for the Facility is included as Figure 04-2, as required by rule 4906-4-04(B)(1). Suitable areas for Facility development are restricted by setbacks from rights-of-way, non-participating parcels, and residences. Illustrative as it is, this graphic cannot appropriately show all the site-specific constraints and considerations, such as minimizing tree clearing and impacts to wetlands and surface waters, landowner preferences, turbine engineering factors (e.g., minimum separation distances to avoid wake loss), shadow flicker and noise assessments, avoiding impacts to existing aviation networks, access road engineering requirements, and minimizing impacts to agricultural lands, all of which further limit siting alternatives within the participating parcels.

In addition to investigating the layout within the constraints discussed above, numerous expert analyses and field studies have been conducted to ensure that the individual turbines are sited so as to minimize environmental impacts to the maximum extent practicable, while still allowing for a successful project. The pertinent studies and analyses are attached hereto as Exhibits and discussed in various sections of this Application.

Wind Resource Constraints

The proposed Facility site underwent a complex wind resource assessment. This type of evaluation is necessary to optimize the turbine layout and assess the energy yield estimation within the context of the existing, site-specific constraints. One objective of siting is to locate wind turbines in the highest energy yield positions with the lowest wake loss influence between these turbines. During the course of the wind analysis, micro-scale modeling tools were utilized to develop the energy yield assessment for the layout proposed herein, which is a result of a comprehensive management of the local constraints with the goal of achieving high energy yield. Inputs to the modeling tools include wind data from on-site meteorological towers and high-resolution terrain/roughness/land cover data from a digital elevation model.

Agricultural Constraints

Agriculture is the dominant land use within the Project Area. Therefore, the Applicant has designed the Facility footprint in order to minimize impacts to active agricultural land. These efforts included site-specific investigations in order to place turbines and access roads along field edges and minimize temporary disturbance and permanent loss of active agricultural land to the maximum extent practicable. The Facility will not physically impact any agriculture-related structures, and aside from temporary disturbance during construction activities, is largely compatible with farming practices. Furthermore, the Facility will not result in a change in land use and will promote the long-term economic viability of the affected farms by supplementing the income of participating farmers. For additional information on agricultural land, see Section 4906-4-08(E) of this Application.

Noise Constraints

No existing national, state, county, or local laws specifically limit wind turbine noise levels in the Project Area. However, in Certificates granted to previously approved wind projects in the State of Ohio, the OPSB has imposed conditions addressing Project-related noise levels at non-participating residences. Approved projects include a Facility-related noise limitation at non-participating residences of 5 dBA over the nighttime average Leq background level (unless the validly measured ambient Leq at the location of the complaint plus 5 dBA is greater). Consequently, these conditions were implemented as voluntary design goals for Republic

Wind, driving selection of individual turbines sites to minimize noise impacts to nearby residences. For additional information on noise, see Section 4906-4-08(A)(3) and Exhibit H of this Application.

Shadow Flicker Constraints

Shadow flicker from wind turbines can occur when moving turbine blades pass in front of the sun, creating alternating changes in light intensity or shadows. These flickering shadows can cause an interruption in sunlight when cast on nearby residences. No existing national, state, county, or local standards regulate frequency or duration of shadow flicker from wind turbines in the Project Area. However, the OPSB has used 30 annual hours of shadow flicker as a threshold of acceptability in reviewing previous commercial wind power projects (e.g., OPSB, 2011a, 2011b, 2012). Accordingly, a threshold of 30 hours of shadow flicker per year was used as a design goal for evaluation of potential impact from the Facility. For additional information on shadow flicker, see Section 4906-4-08(A)(9) and Exhibit I of this Application.

Wetland and Stream Constraints

Federal and state law discourages development in wetlands/streams and advocates that such impacts be avoided or minimized. Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. As described by the EPA (http://water.epa.gov/type/wetlands/outreach/upload/reg_authority.pdf), the basic premise of the program is that no discharge of dredged or fill material may be permitted if: (1) a practicable alternative exists that is less damaging to the aquatic environment, or (2) the nation's waters would be significantly degraded. In other words, an Applicant must show that it has, to the extent practicable:

- Taken steps to avoid wetland impacts,
- Minimized potential impacts on wetlands and streams, and
- Provided compensation for unavoidable impacts, if required by the terms of the permit.

In order to avoid and minimize impacts to waters of the U.S. and wetlands, on-site investigations were conducted to establish the locations of streams and wetlands, and Facility components were sited in an effort to avoid impacts to these resources to the maximum extent practicable. For all identified stream and wetland crossing points, appropriate construction techniques will be used to avoid and minimize impacts to the extent practicable. As a result, the vast majority of stream impacts will be temporary in nature. For additional information on estimated wetland and stream impacts, see Section 4906-4-08(B)(2)(a) and Exhibit J of this Application.

Landowner Considerations

The Applicant has and will continue to meet with various participating landowners to review the Facility footprint on their respective parcel(s). Among other things, these meetings often involve field analysis to ensure that Facility components are sited in a manner that allows continued efficient use of land for agricultural purposes and avoids any site features of importance to the landowner (or ensure adequate separation distances from such features).

(3) Description of Number and Type of Comments Received

Written and oral comments were received at the public meeting, which was held November 29, 2017 at the VFW post in Green Springs, Ohio. The public comments generally focused on air quality benefits; and job creation, increased tax revenue, and other economic benefits. These issues are addressed in this Application. Air quality benefits are discussed in Section 4906-4-07(B) and economic benefits are discussed in Section 4906-4-06(E). All written comments submitted at the public meeting are attached hereto as Exhibit T.

(C) CONNECTION TO THE REGIONAL ELECTRIC GRID

The proposed facility will connect to the American Electric Power (AEP) Fremont Center – Tiffin Center 138 kV circuit via a new 138 kV switching station (i.e., POI).

(D) INTERCONNECTION INFORMATION

(1) Generation Interconnection Request Information

As described above, the name of the interconnection queue is Fremont Center – Tiffin Center 138 kV. The queue number is V4-010, and the queue date is November 12, 2009. The website for the queue is http://www.pjm.com/pub/planning/project-queues/feas_docs/v4010_fea.pdf.

(2) System Studies

(a) *Feasibility Study*

PJM first issued the Feasibility Study in 2008, followed by a revised version in April 2010 (Exhibit B). This report evaluated Queue V4-010 as a 250 MW generating capability to be injected into the existing Fremont Center – Tiffin Center 138 kV circuit. This study evaluated compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts evaluated include generator deliverability, multiple facility contingency, short circuit, and system reinforcements. No problems or new system reinforcements were identified.

PJM also studied the delivery of the energy portion of the surrounding generation, looking for any problems likely to result in operational restrictions to the proposed Facility. This analysis identified eight potential congestion issues:

- The Howard – Brookside 138 kV line (from bus 243024 to bus 238586) loads from 200.14% to 215.58% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to the thermal violation.
- The V1-010TAP – Howard 138 kV line (from bus 292059 to bus 243024, circuit 1) loads from 99.07% to 114.36% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to the thermal violation.

- The V1-010TAP – Howard 138 kV line (from bus 292059 to bus 243024, circuit 2) loads from 159.53% to 181.39% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to the thermal violation.
- The Melmore – V1-010TAP 138 kV line (from bus 243039 to bus 292059) loads from 69.97% to 132.77% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to cause this thermal violation.
- The Melmore – Fostoria Central 138 kV line (from bus 243039 to bus 243006) loads from 90.65% to 138.29% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to cause this thermal violation.
- The Chatfield – S. Tiffin 138 kV line (from bus 242984 to bus 243110) loads from 103.53% to 121.14% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to cause this thermal violation.
- The Tiffin – Green Lawn 138 kV line (from bus 243130 to bus 243015) loads from 51% to 109.98% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to cause this thermal violation.
- The Green Lawn - Melmore 138 kV line (from bus 243015 to bus 243039) loads from 43.86% to 104.61% of its emergency rating for the operational contingency. The Facility contributes approximately 43.2 MW to cause this thermal violation.

The Applicant could elect to proceed with discretionary network upgrades that would eliminate these potential operational restrictions, but such upgrades are not required for reliability (PJM, 2010).

(b) *System Impact Study*

PJM issued the Impact Study in September 2010 (Exhibit C). This report evaluated Queue V4-010 as a 200 MW injection into the existing Fremont Center – Tiffin Center 138 kV circuit. A new in-line switching station will be located between AEP's Fremont Center and Tiffin Center stations. The new station design includes three 138 kV circuit breakers, relaying, 138 kV revenue metering, SCADA, and associated equipment. The Applicant will obtain all necessary permits, as well as the land for the AEP facilities, and the Applicant will be responsible for these construction costs. Ownership of the station will be transferred to AEP upon successful completion of the construction and energization work. Network impacts were assessed for summer peak conditions in 2014.

Local AEP impacts evaluated include normal system, single contingency, multiple contingency, short circuit analysis, stability analysis, local/network upgrades, contributions to previously identified local/network limitations at full output, and additional limitations of concern at full output. The stability analysis indicated that an unstable result is expected for two contingencies: (1) a double contingency outage of Tiffin Center – Fremont Center 138 kV and the Melmore – Fostoria Central 138 kV lines, and (2) the Greenlawn – Melmore 138 kV and the Fremont Center – Tiffin Center 138 kV lines.

Network impacts evaluated include generator deliverability, multiple facility contingency, short circuit; stability contribution to previously identified overloads, new system reinforcements, and contribution to previously identified system reinforcements. No network problems were identified.

In addition, PJM performed deliverability testing that identified five potential congestion issues:

- The Melmore – Fostoria Central 138 kV line (from bus 243039 to bus 243006) loads from 65.44% to 110.13% of its emergency rating for the single line contingency outage. The Facility contributes approximately 110.85 MW to the thermal violation.
- The Melmore – Fostoria Central 138 kV line (from bus 243039 to bus 243006) loads from 82.04% to 116.22% of its normal rating for non-contingency condition. The Facility contributes approximately 58.42 MW to the thermal violation.
- The Melmore – Howard 138 kV line (from bus 243039 to bus 243024) loads from 83.06% to 110.17% of its normal rating for non-contingency condition. The Facility contributes approximately 39.19 MW to the thermal violation.
- The Howard – Brookside 138 kV line (from bus 243024 to bus 238586) loads from 145.11% to 150.01% of its emergency rating for the single line contingency outage. The Facility contributes approximately 18.83 MW to the thermal violation.
- The Howard – Brookside 138 kV line (from bus 243024 to bus 238586) loads from 168.42% to 174.47% of its normal rating for non-contingency condition. The Facility contributes approximately 17.87 MW to the thermal violation.

These potential congestion issues could result in operational restrictions to the proposed Facility. The Applicant could elect to proceed with discretionary network upgrades that would eliminate these potential operational restrictions, but such upgrades are not required for reliability (PJM, 2011).

(c) *Facilities Study*

PJM issued the Facilities Study in September 2015 (Exhibit D). The Facilities Study specifies that there are no changes or amendments to the Impact Study, and that no network upgrade work is required. The Applicant has elected the "Option to Build" route, and will be responsible for the construction of the new

138 kV POI substation. A one-line diagram is included that shows the POI configuration requirements for interconnection to the AEP system. The Facilities Study also provides the estimated cost responsibility and schedule for the interconnection, and outlines AEP's scope of work to facilitate the interconnection (PJM, 2015).

4906-4-06 ECONOMIC IMPACT AND PUBLIC INTERACTION

(A) OWNERSHIP

The Applicant will construct all structures and equipment associated with the Facility, and the Applicant will own and operate all such structures. As depicted on Figure 03-2, limited portions of the buried 34.5 kV electrical collection lines will be located within public road rights-of-way where the collection lines cross roads from one participating parcel to another. The proposed Facility will not change the ownership status of such rights-of-way. All other components of the Facility will be located entirely on privately owned land, and voluntary lease agreements between the Applicant and private landowners will accommodate the Facility. The proposed Facility and associated lease agreements is not expected to change the ownership status of private lands within the Project Area, with the possible exception of land that may be purchased for the Project substation and the O&M facilities, for which the Applicant may either lease land or purchase an existing building and associated land.

The Applicant (Republic Wind, LLC) is a wholly owned subsidy of Apex Clean Energy (Apex). Founded in 2009 by a team of successful energy executives, Apex is an independent renewable energy company focused on building utility-scale generation facilities. Apex is building one of the nation's largest, most diversified portfolios of renewable energy resources, capable of producing over 12,000 MW of clean energy. Apex already has a strong track record of success, with wind and solar energy projects successfully operating in Illinois, Oklahoma, Texas, and Colorado.

(B) CAPITAL AND INTANGIBLE COSTS

(1) Estimated Capital and Intangible Costs by Alternative

The total estimated capital and intangible costs of the Facility could range between approximately $[redacted] and $[redacted] ($[redacted]/kW – $[redacted]/kW) depending on the turbine model and installed capacity selected. These costs are broken out in Table 06-1 below, assuming a cost value in the approximate middle of the estimated range.

Table 06-1. Estimated Capital and Intangible Costs

Description	Cost ($'000)
Tangible Costs	
Turbine (including transportation and installation)	$[redacted]
Civil and Electrical Work	$[redacted]
Other	$[redacted]
Total Tangible Costs	$[redacted]
Intangible Costs	
Development/Management	$[redacted]
Insurance	$[redacted]
Legal/Other	$[redacted]
Total Intangible Costs	$[redacted]
Total	**$[redacted]**
Cost per kW	**$[redacted]**

As described in Section 4906-4-04, the Applicant has not proposed alternative project areas. Therefore, no cost comparison between alternatives is available.

(2) Cost Comparison with Similar Facilities

Installed project costs compiled by the U.S. Department of Energy National Renewable Energy Laboratory (NREL) in August 2017 indicate that the capital costs of the Facility are in line with recent industry trends. The NREL compilation shows that capacity-weighted average installed costs in 2016 averaged roughly $1,590 per kW. This represents a decrease of $780/kW or 33% from the apparent peak in average costs of installed projects in 2009 and 2010. Early indications from a limited sample of projects under construction during report preparation and anticipating completion suggest that capacity-weighted average installed costs will remain similar in 2017 (Wiser & Bolinger, 2017).

By way of further comparison, the costs of wind energy facilities recently completed by affiliates of the Applicant in Texas and Oklahoma averaged around $[redacted] per kW. These costs are not substantially different from the average cost estimated for the Facility.

(3) Present Worth and Annualized Capital Costs

Capital costs will include development costs, construction design and planning, equipment costs, and construction costs. The costs will be incurred within a year or two of start of construction. Therefore, a present worth analysis is essentially the same as the costs presented in Section 4906-4-06(B)(1) of this Application.

As alternative project areas and facilities were not considered in this Application, the capital cost information in this section is limited to the proposed Facility.

(C) OPERATION AND MAINTENANCE EXPENSES

(1) Estimated Annual Operation and Maintenance Expenses

For the first two years of commercial operation, staffing is estimated to be $[redacted] per year and maintenance is estimated at $[redacted] per year.

(2) Operation and Maintenance Cost Comparisons

Operations and maintenance costs are a significant component of the overall cost of wind projects, but can vary widely between facilities. The Berkeley National Laboratory has compiled O&M cost data for 159 installed wind power projects in the United States, totaling 13,120 MW of capacity, with commercial operation dates of 1982 through 2015. The data exhibit considerable spread, demonstrating that O&M costs are far from uniform across projects. In general, facilities installed more recently have incurred lower O&M costs. Specifically, capacity-weighted average O&M costs for projects constructed in the 1980s equal $69/kW-year. The O&M costs dropped to $57/kW-year for projects installed in the 1990s, to $28/kW-year for projects installed in the 2000s, and to $27/kW-year for projects installed since 2010. This decrease in O&M costs is likely due to a combination of factors. O&M costs generally increase as turbines age and manufacturer warranties expire. Furthermore, many of the projects installed in the 2000s may still be within the manufacturers' warranty, and the relatively low costs reported may not include the costs of the turbine warranty. It has also been suggested that the larger, more sophisticated designs used at modern wind energy facilities may experience lower overall O&M costs on a per kW-year basis when compared to older turbine models (Wiser & Bolinger, 2017).

The O&M costs for the Facility are estimated to be approximately $[redacted]/kW-year, depending on the maturity of the project in a given year of its life cycle. These estimated O&M costs exclude any other ongoing expenses related to environmental monitoring, property taxes, land royalties, reverse power, and insurance. These costs will be consistent with the average costs compiled by NREL, as described above. The O&M costs for the Facility will be consistent with O&M costs at other wind energy facilities operated by affiliates of the Applicant, which ranged from approximately $[redacted] to $[redacted] per kW-year in 2016.

(3) Present Worth and Annualized Operation and Maintenance

The annual operation and maintenance costs itemized in Section 4906-4-06(C)(1) will be subject to real and inflationary increases. Therefore, these costs are expected to increase with inflation after the first two years.

Assuming a 25-year project life, an inflation rate of 2.25%, and a 9% discount rate, the pre-tax Net Present Value of the operation and maintenance costs is approximately $[redacted] million. As alternative project areas and facilities were not considered in this Certificate Application, the operation and maintenance cost information in this section is limited to the Facility.

(D) COST OF DELAYS

The monthly delay costs would depend on various factors. If the delay were to occur in the permitting stage, the losses would be associated with the time value of money resulting from a delay in the timing of revenue payments. This is estimated to be about $[redacted] per month. If the delay were to occur during construction, the costs would include lost construction days and the costs associated with idle crews and equipment. This is estimated to be approximately $[redacted] to $[redacted] per month.

There could also be penalties associated with failing to meet a delivery deadline under a potential Power Purchase Agreement. In addition, significant losses would be incurred if the delays prevented the Facility from meeting deadlines to qualify for the existing federal Investment Tax Credit. Prorating these delay costs monthly would not be meaningful, as the lost opportunity is triggered at a single deadline and does not accrue over time.

(E) ECONOMIC IMPACT OF THE PROJECT

Information provided in this section was obtained from the Socioeconomic Report, prepared by EDR (see Exhibit G). The proposed Republic Wind Farm is anticipated to have local and statewide economic benefits. Wind power development, like other commercial development projects, can expand the local, regional, and statewide economies through both direct and indirect means. Income generated from direct employment during the construction and operation phases of the wind farm is used to purchase local goods and services, creating a ripple effect throughout the state. The job and economic impacts of the Facility were assessed using the Job and Economic Impact (JEDI) wind model. The JEDI model allows users to estimate exactly the jobs and economic development impacts from wind power generation projects for both the construction and operation phases of a proposed project (NREL, 2017). These economic development impacts include onsite jobs and earnings, economic output from these onsite earnings, local revenue/supply chain jobs and earnings, economic output from these local revenue/supply chain earnings, induced jobs and earnings, and economic output from these induced jobs and earnings (see Part IV of Exhibit G for a description of impacts and indicators). The JEDI model was created by the NREL, a national laboratory of the United States Department of Energy. It then calculates the aforementioned indicators for each level of impact using project-specific data provided by the Applicant and geographically-defined multipliers. These multipliers are produced by IMPLAN Group, LLC using a software/database system called IMPLAN (IMpact analysis for PLANing), a widely-used and widely-accepted general input-output modeling software and data system that tracks unique industry groups in various levels of the regional data (IMPLAN Group, 2018).

(1) Construction and Operation Payroll

Based upon JEDI model computations, it is anticipated that construction of the proposed Facility will directly generate employment of an estimated 166 FTE on-site construction and project development positions for Ohio residents, which will be for Construction and Interconnection Labor and Construction Related Services. The JEDI model estimates in a total of $10.8 million for annual earnings of the 166 on-site construction jobs. Facility construction labor wages for similar construction positions within the Toledo region range from an average of $18.94 per hour for Construction Laborers, $29.59 for Electricians, and $45.86 for Construction Managers (Bureau of Labor Statistics, 2016). Local, regional, and statewide employment during the construction phase will primarily benefit those in the construction trades, including equipment operators, truck drivers, laborers, and electricians. Facility construction will also require workers with specialized skills, such as crane operators, turbine assemblers, specialized excavators, and high voltage electrical workers. It is anticipated that many of the highly-specialized workers will come from outside the area and will remain only for the duration of construction.

Based upon JEDI model computations, the operation and maintenance of the proposed Facility is estimated to generate 12 full-time equivalent onsite jobs with combined estimated annual earnings of approximately $0.8 million. These 12 jobs are anticipated to be comprised of Project Management, Technician, and Administrative personnel. Projected wage rates are projected to be consistent with statewide averages which are estimated to be $18.66 per hour for Payroll and Timekeeping Clerks, $25.22 per hour for Industrial Engineering Technicians, and, $49.61 for Industrial Production Managers (Bureau of Labor Statistics, 2016).

(2) Construction and Operation Employment

Demand for new jobs associated with the Facility will be created during both the initial construction period and the years following construction, in which the Facility is in operation. The money injected into the statewide economy through the creation of these jobs will have long-term, positive impacts on individuals and businesses in Ohio as it ripples through the economy.

Jobs that will be created by the proposed Facility will include workers who will be directly employed to construct and subsequently operate and maintain the wind farm (approximately 166 jobs during construction and 12 jobs during operation). In addition, other jobs will be created that play a supportive role. The increased wealth from jobs and spending will have a ripple effect in the local economy, thereby creating the need for additional jobs in the area, as the wages of the locally based workers go toward the support of household and local businesses.

Turbine manufacturing and supply chain industries could in turn generate an additional 411 jobs across the State of Ohio over the course of Facility construction. In addition, Facility construction could induce demand for 163 jobs statewide through the spending of additional household income. Based on the results of the model, the total impact of potentially 740 new jobs could result in up to $43.1 million of earnings, assuming a 2018 construction schedule and wage rates consistent with statewide averages. Operations and maintenance should also generate new jobs in other sectors of the economy through supply chain impacts and the expenditure of new and/or increased household earnings. Increased employment demand throughout the supply chain is estimated to result in approximately 18 jobs with annual earnings of approximately $1.2 million. In addition, it is estimated that nine jobs with associated annual earnings of $0.5 million will be induced through the increased household spending associated with Facility operations. In total, while in operation, this Facility is estimated to generate demand for 39 jobs per year with annual earnings of approximately $2.5 million. Total economic output could also increase by an estimated $5.9 million as a result of Facility operations and maintenance.

(3) Local Tax Revenues

The proposed Facility will have a significant positive impact on the local tax base, including local school districts and other taxing districts that service the area where the proposed wind farm is to be located. Taxing districts within the Project Area include five municipalities (Adams, Pleasant, Reed, Scipio, and Thompson Townships) in Seneca County and one municipality (York Township) in Sandusky County, along with four school districts (Bellevue City School District, Clyde-Green Springs Exempted Village School District, Old Fort Local School district, Seneca East Local School District) and one school district in Sandusky County (Bellevue City School District).

The amount of the annual service payment depends on the ratio of Ohio-domiciled full-time equivalent employees to total full-time equivalent employees during construction or installation during the preceding tax year. The base payment ranges from $6,000 to $8,000 per MW of nameplate capacity. The county could also require that an additional service payment be made to the county's treasurer. However, in accordance with Section 5727.75 Ohio Revised Code (ORC), the total annual payment cannot exceed $9,000 per MW.

The Applicant anticipates that it will pay real and personal property taxes between the minimum and maximum rate set under Section 5727.75; between $6,000 to $9,000 per MW of nameplate capacity per year during the life of the project. Assuming an aggregate nameplate capacity of 198 MW, the increase in local tax revenues will be between $1.188 million and $1.782 million annually for the Facility. It is important to note that the proposed Facility will make few, if any, demands on local government services. Therefore, payments made to local governments will be net positive gains and represent and important economic benefit to the local area.

(4) Economic Impact on Local Commercial and Industrial Activities

Wind power development can expand the local economy through ripple effects. Ripple effects stem from subsequent expenditures for goods and services made by first-round income from the development. A direct effect or impact arises from the first round of buying and selling. Direct effects include the purchase of inputs from local sources, the spending of income earned by workers, annual labor revenues, and the income effect of taxes. These direct effects can be used to identify additional, subsequent rounds of buying and selling for other sectors and to identify the effect of spending by local households. The indirect effect or impact is the increase in sales of other industry sectors in the region, which include further round-by-round sales. The induced effect or impact is the expenditure generated by increased household income resulting from direct and indirect effects. The total effect or impact is the sum of the direct, indirect, and induced effects.

The proposed Facility will have a beneficial impact on the local economy. In addition to jobs and earnings, the construction of the Facility is expected to have a positive impact on economic output, a measurement of the value of goods and services produced and sold by backward-linked industries. Economic output provides a general measurement of the amount of profit earned by manufacturers, retailers, and service providers connected to a given project. The value of economic output associated with Facility construction is estimated to be $120.3 million. Between workers' additional household income and industries' increased production, the impacts associated with the Facility are likely to be experienced throughout many different sectors of the statewide economy.

(F) PUBLIC RESPONSIBILITY

(1) Public Interaction

The Applicant has and will continue to make general information about wind power and specific information about the proposed Facility available to community members, elected officials, the media, and local civic organizations. Information has been shared through, among other activities, a public meeting in November 2017; official Board of Trustee and Planning Board meetings; presentations to various schools, churches, and clubs; and through the company website. In addition, the Applicant has a local office in Bellevue, Ohio to help with general project development and community outreach. Representatives and corporate staff have been responsive to questions and requests by local media and will continue to be responsive.

The Applicant maintains an informational website for the Facility (http://www.republicwindenergy.com/). This site provides project information, along with news releases and general information about wind power resources and the benefits of wind power. This website will be updated with new information throughout the planning and review process. In addition, Republic Wind staff will continue to be available to interact with the community and public officials during the construction and operation phases of the Facility.

A complaint resolution procedure will be implemented to ensure that any complaints regarding Facility construction or operation are adequately investigated and resolved. A hotline will be setup to receive and formally document all complaints, which will then be investigated by onsite Facility staff. This complaint resolution process will be formalized with OPSB Staff before construction begins. At least seven days prior to the start of construction, the Applicant will notify affected property owners and tenants of the approved Complaint Resolution Plan and other sources of information about the Facility. A draft Complaint Resolution Plan and a sample notification letter are attached hereto as Exhibit U.

(2) Liability Insurance

The Applicant will acquire and maintain throughout the term of the Facility, at its sole cost, insurance against claims and liability for personal injury, death, and property damage arising from operation of the Facility. The insurance policy or policies will insure the Applicant to the extent of their interests. The limits of the insurance policy described will, at a minimum, insure against claims of $1,000,000 per occurrence and $2,000,000 in the aggregate. In addition, Applicant shall acquire and maintain throughout the construction and operation period, at its sole cost, Umbrella Coverage against claims and liability for personal injury, death, and property damage arising from the operation of the Facility. The limits of the excess liability insurance will, at a minimum, insure against claims of $10,000,000 per occurrence and $10,000,000 in the aggregate.

(3) Roads and Bridges

R.C. 5727.75 requires the Applicant to repair and restore roads, bridges, and culverts that become damaged by the Facility and requires posting of a bond in favor of the County Commissioners to ensure funding for such work. The statute also empowers the County Engineer to require the Applicant to enter into an agreement regarding roadway use, commonly referred to as a Road Use Maintenance Agreement (RUMA). It is expected that the Seneca and Sandusky County Engineers will each require a RUMA, which will contractually bind the Applicant to its statutory roadway protection responsibilities.

At this point the Applicant has made the following determinations with respect to roadway improvements and protection, which shall form the basis of the RUMAs or the Applicant's operations if a RUMA is not required:

State and local roads in the vicinity of the Project Area will experience increased traffic during Facility construction due to the delivery of materials and equipment. Information provided in this section was obtained primarily from the Transportation Study prepared by Hull & Associates, Inc. (Hull), attached hereto as Exhibit E. The study identifies a primary and alternate transportation route to the Project Area, and evaluates the existing characteristics of the roadways and bridges, describes the anticipated impacts to roads and bridges from construction vehicles and equipment delivery; and identifies mitigation measures to address identified impacts. Specific to constraints, the Transportation Study identifies roadway limitations for load, pavement width, pavement condition, height, grades, intersection radii, and sharp curve radii. The evaluation also identifies locations where improvements to the road are likely needed to accommodate the size of the delivery and construction vehicles and are depicted in Figures 3 through 24 in Exhibit E. This study will be submitted to the Seneca and Sandusky County Engineers.

Construction/Delivery Vehicles: To deliver the turbine components, concrete, gravel, equipment, and construction workers to each turbine site during the construction of the Facility, the roads will experience increased truck traffic. Construction traffic will consist of standard construction equipment and specialized hauling trucks to deliver the turbine components. Standard construction traffic consists of gravel/dump trucks, concrete trucks, excavation equipment, conventional semi-trailers, transport/tool vehicles and employee vehicles. Delivery of the wind turbine components will utilize oversize flatbed trucks with multiple axels. Oversize trucks are special hauling vehicles with unique lengths, widths, heights, and weights depending on the component being transported. These trucks require particular clearances due to their size and turning radii and will likely require physical modifications to local roadways.

Turbine components and associated vehicles can be classified as follows:

- *Blade Sections:* Blades are transported on trailers with one to three blades per vehicle. Blades typically control the length of the design vehicle, and the radii of the curves that can be navigated along the travel route to the site. Specialized transport vehicles are designed with articulating (manual or self-steering) rear axles to allow maneuverability through curves.

- *Tower Sections:* Towers are typically transported in four to six sections depending on the supplier. Although towers do not generally control design vehicle length, they often determine vertical clearance.
- *Nacelle and Hub:* The turbine nacelle, hub, and related elements are typically the heaviest components transported.
- *Escort Vehicles:* Light trucks with signs and banners that travel immediately in front and/or behind oversized loads to provide warning to motorists of the oversized vehicle.

The transportation provider (i.e., hauling contractor) delivering the turbine components will further evaluate all primary, secondary, and tertiary roadways prior to construction as part of the Special Hauling Permit process or pursuant to any RUMAs. A Special Hauling Permit is required for vehicles and/or loads that exceed the legal maximum dimensions or weights specified by Special Hauling Permit Section of the ODOT. Transportation of the blades, nacelles, and tower sections will require Special Hauling Permits for criteria that exceed state highway limits. Each overweight or oversized vehicle must receive a separate Special Hauling Permit from ODOT for hauling across State Routes and from those counties, townships, and municipalities whose roadways will be affected, as set forth in R.C. 4513.34. Oftentimes Township Officials will "piggyback" their Special Hauling Permits with those issued by the County Engineer. The specifications of the Special Hauling Permit depend on the characteristics of the vehicle, its cargo, and the duration of the delivery schedule. If any vehicle exceeds 120,000 pounds, 14 feet wide, or 14.5 feet in height, a permit via the "super load" process will be required. See Section 4906-4-06(F)(4) below for further discussion on transportation permits.

Delivery Route: A final delivery route has not yet been finalized, but it is likely that delivery of turbine components to the Project Area will be from the northeast by way of Interstate-80/90 (I-80/90; Ohio Turnpike) to State Route 4 or from the northwest by way of I-80/90 to State Route 53, then State Route 20. Within the Project Area, several county and township roads and new gravel access roads will likely be used to deliver components to each turbine site. Prior to construction, such factors as highway limitations (height, width, and weight constraints), planned work schedules for state and local roadways, road widening, intersection improvements, utility relocations, and bridge/culvert reinforcement will be assessed by the selected transportation company.

With regard to bridge impacts, Hull contacted the Ohio Department of Transportation (ODOT) District 2 and District 3 Bridge Engineers to discuss the load capacity of bridges and culverts along the portions of state routes listed above. Both district engineers indicated that there are no "posted" bridge or culvert crossings along these specified routes. A bridge or culvert is "posted" if it does not meet ODOT's loading/inspection requirements. County and Township bridge and culvert impacts will be identified and addressed during the Special Hauling permitting process or pursuant to any RUMAs.

During the Transportation Study, Hull investigated the state routes for height limitations, such as bridges and overpasses. Along the primary route (State Route 4 and State Route 269), there were no overpasses or bridges over the road. Along the alternate route (State Route 53 and State Route 20) there were multiple overpasses. No observations indicated a less-than-legal overhead clearance for these structures. The ODOT Location and Design Manual Figures 302-1E and 302-2E indicate that the minimum vertical clearance for interstate and other freeway bridges is 14.5 feet. If the alternate route is selected, the selected transportation company will investigate the actual vertical clearances at these locations using the selected turbine and component delivery vehicles.

Impacts and Mitigation: Oversized construction vehicles could cause minor delays on public roads in the vicinity of the Facility, but these are unlikely to be significant given the relatively low traffic volume through the area. Most of the impacts will be to transportation infrastructure due to roadway improvements for oversized vehicles. Temporary turn-outs may be installed to allow uninterrupted flow of traffic, and spot radii widening may be used to accommodate the turning radius of over-length vehicles. Overhead utility line re-location projects will be needed in some areas to accommodate over-height vehicles and turning radii. Culvert and/or bridge reinforcement projects are also likely along main delivery routes for heavy vehicles. All such improvements will be first approved by the relevant public authority and identified in any RUMAs or Final Transportation Routing Plan.

There are locations along the identified routes where component delivery vehicles and construction traffic will cross into opposing lanes of traffic. Maintenance of traffic will be addressed with the assistance of law enforcement officers, escorts, and/or flaggers.

Prior to construction, the selected transportation provider will obtain all necessary permits from ODOT and the Sandusky and Seneca County Engineers and any affected Townships (see Section 4906-4-06(F)(4) below for further discussion on transportation permits). All public upgrades that may be required to accommodate construction vehicles will be identified as part of the Final Transportation Routing Plan, or any RUMAs, based on the routes selected. The following mitigation techniques may be utilized to avoid or minimize transportation-related impacts and/or to provide long-term improvement to the local road system:

Insufficient Roadway Width

- Widening roadway width to accommodate construction vehicles.
- Rerouting over-width vehicles to wider roadways.

Insufficient Vertical Clearance

- Temporarily relocating overhead utility lines and poles.
- Permanently relocating overhead utility lines and poles.
- Rerouting over-height vehicles to roadways with sufficient vertical clearance.

Insufficient Cover over Drainage Structures

- Adding temporary gravel.
- Reinforcing structures with bracing.
- Using bridge jumpers to clear structures.
- Replacing structures prior to construction.
- Repairing structures during or after construction if damaged by construction traffic.
- Rerouting heavy-loaded vehicles to avoid structures.

Poor Structure Condition

- Repairing structure prior to construction.
- Replacing structure during or after construction if damaged by construction traffic.
- Using bridge jumpers to clear structures.
- Rerouting heavy-loaded vehicles to avoid structures.

Inadequate Bridge Capacity

- Using bridge jumpers to clear bridges.
- Reinforcing bridge with additional longitudinal or lateral support beams.
- Replacing bridge components that provide insufficient capacity.
- Rerouting heavy-loaded vehicles to avoid bridges.

Insufficient Roadway Geometry

- Constructing appropriate turning radii at intersections where construction traffic is anticipated. This includes clearing and grubbing of existing vegetation, grading of the terrain to accommodate the improvement, extension of existing drainage pipes and/or culverts, re-locating utility poles if necessary, re-establishment of ditch line if necessary, and construction of a suitable roadway surface to carry the construction traffic, based on the existing geotechnical conditions.

- Rerouting over-sized vehicles to avoid insufficient roadway geometry.
- Profile adjustments to roadways with insufficient vertical geometry.

The selected roadways will also be video-documented to establish existing conditions prior to, and after construction. Upon completion of the Facility, Republic Wind will return all roadways to their pre-construction conditions (i.e., the condition of the roadway will be the same or better than it was prior to construction). The process of documenting roadway conditions and restoring impacted roads after construction will be performed in conjunction with local permitting and any RUMAs. In addition, the ODOT may review all bridges to be used for construction during the Special Hauling Permit application process.

Based on information collected during the Transportation Study field investigation, delivery vehicle assumptions, and information available from ODOT, sufficient infrastructure exists via primary and secondary roads to transport the turbine components to the Project Area. A number of intersection radii improvements will be required (see Figures 3 through 24 in Exhibit E). A transportation provider experienced with oversized loads will be engaged to provide a Final Transportation Routing Plan including all primary, secondary, and tertiary roads. The plan will be performed in conjunction with the special hauling permit process for ODOT and County and any Township authorities, as well as any RUMAs, as discussed in Section 4906-4-06(F)(4) below. Construction plans will be prepared for any roadway or intersection improvements in accordance with any RUMAs or the Final Transportation Routing Plan. All temporary improvements will be restored to their pre-construction condition following completion of construction. All work will be coordinated and approved by the appropriate public authority prior to construction.

(4) Transportation Permits/Right of Way Occupancy Permits

Prior to construction, the selected transportation provider will obtain all necessary permits from ODOT, the Sandusky and Seneca County Engineers, and Township officials. It is anticipated that permits will be required for oversized loads, new access points, improving existing roadways, and crossing highways with buried electrical interconnects. To the extent that public roads will be utilized and damaged from actual construction or construction-related traffic, the Applicant will restore the roadway consistent with its R.C. 5727.75 responsibilities, any RUMAs, and permit conditions.

ODOT special hauling permits are required when loads exceed legal dimensions or weights. Transportation of the blades, nacelles, tower sections, and cranes will require special hauling permits for a variety of criteria.

Each vehicle must receive an individual special hauling permit from the ODOT Central Office, as the specifications of the permit depend on the characteristics of the vehicle, its cargo, and duration of the delivery schedule. If any vehicle exceeds 120,000 pounds, 14 feet wide, or 14.5 feet in height, a permit via the "super load" process is required. Table 06-2 presents the criteria for special hauling permits, as well as the approximate dimensions for the project delivery vehicles.

Table 06-2. Criteria for Special Hauling Permits

Vehicle Characteristic	State Highway Limit	State Highway Limit with Special Hauling Permit	Approximate Dimension of Component and Transport Vehicle			
			Blade	Nacelle	Tower Sections	Crane Sections[1]
Width of vehicle, inclusive of load	8.5 feet	None	12 feet	14.1 feet	14.1 feet	unknown
Height of vehicle, inclusive of load	13.5 feet	None	14 feet	15.1 feet	15.1 feet	unknown
Length of vehicle, inclusive of load and bumpers	85 feet	None	209 feet	100 feet	188 feet	unknown
Total Weight of vehicle with 3 or more axels	80,000 pounds	None	79,000 pounds	354,000 pounds	233,000 pounds	unknown
Weight per axel, for 2-axel group	34,000 pounds	Usually 46,000 pounds	unknown	unknown	unknown	unknown

[1] Crane sections are typically designed to be disassembled and transported without super load permits.

Based on the criteria in Table 06-2, both the primary route and alternate route will require special hauling permits based on the height and weight for many components. However, specialized transport vehicles with numerous axels can be used to distribute the weight, minimize the effects to the roadway, and comply with the special hauling permit requirements.

In addition to coordinating with state, county, and township authorities to obtain transportation permits, the Applicant will also coordinate with appropriate authorities for temporary or permanent road closures, lane closures, road access restrictions, and traffic control necessary for construction and operation of the proposed facility. There are locations along the identified routes where component delivery vehicles and construction traffic will cross into opposing lanes of traffic. Maintenance of traffic will be addressed with the assistance of law enforcement officers, escorts, and/or flaggers. The Final Transportation Routing Plan will be provided to the government agencies prior to the start of the Project, and all work will be coordinated and approved by the appropriate regulatory agency prior to construction.

(5) Decommissioning

Megawatt-scale wind turbine generators typically have a life expectancy of 20 to 25 years. The current trend in the wind energy industry has been to replace or "re-power" older wind energy projects by upgrading older equipment with more efficient turbines. However, if not upgraded, or if the turbines are non-operational for an extended period of time (such that there is no expectation of their returning to operation), they will be decommissioned. The Applicant's plan for decommissioning is comprised of two primary components: removal of Facility components/improvements and financial assurance. Each of these is described in additional detail below:

<u>Removal of Facility Improvements</u>

At the termination of the lease, the Applicant will dismantle and remove Facility improvements and other above-ground property owned or installed by Republic Wind. Below-ground structures, such as turbine foundations/footings and buried interconnect lines, will be removed to a minimum depth of 36 inches. Any underground infrastructure installed to a greater depth will remain in place. Republic Wind will re-grade disturbed areas, restoring slopes and contours to their original grade, to the extent possible. Upon request of the landowner, the Applicant may consider allowing roads, foundations, buildings, structures, or other improvements to remain in place. However, Republic Wind will not be obligated to leave any components or improvements and will only consider such action so long as it does not violate any permits or legal requirements.

<u>Financial Assurance</u>

The Applicant will post and maintain a performance bond in an amount equal to the per-turbine decommissioning costs multiplied by the sum of the number of turbines constructed and under construction. The performance bond will ensure the faithful performance of all requirements and reclamation conditions of the most recently filed and approved decommissioning and reclamation plan. At least thirty days prior to the pre-construction conference, the Applicant will provide an estimated timeline for the posting of decommissioning funds based on the construction schedule for each turbine. Prior to commencement of construction, the Applicant will provide a statement from the holder of the performance bond demonstrating that adequate funds have been posted for the scheduled construction. Once the performance bond is provided, the Applicant will maintain such funds or assurance throughout the remainder of the applicable term. Every five years throughout the operational life of the Facility, the Applicant will provide a revised decommissioning plan and a new performance bond, based on updated decommissioning cost estimates.

4906-4-07 COMPLIANCE WITH AIR, WATER, SOLID WASTE, AND AVIATION REGULATIONS

(A) PURPOSE

This section provides data regarding air, water, and solid waste in terms of current site conditions, potential impacts of the proposed facility, and any proposed mitigation measures.

(B) AIR

(1) Preconstruction

(a) *Ambient Air Quality*

The Ohio EPA Division of Air Pollution Control publishes air quality data for the State of Ohio annually. The most recent summary of air quality data available for the state is the *Division of Air Pollution Control 2015 Annual Report* (Ohio EPA, 2016). Included in this report are a summary of 2015 air quality data, a discussion of toxics monitoring projects, and trend studies for selected pollutants. No air monitoring sites are located in Seneca or Sandusky Counties, or in adjacent Crawford, Erie, Hancock, Huron, Ottawa, or Wyandot Counties. Ozone is monitored in adjacent Wood County, and recorded values are among the lowest in the State. There were no violations of National Ambient Air Quality Standards (NAAQSs) reported at monitoring stations in the vicinity of the Project Area (Ohio EPA, 2016).

Air emissions in the area are related primarily to farm operations, vehicular travel, and manufacturing. Vehicles traveling area roads and operating farm equipment produce exhaust emissions, along with dust from unpaved road surfaces and exposed agricultural soils. In addition, routine odors are associated with certain farming practices (e.g., manure-spreading). The greatest sources of manufacturing emissions in the vicinity of the Project Area originate from Materion Brush Inc. in Ottawa County, approximately 18 miles northwest of the proposed Facility; Carmeuse Lime, Inc. – Maple Grove Operations in Seneca County, approximately 4 miles west of the proposed Facility; Martin Marietta Magnesia Specialties, Inc. in Sandusky County, approximately 21 miles northwest of the proposed Facility; Pilkington North America Inc. in Wood County, approximately 35 miles northwest of the proposed Facility; Sunny Farms Landfill in Seneca County, approximately 17 miles southwest of the proposed Facility; Bunge N.A. in Huron County, approximately 2.5 miles northeast of the proposed Facility; and Ventura Sandusky, LLC in Erie County, approximately 13 miles northeast of the proposed Facility (Ohio EPA, 2017a).

(b) *Air Pollution Control Equipment*

Wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, air pollution control equipment is not required for the proposed Facility.

(c) *Air Quality Standards and Limitations*

In accordance with Section 111 of the Clean Air Act Extension of 1970, the EPA established New Source Performance Standards (NSPSs) to regulate emissions of air pollutants from new stationary sources. The OAC does not contain any NSPS regulations for the Project Area beyond those promulgated at the federal level. These standards apply to a variety of facilities including landfills, boilers, cement plants, and electric generating units powered by fossil fuels. Because wind turbines generate electricity without releasing pollutants into the atmosphere, NSPSs do not apply to the proposed Facility.

The Clean Air Act, as amended by the Clean Air Act amendments of 1990, requires the EPA to set NAAQSs (40 CFR part 50) for pollutants considered harmful to public health and the environment. The EPA Office of Air Quality Planning and Standards has set NAAQSs for six principal pollutants, which are called "criteria" pollutants and include carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide. As described above, no air quality monitoring currently occurs in Seneca or Sandusky Counties; however, monitoring occurs in adjacent Wood County. No violations of NAAQSs were reported in the vicinity of the Project Area (Ohio EPA, 2016).

Prevention of Significant Deterioration (PSD) applies to new major sources of pollutants, and/or major modifications at existing sources for pollutants where the source is located in an area in attainment or unclassifiable with the NAAQS. The proposed Facility will not be a major source of any pollutants. Therefore, PSD does not apply.

All new sources of air emissions in Ohio are required to obtain a Permit to Install (PTI) for large (Title V) facilities, or a Permit to Install and Operate (PTIO) for non-Title V facilities. Because wind turbines generate electricity without releasing pollutants into the atmosphere, the proposed Facility will not require a PTI or PTIO.

Administered by the EPA, the Acid Rain Program was established by the Clean Air Act Amendments of 1990 to reduce emission of SO_2 and NO_x through regulatory and market-based approaches. Because wind turbines generate electricity without releasing pollutants into the atmosphere, the proposed Facility will not require an acid rain permit.

(d) *List of Required Air Pollution Permits*

Wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, air pollution permits are not required for the proposed Facility.

(e) *Air Quality Map*

As per OAC paragraph 4906-4-07(B)(1)(e), this requirement does not apply to wind farms.

(f) *Compliance with Permits and Standards*

As indicated above, wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, no air pollution permits are required. However, fugitive dust rules adopted pursuant to the requirements of Chapter 3704, Revised Code, may be applicable. The Applicant will control fugitive dust through the use of several practices, as described below in section 4906-4-07(B)(2).

(2) Plans to Control Air Quality During Site Clearing and Construction

Best management practices will implemented to minimize the amount of dust generated by construction activities, to include minimizing and restoring/stabilizing the extent of exposed/disturbed areas on the site at any one time as soon as possible, applying water or a dust suppressant such as calcium carbonate to suppress dust on unpaved roads (public roads as well as Facility access roads) as needed throughout the duration of construction activities, and temporary paving of certain locations to stabilize dusty surfaces if necessary (e.g., the laydown yards). Temporary paving methods (e.g., oil and stone) will not be applied within or immediately adjacent to sensitive areas, such as streams or wetlands. Any unanticipated construction-related dust problems will be identified and immediately reported to the construction manager and contractor. In addition, all construction vehicles will be maintained in good working condition to minimize emissions from construction related activities.

(3) Plans to Control Air Quality During Facility Operation

As per OAC paragraph 4906-4-07(B)(3), this requirement does not apply to wind farms.

(C) WATER

(1) Preconstruction

(a) *List of Required Permits to Install and Operate the Facility*

Prior to the start of construction, the Applicant will obtain the following permits:

- The Ohio NPDES construction storm water general permit, Ohio EPA Permit No. OHC000004
- An individual permit or nationwide permit under Section 404 of the Clean Water Act, (if necessary as determined after final engineering)
- A Water Quality Certification from the Ohio EPA (if necessary as determined after final engineering)
- An Ohio Isolated Wetland Permit (if necessary as determined after final engineering)
- An Ohio Permit to Install on-site sewage treatment under OAC 3745-42 (if necessary)

(b) *Water Quality Map*

The Facility will not discharge water or waste into streams or water bodies, nor will Facility operation require the use of water for cooling or any other activities. Furthermore, the Facility will add only small areas of impervious surface, which will be dispersed throughout the Project Area, and will have a negligible effect on surface water runoff and groundwater recharge. Therefore, measurable impacts on the quality of surrounding water resources are not anticipated. Since there are no bodies of water likely to be affected by the proposed Facility, the requirements of OAC paragraph 4906-4-07(C)(1)(b) are not applicable to Republic Wind Farm.

(c) *Description of Water Monitoring and Gauging Stations*

As described above in Section 4906-4-07(C)(1)(b), there are no bodies of water likely to be affected by the proposed Facility. Therefore, this section is not applicable.

(d) *Existing Water Quality of Receiving Stream*

The Facility will not discharge water or waste into streams or water bodies. Therefore, there will be no receiving streams and this section is not applicable.

(e) *Water Discharge Permit Application Data*

The Facility will not discharge any water. Therefore, this section is not applicable.

(2) Construction

(a) *Water Quality Map*

As described above in 4906-4-07(C)(1)(b), measurable impacts on the quality of surrounding water resources are not anticipated. Since there are no bodies of water likely to be affected by the proposed Facility, this section is not applicable.

(b) *Quantity/Quality of Construction Runoff*

The proposed Facility will not result in wide-scale conversion of land to impervious surfaces. Tower bases, crane pads, access roads, and the substation in total will add approximately 55.9 acres of impervious surface to the approximately 24,221 acres of leased land (i.e., conversion of approximately 0.2%). Consequently, no significant changes to the rate, make-up, or volume of stormwater runoff are anticipated.

Construction of the proposed Facility could result in certain localized impacts to groundwater. Installation of turbine foundations has the greatest potential for such impacts. Based on the preliminary turbine design information, shallow foundations may be able to support the turbines. Due to the anticipated depth of bedrock in the area, blasting is not anticipated for construction. When required, blasting can generate seismic vibrations, fracture bedrock, and potentially impact localized groundwater levels. However, the turbine setback from residences helps to ensure that private wells would not likely be damaged or suffer reduced well yields, since private wells are typically located within 100 feet of residences. Therefore, construction is not anticipated to physically damage private wells or affect well yields.

In addition to potential impacts to groundwater due to turbine foundation installation, minor impacts could result from other Facility activities. Soil compaction from the use of construction equipment could limit the efficiency of surface water infiltration to groundwater. When soils are compressed, the pore spaces within the soil are decreased, which reduces water percolation. Construction of access roads will result in minor increases in storm water runoff that otherwise would have infiltrated into the ground at the road locations. However, areas so affected will be a miniscule percentage (0.2%) of the ground surface within the leased lands, and will not have a noticeable impact on groundwater recharge.

A final potential impact to groundwater is the possible introduction of pollutants to groundwater from accidental discharge of petroleum or other chemicals during construction. Such discharges could occur in the form of leaks from fuel and hydraulic systems, or as more substantial spills that could occur during refueling of vehicles or due to mechanical failures and other accidents. As described below, a Spill Prevention, Control, and Countermeasure (SPCC) Plan will be prepared that outlines procedures to be implemented to prevent the release of hazardous substances into the environment. In the event of a release, the SPCC Plan discusses how to contain and respond to the release.

(c) *Mitigation*

As described above, groundwater is not expected to be directly encountered, even if blasting is required. However, the construction process could potentially impact groundwater, should excavation or blasting occur below the water table or alter fractures in the rock that carry ground water. Although it is not anticipated, any blasting necessary for construction of wind turbine foundations will be designed with appropriate charge weights and delays to localize bedrock fracturing to the proposed foundation area, thus minimizing the already unlikely chance of impacting water levels in residential wells. Should groundwater be encountered during excavation, water removal shall be conducted in accordance with the following best management practices:

- A sump pit shall be used to trap and filter water for pumping to a suitable discharge point.
- Clean pumped water shall be discharged to a vegetated and stabilized area (or to an appropriately sized level spreader or riprap energy dissipater) to prevent scouring of the receiving area.
- Sediment-laden water shall be pumped through a filter bag or into a sediment trapping device prior to discharge.
- No discharges shall occur directly to a receiving water body.

As mentioned in 4906-4-07(C)(1)(a), the Facility will require a NPDES Construction Storm Water General Permit from the Ohio EPA. This permit is required for all construction sites disturbing 1.0 or more acres of ground. To obtain this permit, the Applicant will develop a SWP3 and file an NOI letter with the Ohio EPA at least 21 days prior to the commencement of construction activities.

The SWP3 will address all minimum components of the NPDES permits and conform to the specifications of the Rainwater and Land Development manual, which describes Ohio's standards for storm water management, land development, and urban stream protection. The SWP3 will identify potential sources of pollution that may reasonably be expected to affect the quality of storm water discharges associated with construction activities. If applicable, the SWP3 will clearly identify all activities that will be authorized under Section 401 of the Clean Water Act. The SWP3 will also outline best management practices that the applicant will implement to reduce pollutants in storm water discharges during construction.

In addition to the SWP3, an SPCC Plan will be prepared in accordance with 40 CFR 112 that outlines procedures to be implemented to prevent the discharge of oil into the environment. Any spills will be reported in accordance with Federal and Ohio EPA Division of Emergency and Remedial Response regulations.

As described below in Section 4906-4-08(E)(2)(c), topsoil removal and de-compaction will occur in agricultural areas, which constitute the majority of the Facility footprint. These practices will also mitigate any potential impacts that soil compaction could have on infiltration of rain and snowmelt, thereby further reducing any potential impact to groundwater recharge. The construction footprint will be minimized by defining/delineating the work area in the field prior to construction and adhering to work area limits during construction. These measures will limit potential impacts of soil compression on normal infiltration rates.

On-site investigations were conducted to establish the locations of streams and wetlands, and Facility components were sited to avoid impacts to these resources to the maximum extent practicable. Impacts to surface waters will be minimized by utilizing existing or narrow crossing locations whenever possible. Horizontal directional drilling (HDD) will be used in some locations to avoid impacting those waterbodies. Equipment restrictions and erosion and sediment control measures will also be utilized to reduce adverse impacts to water quality, surface water hydrology, and aquatic organisms. In addition, vegetation clearing along stream banks and in wetland areas will be kept to an absolute minimum. For more information on mitigation measures to protect wetlands and surface water, see 4906-4-08(B)(2)(b).

These mitigation measures will ensure that impacts to groundwater, surface waters, and wetlands are avoided or minimized to the maximum extent practicable during Facility construction.

(d) *Changes in Flow Patterns and Erosion*

As a result of the limited impacts discussed in 4906-4-07(C)(2)(b) and the mitigation measures discussed above in 4906-4-07(C)(2)(c), changes to flow patterns are not anticipated.

(e) *Equipment for Control of Effluents*

Facility construction will not involve the discharge of effluents into streams or water bodies. Therefore, this section is not applicable.

(3) Operation

(a) *Water Quality Map*

As described above in 4906-4-07(C)(1)(b), measurable impacts on the quality of surrounding water resources are not anticipated. Since there are no bodies of water likely to be affected by the proposed Facility, this section is not applicable.

(b) *Water Pollution Control Equipment and Treatment Processes*

The Facility will not require any water pollution control equipment or treatment processes. As such, this section is not applicable.

(c) *NPDES Permit Schedule*

As mentioned above, Facility construction will require an Ohio NPDES construction storm water general permit, Ohio EPA Permit No. OHC000004. The Applicant anticipates full and complete compliance with this permit. The Notice of Intent (NOI) and associated fee for the Construction Activities General Permit will be filed at least 21 days prior to commencement of construction activities.

(d) *Quantitative Flow Diagram*

As explained in the following sub-sections, flow diagram information is not applicable to the proposed Facility.

(i) Sewage

The O&M building will generate sewage comparable to a typical small business office. These waterborne wastes will be disposed of through use of a septic system, and if necessary, the Applicant will obtain a permit to install on-site sewage treatment under OAC 3745-42. No other Facility components will discharge measurable quantities of wastewater.

(ii) Blow-down

This section is not applicable, as wind turbines do not utilize blow-down equipment.

(iii) Chemical and Additive Processing

This section is not applicable because the Facility will not require the use of chemical and/or additive processing.

(iv) Waste Water Processing

Aside from the sewage discussed above in Section 4906-4-07(C)(3)(d)(i), the Facility will not process or generate waste water. Therefore, this section is not applicable.

(v) Rim-off and Leachates

This section is not applicable because the Facility is not expected to generate any run-off or leachates.

(vi) Oil/Water Separators

This section is not applicable because the Facility will not utilize any oil/water separators.4906

(vii) Run-off from Soil and Other Surfaces

Following completion of construction, temporarily impacted areas will be stabilized and restored to their pre-construction condition. Facility operation will not result in further soil disturbance, aside from occasional repair activities. Therefore, this section is not applicable.

(e) *Water Conservation Practices*

Staff operating out of the O&M building will use water at a rate comparable to a typical small business office. No other Facility components will require measurable quantities of water. Therefore, water conservation practices are not applicable.

The US Department of Energy, Office of Energy Efficiency and Renewable Energy issued a report detailing the water conservation benefits of wind energy as compared to thermoelectric power. According to this report, a 200 MW windfarm such as the proposed Facility will conserve approximately 315 million gallons of water annually because wind-powered electric generation facilities do not use or consume water as do conventional thermal power plants such as coal (NREL, 2006).

(D) SOLID WASTE

(1) Preconstruction

(a) *Nature and Amount of Solid Waste*

The Applicant is not aware of any debris or solid waste within the Project Area.

(b) *Plans for Waste Removal*

No waste removal is necessary or planned for Facility development.

(2) Construction

(a) *Nature and Amounts of Construction Waste*

Facility construction will generate some solid waste, primarily plastic, wood, cardboard and metal packing/packaging materials, construction scrap, and general refuse. The amount of construction waste will be minimal.

(b) *Methods for Storage and Disposal of Construction Waste*

Construction waste will be collected from turbine sites and other Facility work areas and disposed of in dumpsters located at the laydown yards. Where appropriate, construction waste will be sorted for recycling (e.g., corrugated cardboard). A private contractor will empty the dumpsters on an as-needed basis and dispose of the refuse at a licensed solid waste disposal facility. Used oil, used antifreeze, and universal waste will be handled, managed and disposed of in accordance with federal, state and local regulations.

(3) Operation

(a) *Nature and Amounts of Waste*

For the most part, Facility operation will not result in significant generation of debris or solid waste. Waste generated from the O&M facilities could include wood, cardboard, metal packing/packaging materials, used oil, general refuse, universal waste, and used antifreeze. The O&M facility offices will generate solid wastes comparable to a typical small business office.

(b) *Methods for Storage and Disposal of Waste*

The O&M facilities will utilize local solid waste disposal and recycling services. Used oil, used antifreeze, and universal waste will be handled, managed and disposed of in accordance with federal, state and local regulations.

(4) Licenses and Permits

Facility operation will not require acquisition of waste generation, storage, treatment, transportation, and/or disposal licenses or permits.

(E) COMPLIANCE WITH AVIATION REGULATIONS

(1) Aviation Facilities List and Map

Figure 07-1 illustrates all public use airports, helicopter pads, and landing strips within 5 miles of the Project Area. This mapping was developed from ESRI ArcGIS "World Topographic Map" map service at a 1:24,000 scale. There are no known private use airports, helicopter pads, and landing strips or property within or adjacent to the Project Area. The closest known private airport is the Dougherty Airport (1OH2), located on a parcel that is participating in the project, approximately 0.3 mile south of the nearest turbine. The closest private heliport facilities are the Bellevue Hospital Heliport (4OH9) and Tesar Heliport (OI48), both located approximately 1.5 miles from of the Project Area.

The following public use aviation facilities are located within 5 miles of the Project Area:

- Sandusky County Regional Airport (S24) is approximately 4 miles north of the Project Area.
- Bandit Field Airdrome (5D9) is approximately 0.9 mile from the Project Area.

The Applicant has contacted the owners of these aviation facilities to provide notification of the proposed Facility. Copies of these letters are attached hereto in Exhibit V. The Applicant is working with the FAA and ODOT Office of Aviation to ensure there will be no aviation impacts as a result of the Project.

(2) FAA Filing Status and Potential Conflicts

The Federal Aviation Administration (FAA) is the authority in the United States government responsible for regulating all aspects of civil aviation, including issuing determinations on petitions for objects that penetrate the nation's airspace. The FAA conducts aeronautical studies for new structures that will exceed 200 feet in height under the provisions of Title 49 of the U.S. Code, Section 44718, and applicable Title 14 of the Code of Federal Regulations, part 77 and section 4561.32 of the Ohio Revised Code respectively. The FAA can issue two types of determinations, one that identifies a hazard and another that identifies no hazard.

Aeronautical studies for the proposed Facility are currently underway. The Applicant submitted completed Notices of Proposed Construction, Form 7460-1, for each of the 58 proposed turbine sites on November 17, 2017. Upon receipt of these forms, the FAA obstruction group automatically notifies the ODOT Office of Aviation, thereby fulfilling the state permit application requirements as set forth in OAC Section 5501:1. The FAA and ODOT Office of Aviation will evaluate the proposed turbines and determine whether they are in compliance with the standards set forth in 14 CFR Part 77 and the Ohio Revised Code. The FAA receipt for submittal of the Facility's 7460-1 Forms is included in Exhibit V. It is anticipated that the proposed turbines will not exceed obstruction standards and will not be a hazard to air navigation.

Turbines will be marked and/or lit in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting. Because no turbine will be constructed until the respective Determination of No Hazard has been issued, neither construction nor operation of the proposed Facility is expected to create any adverse impacts on the existing air travel network.

4906-4-08 HEALTH AND SAFETY, LAND USE, AND ECOLOGICAL INFORMATION

(A) HEALTH AND SAFETY

(1) Equipment Safety and Reliability

(a) *Major Public Safety Equipment*

Public safety concerns associated with Facility construction include 1) the movement of large construction vehicles, equipment, and materials, 2) falling overhead objects, 3) falls into open excavations, and 4) electrocution. These issues are most relevant to construction personnel who will be working in close proximity to construction equipment and materials and exposed to construction related hazards on a daily basis. The risk of construction-related injury will be minimized through daily safety meetings, regular safety training, and the use of appropriate safety equipment.

The general public could also be exposed to construction-related hazards due to the passage of large construction equipment on area roads and unauthorized access to the work site (on foot, by motor vehicle, ATV, or snowmobile). The latter could result in collision with stockpiled materials (soil, rebar, turbine components), as well as falls into open excavations. To ensure that local first responders are aware of these potential issues, the Applicant will meet with the local emergency service personnel (fire, police, and EMS) to review and discuss the planned construction process. However, because construction activities will adhere to industry safety standards and will occur primarily on private land well removed from adjacent roads and residences, exposure of the general public to construction-related risks/hazard is expected to be very limited.

Wind turbines, due to their height, physical dimensions, and complexity, have the potential to present response difficulties to local emergency service providers and fire departments. Although the turbines contain relatively few flammable components, the presence of electrical generating equipment and electrical cables, along with various oils (lubricating, cooling, and hydraulic) does create the potential for fire or a medical emergency within the tower or the nacelle. This, in combination with the elevated location of the nacelle and the enclosed space of the tower interior makes response to a fire or other emergency difficult, and beyond the capabilities of most local fire departments and emergency service providers. The presence of high voltage electrical equipment also presents potential safety risks to local responders.

All turbines and electrical equipment will be installed according to NFPA 70E code standards prior to being brought on line. This, along with implementation of built-in safety systems, minimizes the chance of fire occurring in the turbines or electrical stations. However, fire at these facilities could result from a lightning strike, short circuit or mechanical failure/malfunction. Any of these occurrences at a turbine would be sensed by the System Control and Data Acquisition system and reported to the Facility control center. Under these conditions, the turbines would automatically shut down and Facility maintenance personnel would respond as appropriate.

Lightning protection systems were first added to rotor blades in the mid-1990s and are now a standard component of modern turbines. These systems rely on lightning receptors and diverter strips in the blades that provide a path for the lightning strike to follow to the grounded tower. Lightning is effectively and safely intercepted at several receptor points, including the outermost blade tip and the blade root surface, and transmitted to the wind turbine's lightning conductive system. The turbines' blade monitoring system provides documentation of all critical lightning events. If a problem is detected, the turbine will shut down automatically, or at a minimum, be inspected to assure that damage has not occurred.

In the unlikely event that a wind turbine were to catch fire, it would typically be allowed to burn itself out while maintenance and fire personnel maintain a safety area around the turbine to protect against the potential for spot ground fires that might start due to sparks or falling material. Power to the circuit of the Facility with the turbine fire is also disconnected. An effective method for extinguishing a turbine fire from the ground does not exist, and the events generally do not last long enough to warrant attempts to extinguish the fire from the air. However, since the public does not have access to the private land on which the turbines are located, risk to public safety during a fire event is essentially non-existent. In addition, transformers at the substation are equipped with a fire suppression system. This system will quickly extinguish any fires that occur at the Project substation.

Generally, any emergency/fire situations at a wind turbine site or substation that are beyond the capabilities of the local service providers will be the responsibility of the Facility owner/operator. Construction and maintenance personnel (and properly trained and equipped regional responders) will be trained and will have the equipment to deal with emergency situations that may occur at the Facility site (e.g., tower rescue, working in confined spaces, high voltage, etc.). Consequently, such an incident would generally not expose local emergency service providers or the general public to any public health or safety risk. The Applicant will include local rescue workers in regular joint training for the emergency procedures specific to the turbine model used for the Facility. This would provide additional trained rescue personnel in the unlikely case of injury or other accident occurring in the turbines.

The turbines proposed for the Facility will utilize appropriate ice detection equipment. For example, systems currently in place monitor the temperature and conditions on the detection unit. If ice starts to form on this unit, it will send a command to the turbine to shut down. Most modern wind turbines also monitor the wind speed to power output ratio. If ice accumulates on the blades, this ratio becomes too high and the turbine will stop itself.

(b) *Equipment Reliability*

Equipment reliability is an important criterion in turbine selection. As described in Section 4906-4-03(B)(1)(a), turbine models that have been determined to be suitable for this site include the Acciona AW132, Vestas V136, and General Electric GE 3.6-137. These turbines are independently certified as meeting international design standards by independent product safety certification organizations such as Germanischer Lloyd and Underwriters Laboratories. These certifications require that the wind turbines have a design life of at least 20 years for the specified wind regime. The wind regime considers factors such as weather extremes, average wind speed, wind gusts, and turbulence intensity. In addition to stringent design standards, turbines are equipped with monitoring equipment that will shut down the turbines in the event of excessive blade vibrations or when wind speeds exceed maximum values. This equipment is regularly maintained on a preventative maintenance schedule to ensure continued operation.

(c) *Generation Equipment Manufacturer's Safety Standards and Setbacks*

Exhibit W consists of safety manuals for the three turbine models under consideration for the proposed Facility, submitted under seal. These manuals address safety measures specific to operations and maintenance employees, such as first aid, protection against falls, and personal protective equipment.

(d) *Measures to Restrict Public Access*

The public does not have access to the private land on which the Facility is located; hence, the public would encounter the proposed Facility only by trespassing. There will be signs at the intersection of public roads and access roads identifying the turbine(s) served by the access road and prohibiting unauthorized entry. If a fence already exists; then a gate will be installed; otherwise access roads will not have gated entrances. The Project substation will be enclosed by a chain link fence. The doors at the base of the turbines are locked to prevent unauthorized access to the interior of the turbines.

(e) *Fire Protection, Safety, and Medical Emergency Plans*

All Facility employees and contractors will be required to adhere to a Health and Safety Policy and Facility Safety Manual, as well an Emergency Action Plan (EAP). Preliminary versions of these documents are attached as Exhibit X and Y, respectively. The final HSP and EAP will be developed with consultation from all necessary local emergency services, including medical facilities. To ensure that local first responders are aware of potential issues, the Applicant will consult with the local emergency service personnel (fire, police, and EMS) to review and discuss the planned construction process. The Applicant will include local rescue workers in regular joint training for the emergency procedures specific to the turbine model used for the Facility. In addition to training, the Applicant will equip fire and emergency responders with proper equipment to enable them to respond to emergency situations.

(2) Probable Impacts due to Failures of Pollution Control Equipment

Wind turbines generate electricity without combusting fuel or releasing pollutants into the atmosphere. Therefore, this section is not applicable.

(3) Noise

Resource Systems Group, Inc. (RSG) was retained by the Applicant to evaluate potential noise impacts from the proposed Facility (see Exhibit H). The study consists of two principal phases: (1) a background sound level survey and (2) a computer modeling analysis of future turbine sound levels. The report also includes a primer on the science of sound, an overview of relevant standards and precedents that apply to the proposed Facility, a discussion of noise issues particular to wind turbines, and an evaluation of construction noise impacts.

The purpose of the background sound level survey was to determine what minimum environmental sound levels are consistently present and available to mask or obscure potential noise from the Facility at locations representative of potentially sensitive receptors close to project turbines. The background sound level survey was performed to determine how much existing natural masking noise there might be at the nearest residences to the project. The relevance of this is that high levels of background noise, such as insects or the rustling of leaves on trees or corn stalks, act to reduce the audibility of the wind farm, while low levels of natural noise would permit operational noise from the turbines to be more readily perceptible. For a broadband noise source such as a wind farm, the audibility and potential impact of the new noise source is a function of how much, if at all, it exceeds the pre-existing background sound level.

An additional factor that is important in establishing the minimum background sound level available to mask potential wind turbine noise is the natural sound generated by the wind itself. The sound from a wind turbine can often be masked by wind noise at downwind receivers because the frequency spectrum from wind is very similar to the frequency spectrum from a wind turbine. In general, wind turbines only operate and produce noise when the wind exceeds a minimum cut-in speed of roughly 3 m/s at hub height. Turbine sound levels increase with wind speed up to about 6 or 7 m/s, when the sound produced generally reaches a maximum and no longer increases because the rotor has reached a predetermined maximum rotational speed. Consequently, at moderate to high wind speeds – when turbine sound levels are most significant – the level of natural masking noise is normally also relatively high due to tree or grass rustle thus reducing the perceptibility of the turbine noise.

Long term sound level monitoring was carried out at the site from February 3 through February 18, 2016 at seven different locations spread across the proposed Project Area. The microphones were mounted on a 1.2-meter (4-foot) tall wooden stakes and covered with a weather resistant windscreen. Temperatures ranged from -2.4° to 60.1° F and maximum wind speeds recorded at four sites ranged from 15.2 to 23.1 mph, with gusts ranging from 24.2 to 30.4 mph. There were two rainy days, February 8th and 15th. Sound level data was collected using either Cesva SC-310, Svantek SV979, or Rion NL-22 sound level meters. All sound level meters logged A-weighted equivalent sound levels once each second. The Cesva and Svantek models are ANSI/IEC Type 1 sound level meters, and also logged 1/3-octave-band spectral sound levels once each second. The Rion model is an ANSI/IEC Type 2 sound level meter. Real time audio recorded continuously at each location using the signal acquired by the sound level meter microphone. The Svantek SV979 meters recorded WAV audio internally. The analog signal from each of the other meters was input to an external digital audio recorder.

Data was summarized into 10-minute periods. All periods that contained precipitation, wind speeds above 11 mph, temperatures below 14° F, anomalous sound sources, seasonal sound sources, and readily noticeable sounds that were due to interaction of animals or humans with the sound monitors were eliminated during post-processing.

The meters continuously recorded a number of statistical parameters, such as the average (Leq), minimum (Lmin), maximum (Lmax), and various percentile sound levels (L90, L50, L10). Of these, Leq and L90 levels are the most meaningful. The Leq is literally the average sound level over each measurement interval. Since Leq describes the average pressure, loud and infrequent noises have a greater effect on the resulting level than quieter and more frequent noises. Because it tends to weight the higher sound levels and is representative of sound that takes place over time, the Leq is the most commonly used descriptor in noise standards and regulations. The L90, or residual sound level, is commonly used to conservatively quantify background sound levels. The L90 is the sound level exceeded during 90% of the measurement interval (i.e., it is louder than the L90 level most [90%] of the time). This measure has the quality of filtering out relatively loud, sporadic, short-duration noise events thereby capturing the quiet lulls between such events. It is this consistently present, near-minimum "background" level that forms a conservative basis for evaluating the audibility of a new source. The L10 is the sound level that is exceeded 10 percent of the time, while the L50 is the median sound level, or the sound level exceeded 50% of the time.

The overall average nighttime Leq sound for the seven measurement positions was 41 dBA, and the daytime average was 45 dBA. In all cases the nighttime Leq levels are less than or equal to the daytime Leq levels, which is typical. There is also a generally large spread between the Leq and L90 values, indicating that the soundscapes at most sites are dominated by intermittent sounds (such as cars driving nearby and airplanes flying overhead) instead of constant sound sources (such as streams and distant traffic). The nighttime and daytime sound are summarized below in Table 08-1.

Table 08-1. Sound Monitoring Summary

Monitoring Location	Sound Level (dBA)							
	Night				Day			
	Leq	L90	L50	L10	Leq	L90	L50	L10
Agricultural Operations	40	24	30	41	44	29	37	47
Busy Roadway	47	24	33	49	52	32	42	55
Mixed Residential	51	27	34	46	51	31	37	47
North Boundary	44	25	31	41	48	28	34	42
Remote Rural	39	21	30	40	43	26	34	45
Southern Boundary	34	17	28	37	38	23	32	39
Wooded Area	32	21	27	35	37	25	31	39

Source: RSG, 2017.

(a) *Construction Noise Levels at the Nearest Property Boundary*

Noise from construction activities associated with the Facility is likely to temporarily constitute a moderate unavoidable impact at some of the homes in the vicinity of the Project Area. The sound levels resulting from construction activities vary significantly depending on several factors such as the type and age of equipment, the specific equipment manufacture and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers. The development of the Facility will involve construction to establish access roads, excavate and form wind turbine foundations, preparation of the site for crane-lifting, and wind turbine assembly and commissioning.

In general, the maximum potential noise impact at any single residence might be analogous to a few days to a few weeks of repair or repaving work occurring on a nearby road or to the sound of machinery operating on a nearby farm. More commonly (at houses that are some distance away), the sounds from project construction are likely to be faintly perceived as the far-off noise of diesel-powered earthmoving equipment characterized by such things as irregular engine revs, back up alarms, gravel dumping, and the clanking of metal tracks. According to the geotechnical desktop review (Hull, 2017b), excavation within bedrock may be necessary to install foundations in the eastern portion of the Project Area. Therefore, the need for blasting, rock breaking/hammering, and/or pile driving may arise during construction. It is expected that any such activities would occur intermittently and only for limited periods of time. Furthermore, the location of such activities, if needed, would not be widespread (i.e., would most likely be confined to limited areas). Prior to construction, initial geotechnical investigation and test borings will be conducted to confirm/refine the information presented in Exhibit F, and to facilitate final foundation design and engineering. The locations of test borings will be at appropriate turbine sites, as determined necessary by the geotechnical engineer. The borings will extend to the proposed depth or competent bedrock, whichever is encountered first (Hull, 2017b).

Construction of the Facility is anticipated to consist of the following four phases:

- Site clearing: The initial phase includes establishing temporary site offices, workshops, stores, and other on-site facilities. Installation of erosion and sedimentation control measures, as well as the preparation of initial haulage routes.
- Excavation: This phase includes the excavation and formation of access roads, preparation of laydown areas, and excavation for the concrete turbine foundations.
- Foundation work: This phase consists of construction of the reinforced concrete turbine foundations and installation of the electrical interconnection network. As indicated above, excavation within bedrock may be necessary to install foundations in the eastern portion of the Site. Construction methods in such areas could include rock breaking/hammering, pile driving, and/or blasting.
- Wind Turbine installation: Delivery of the turbine components, followed by their installation and commissioning.

- Restoration: Once construction is complete, temporarily disturbed areas will be restored and returned to their approximate pre-construction contours. Exposed soils will be stabilized by seeding, mulching, and/or agricultural planting.

As required by rule 4906-4-08(A)(3)(a)(i) through (vi), the individual pieces of equipment likely to be used for each of these phases and noise levels at 50 feet (near) and 1,457 feet (far), which is the closest distance between a turbine site and non-participating residence, are summarized below in Table 08-2. The expected construction noise levels at the nearest property boundary will be variable, given the varying distances between the turbine sites and property lines. As currently sited, the distance between proposed turbines and the nearest non-participating property line ranges from 548 feet to 2,078 feet, and averages 1,043 feet. Construction noise levels at property lines are expected to be within the range of sound levels presented in Table 08-2.

Table 08-2. Maximum Sound Levels from Various Construction Equipment

Equipment	Maximum Sound Pressure Level at 50 feet (dBA)	Maximum Sound Pressure Level at 1,457 feet (dBA)
M-250 Liftcrane	83	48
2250 S3 Liftcrane	78	43
Excavator	83	51
Dump truck being loaded	86	54
Dump truck at 25 mph accelerating	76	44
Tractor trailer at 25 mph accelerating	80	49
Concrete truck	81	46
Bulldozer	85	50
Rock drill	100	62
Loader	80	42
Backhoe	80	45
Wood chipper	96	64

Source: RSG, 2017.

The values in Table 08-2 generally indicate that sound levels ranging from 76 to 100 dBA might temporarily occur at property boundaries, which is within the OSHA permissible daily noise exposure limits for two hours per day (29 CFR §1910.95). Such levels would not generally be considered desirable on a permanent basis or outside of normal daytime working hours, but as a temporary, daytime occurrence, construction noise of this magnitude may well go unnoticed by many in the vicinity of the

Project Area. This is especially true in agricultural areas, where the sounds of tractors, trucks, and other agricultural machinery are commonplace.

Sounds generated by construction activities are typically exempt from state and local noise oversight provided that they occur within weekday, daytime periods as may be specified under local zoning or legal codes. All reasonable efforts will be made to minimize the impact of noise resulting from construction activities. When construction scheduling is finalized, the construction engineer will notify the community via public notice (or similar method) of expected Project construction commencement and duration to help minimize the effects of construction noise. In addition, the location of stationary equipment and the siting of potential construction laydown areas have been carefully selected to be as far removed from existing noise sensitives areas as is practical.

As currently sited, the distance between proposed turbines and the nearest non-participating residential structure ranges from 1,457 feet to 2,692 feet, and averages 1,699 feet. However, there may be some cases where access road construction or trenching operations occur closer to homes, which could result in higher sound levels if this work occurs very close to residences. In such cases, every effort will be made to give affected residents advanced notice about when this kind of work will be occurring and how long it is expected to last.

Increased traffic will be generated throughout the construction period with personnel, equipment, and materials deliveries. The volume, vehicle type, and roadways utilized will be dependent on the construction activities taking place or scheduled to occur. According to the Transportation Study prepared in support of the Facility, construction traffic will consist of standard construction equipment including dump trucks, concrete trucks, semi-trailers, and pick-up trucks, as well as specialized hauling trucks for delivery of turbine components. All component delivery traffic is currently assumed to enter the Project Area from the north. The specialized hauling trucks will use over-size/over-weight trucks to bring the components from the manufacturer to the Project Area (Hull, 2017a).

Nearly all vehicle traffic produces noise. However, the source and magnitude of the noise may vary significantly due to several factors including road grade, vehicle type, and speed. Typical noise levels for passenger vehicles traveling 55 mph are 72 to 74 dBA at 50 feet. Comparatively, noise levels for heavy trucks traveling 55 mph range from 84 to 86 dBA at 50 feet. Of the construction traffic generated, approximately 50 percent is expected to be heavy vehicles based on construction of similar wind energy facilities. The greatest impact in traffic noise will be on roadways that are expected to have their peak average daily traffic volumes increase by more than a factor of two, which is equivalent to a 3 dBA increase in the hourly Leq sound level. This scenario is expected to be limited to relatively isolated roadways with low existing traffic volumes. For all other access routes, construction of the Project is unlikely to cause increases in the existing traffic in excess of 3 dBA.

Major construction work, such as clearing for the access roads and any drilling and blasting, will occur during the day. Some construction activity such as extended concrete pours, blade lifts, and minor construction work may extend earlier or later. Work on the turbine sites will be at least one-quarter mile from the nearest residence. Due to the distances between residences and construction locations, the time-of-day restrictions on drilling and blasting, and the limited duration of construction, construction noise will not create and undue adverse impact (RSG, 2017).

(b) *Operational Noise Levels at the Nearest Property Boundary*

(i) Operational Noise from Generation Equipment

In the absence of any specific local or federal noise regulations, the Facility's potential noise impact will be compared to reactions observed at operational wind projects in similar settings and evaluated in accordance with OPSB precedent on other approved wind projects in the State, such as the noise conditions imposed under the Timber Road II and Greenwich Wind Park project. Those projects include a Facility-related noise limitation at non-participating residences of 5 dBA over the nighttime average Leq background level (unless the validly measured ambient Leq at the location of the complaint plus 5 dBA is greater). Since the measured average nighttime Leq sound in the Project Area was 41 dBA, it is anticipated that that OPSB would impose a threshold of 46 dBA for Facility noise at non-participating residences.

The starting point for any wind turbine noise modeling study is the sound level, or more specifically, the sound power level, of the turbine model. A manufacturer of a wind turbine must test and report sound emissions from its turbines using two international standards:

1. International Electrotechnical Commission standard IEC 61400-11:2002(E), "Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques"
2. International Electrotechnical Commission standard IEC 61400-14:2005(E), "Wind Turbine Generator Systems – Part 14: Declaration of Apparent Sound Power Level and Tonality Values"

These standards provide sound power emission levels from a turbine, by wind speed and frequency. They also provide a confidence interval. Since the specific make and model of turbine to be installed in the Project Area has not yet been determined, the sound characteristics of all turbines under consideration were reviewed. Sound propagation modeling was performed for each of three turbine models (Acciona AW132, Vestas V136 3.45 MW, and GE 3.6-137) at all 58 turbine locations. The Vestas V136-3.45 MW was modeled at three different hub heights (82 meters, 105 meters, and 112 meters). The Acciona AW132 was modeled at an 84-meter hub height and the GE 3.6-137 was modeled at a 110-meter hub height.

Modeling for the project was completed using the International Standards Organization ISO 9613-2 standard, "Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation." The ISO standard states,

> *"This part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level … under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation … or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night."*

The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain. Model input data is provided in Appendix B of Exhibit H. The ISO standard was implemented in the Cadna A acoustical modeling software. Made by Datakustik GmbH, Cadna A is an internationally accepted acoustical model, used by many other noise control professionals in the United States and abroad. Standard modeling methodology takes into account moderate nighttime inversions or moderate downwind conditions. In the RSG study, sound propagation was modeled in accordance with ISO 9613-2 with spectral ground attenuation, mixed ground (G=0.5[6]), a 2 dB uncertainty factor added to the manufacturer-published wind turbine apparent sound power, and foliage was not modeled. These model parameters have been shown to yield conservative results for wind turbine noise. Results calculated with these parameters represent the highest one-hour equivalent sound level that will be emitted by the Project. A 40-meter by 40-meter grid of receivers

[6] The ground absorption coefficient (from ISO 9613-2) ranges from 0 for water or hard concrete surfaces to 1 for absorptive surfaces such as farm fields, woods, or sand. Consequently, a ground absorption coefficient on the order of 0.8 or 0.9 could be justified here. However, a value of 0.5 has been used to present worst-case impacts.

was set up in the model covering 186 square miles around the proposed Facility. In addition, 3,325 discrete receivers were modeled at residences and other sensitive locations. A receiver is a point above the ground at which the computer model calculates a sound level. The coordinates for each receiver are provided in Appendix C of Exhibit H.

Where initial modeling showed that sound levels could exceed the Facility's 46 dBA noise limit at non-participating residences, nearby turbines were placed into noise reduced operations (NROs)[7]. Sound propagation modeling results with select turbines placed in NRO are illustrated in Exhibit H. See Figure 42 for the Acciona AW132, Figure 43 for the Vestas V136 3.6 MW, and Figure 4 for the GE 3.6-137. For the GE turbine, the NRO mode listed is the integer reduction in turbine sound power level in decibels, so "NRO 1" is a sound power reduction of 1 dB. The Vestas turbines have four NRO modes reported by the manufacturer (Mode 1 through Mode 4) which are used for modeling and the Gamesa G132 3.465 MW has five specific noise modes reported by the manufacturer (NL 1 through NL 5). These do not necessarily correspond to whole-number sound power level reductions.

Project-only sound levels in each of these mitigated scenarios do not exceed 46 dBA at any non-participating residence, which is at or below the nighttime background Leq plus 5 dB. Note that particular turbine locations that are in NRO may change due to the final number of turbines built, and changes in manufacturer-published turbine sound emissions data. Also, specific NRO plans may include provisions for different NRO settings to be used depending on the time of day and meteorological conditions.

(ii) Processing Equipment

There is no processing equipment associated with this Facility. Therefore, this section is not applicable.

(iii) Associated Road Traffic

Transportation noise during Facility construction is addressed above in Section 4906-4-08(3)(a). Once operational, the proposed Facility will not significantly contribute to traffic on local roads. Post-construction traffic will be associated with operations personnel traveling to and from the O&M building and wind turbine sites. Routine maintenance will typically be required on a quarterly basis

[7] Noise Reduced Operations modes are turbine modes that reduce the maximum sound power emissions of turbines. This is typically accomplished through slowing down the rotational speed of the turbine's rotor.

at each wind turbine, as well as at the collection substation. These service visits will usually involve one or two pick-up trucks. Therefore, significant impacts from traffic noise are not anticipated.

(c) *Location of Noise-Sensitive Areas within One-Mile of the Facility*

The predicted sound contour plots in Exhibit H depict residential structures within one mile of the proposed Facility. There are no schools, libraries, nursing homes, or hospitals within one mile of the proposed turbines. However, several churches are located within one mile of the Facility: Ebenezer United Methodist Church, Zion Lutheran Church, and York Free Chapel. In addition, two sites listed by the National Register of Historic Places (NRHP) (Heter Farm and Henny Barn), one NRHP-eligible site (0.05 mile south of State Route 18), three wildlife management areas (Knobbys Prairie WMA, Wildlife Production Area 47 WMA, and Wildlife Production Area 62 WMA), and the North Coast Inland Trail are within one mile of the proposed Facility. Adverse impact to noise-sensitive areas from Facility-related sound is not anticipated (i.e., Project-only sound levels will not exceed 46 dBA at these sites). See Section 4906-4-08(D)(3) of this Application for additional information on impacts to recreational areas.

(d) *Mitigation of Noise Emissions during Construction and Operation*

Over the last decade, the wind industry has invested heavily in reducing turbine noise through improvements in turbine technology, engineering, and insulation. According to a 2006 report prepared by the Renewable Energy Research Laboratory, sound levels emitted by wind turbines have decreased as technology has advanced. Improvements in blade airfoil efficiency have resulted in more wind energy being converted into rotational energy, and less into acoustic energy. Vibration dampening and improved mechanical design have also significantly reduced noise from mechanical sources. Furthermore, aerodynamic sound generation is very sensitive to speed at the blade tips. Modern variable speed wind turbines, like those proposed for the Facility, rotate at slower speeds in low winds, increasing in higher winds. This results in quieter operation in low winds when compared to older, constant speed wind turbines (Rogers et al., 2006). These findings are consistent with a recent U.S. Department of Energy Report (2008), which found "advances in engineering and insulation ensure that modern turbines are relatively quiet; concerns about sound are primarily associated with older technology, such as the turbines of the 1980s, which were considerably louder."

Although residential sound impacts are anticipated to be minor, additional mitigation measures will include the following:

- Implementing best management practices for sound abatement during construction, including use of appropriate mufflers, proper vehicle maintenance, and limiting hours of construction to normal working hours, unless there is a compelling reason to work beyond those hours.
- Notifying landowners of certain construction sound impacts in advance, e.g., if blasting becomes necessary.
- The highest possible sound levels produced by the proposed wind turbine models were used for modeling, when the turbine will not actually produce such high levels during many operating conditions (i.e., sound levels will often be lower than those presented herein, which represent the worst-case scenario).
- Noise levels at many locations would be lower than those modeled and presented herein. As necessary to keep Facility-related sound levels below the anticipated 46 dBA limit, a subset of the turbines will be operated in one of several low noise modes during nighttime hours, as indicated on Figures 42 through 44 in Exhibit H.

In addition, if adverse noise impacts are identified from wind turbine operations, a reasonable complaint resolution procedure will be implemented to ensure that any complaints regarding construction or operational sound are adequately investigated and resolved. A hotline will be setup to receive and formally document all noise complaints, which will then be investigated by onsite Facility staff. A draft Complaint Resolution Plan is attached hereto as Exhibit U.

(e) *Pre-construction Background Noise Study*

A pre-construction noise analysis will be conducted to determine the Facility-related sound levels based on the final turbine model selected, and the associated turbine sites.

(4) Water Impacts

Hull & Associates, Inc. (Hull, 2017b) conducted a desktop review of available hydrogeology and geotechnical information for the proposed Facility, attached as Exhibit F. Information was summarized from available on-line databases and/or documents produced by the following federal, state, and local agencies: the Federal Emergency Management Administration (FEMA); the USGS; the USDA Soil Conservation Service Soil Survey of Seneca and Sandusky Counties; the ODOT District 2; the Seneca and Sandusky County Engineers and Health Departments; the Ohio EPA; the ODA; the Ohio Department of Natural Resources (ODNR); and the Ohio State University Agricultural Extension Office. In addition, Hull mailed a brief well survey to landowners that were under contract with the Applicant as of April 2016. The survey included questions regarding the owner, address, and the number, depth, installation date, and construction of water wells on the subject property. Additional information was requested regarding the aquifer type, depth to water, and yield of each well. The survey also requested information regarding problems with the wells, if any, encountered by the property owners.

(a) *Impacts to Public and Private Water Supplies from Construction and Operation*

In general, the Project Area lies within rural areas of Seneca and Sandusky Counties. The Facility is located within a rural area. Consequently, the majority of residents in the vicinity of the Project Area rely upon private wells for their potable water. Several source water protection areas (SWPAs) are located within the Project Area, in Seneca and Sandusky Counties. Construction of the proposed Facility will not constitute an activity that would be restricted within either a surface water or groundwater SWPA (see further discussion below in Section 4906-4-08(A)(4)(d). The principal source of groundwater in the Project Area is a carbonate limestone bedrock aquifer. Figure 7 in Exhibit F depicts aquifers, along with well locations compiled from information provided by ODNR, Ohio EPA, and the Seneca and Sandusky County Health Departments. It should be noted that Hull (2017b) has not reviewed specific information such as depth, boring logs, or construction associated with any of the wells depicted on Figure 7 in Exhibit F, nor has there been any attempt to differentiate whether the private wells were installed within the carbonate aquifer, the unconsolidated aquifers, or another aquifer.

Hull received completed well surveys from 79 of the 134 property owners to which the surveys were mailed (59%). The 79 respondents indicated that a total of 86 water wells existed on their collective properties. Nineteen respondents indicated that there were no wells on their property, while 41 stated that they had one well. Nineteen respondents reported that they had multiple wells, including fifteen properties with two wells, two properties with three wells, one property with four wells, and one property with five wells. All respondents reported that their wells were used for potable water, or general domestic purposes. Several property owners also stated that their wells were used for agricultural purposes. Five respondents indicated that their properties were connected to a municipal water supply. Approximately half of the respondents were able to provide information regarding the total depth and diameter of their wells, stating total depths ranging between 18 and 160 feet. The majority of drilled well diameters is six inches, with a range between three to ten inches. Several dug wells were reported as four to five feet in diameter. Steel casing was generally listed as the construction material, with a lesser number of wells constructed of PVC and brick/clay.

Well installation dates ranged between 1850 and 2011. Thirty-four respondents were able to provide the aquifer source of their well. Of these, 30 respondents indicated that their well was completed in an unspecified bedrock, while four respondents indicated their well was set in a limestone bedrock. Twenty-two respondents were unaware of what formation their well was set in and seven respondents indicated that their well was set in sand and gravel formations. Reported depths to water varied between 8 and 100 feet, and well yields ranged from 4 to 50 gallons per minute. Five property owners indicated that they had had a new well installed. The reasoning for three of these well replacements was turbid water. For the other two respondents, one well was re-drilled because of poor water quality and the other well was replaced because the water table dropped.

Based on the requirements of OAC Section 4906-4-08(C)(2)(b) and the dimensions of the proposed turbines, setbacks from non-participating property line must be at least 1,350 feet, based on the longest rotor blades under consideration for the Facility[8]. All turbine locations will comply with these setbacks. As currently sited, the distance between proposed turbines and the nearest non-participating property line ranges from 548 feet to 2,078 feet, and averages 1,043 feet. In addition, the distance between proposed turbines and the nearest non-participating residence ranges from 1,457 feet to 2,692 feet, and averages 1,699 feet. Although the exact location of each potable use well cannot be determined with the information obtained to date, it is assumed that the potable wells are located in close proximity to each property owners' residence. Due to the distance between residences and construction activities at proposed turbine sites, this setback will protect wells from any significant negative impact. Therefore, no impact to public or private water supplies is anticipated from the construction or operation of the proposed Facility (Hull, 2017b).

(b) *Impacts to Public and Private Water Supplies from Pollution Control Equipment Failures*

Wind turbines generate electricity without combusting fuel or releasing pollutants into the atmosphere. Therefore, this section is not applicable.

(c) *Water Resources Map*

Figure 08-1 depicts existing aquifers, water wells, and drinking water source protection areas that may be directly affected by the proposed Facility. The water resources mapping was developed from publicly available data from the Ohio EPA (2017b).

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[8] According to 4906-4-08(C)(2)(b), "The wind turbine shall be at least one thousand, one hundred, twenty-five feet in horizontal distance from the tip of the turbine's nearest blade at ninety degrees to the property line of the nearest adjacent property at the time of the certification application." Of the turbine models under consideration for the proposed Facility, the GE 3.6-137 has the largest rotor diameter at 449 feet (137 meters), meaning the turbine's blade would extend out 249.5 feet when at ninety degrees. 1,125 feet + 250 feet = 1,350 feet.

(d) *Compliance with Local Water Source Protection Plans*

Ohio's Source Water Assessment and Protection Program, also known as "Wellhead Protection" and "Drinking Water Source Protection", assists communities with protecting their sources of drinking water (streams, rivers, lakes, reservoirs, and aquifers) from contamination. SWPAs as defined and approved by Ohio EPA for the protection of drinking water sources were also evaluated during the Groundwater Hydrogeological and Geotechnical Desktop Document Review Summary Report prepared by Hull (see Exhibit F). Environmental regulatory programs within the Ohio EPA, as well as other regulatory agencies such as the Ohio Bureau of Underground Storage Regulations, have adopted regulations that restrict specific activities within SWPAs. These activities include concentrated animal feeding operations, sanitary, industrial or residual waste landfills, land application of biosolids, and voluntary brownfield cleanups. The restrictions typically apply to SWPAs relying on groundwater as their drinking water source. Figure 7 in Exhibit F shows the estimated one-year and five-year time of travel distances from the respective supply wells.

Numerous SWPAs have been established in Seneca and Sandusky Counties. A ground water protection area is located on the northeastern portion of the Project Area (Capital Aluminum and Glass SWPA, Figure 7 in Exhibit F), protecting the groundwater associated with the karst formations of the Columbus Limestone. Twenty-two (22) turbines are located inside the Capital Aluminum and Glass SWPA. Due to the high groundwater flow rates (3,500 - 8,600 feet per day) and a relatively high vulnerability (shallow depth to bedrock, sinkholes and rapid flow of groundwater), the Ohio EPA delineated the entire region contributing water via the karst system as a SWPA. The Capital Aluminum and Glass SWPA is a non-transient, non-community public water system located near Bellevue. The system operates one well and pumps approximately 2,600 gallons per day from the carbonate bedrock aquifer.

Additionally, there are two Inland Surface Water Protection Areas located in the central (City of Clyde) and northwestern (City of Fremont) portion of the Project Area, as presented in Figure 7 of Exhibit F and Figure 08-1 of this Application. The Clyde City Inland Surface Water Protection Area encompasses Beaver Creek, which serves as the surface water source for the City of Clyde. Beaver Creek is approximately 3.6 miles long and has a drainage area of 49.8 square miles, it flows into Green Creek before discharging into the Sandusky River. The protection area covers approximately 44.3 square miles, 25 of the turbines are located within the Surface Water Protection Area.

The City of Fremont Inland Surface Water Protection Area encompasses the Sandusky River, which serves as the surface water source for the City of Fremont. The Sandusky River is approximately 130.2

miles long and has a drainage area of 1,420 square miles. The Sandusky River flows into Sandusky Bay, Lake Erie. The water system intake is located approximately 18.02 miles from the mouth of the Sandusky Bay. The protection area covers approximately 1,256 square miles, 21 turbines are located within the Surface Water Protection Area.

Hull (2017b) has reviewed the range of programs which have adopted rules related to the presence of SWPAs and have concluded that construction of the proposed wind turbine facility will not constitute an activity that would be restricted within either a surface water or groundwater SWPA.

(e) *Prospects of Floods in the Area*

A floodplain is flat land adjacent to a stream or river that experiences occasional or periodic flooding. For regulatory purposes, the floodplain is divided into two areas, based on water velocity: the floodway and the flood fringe. The floodway includes the channel and the portion of the adjacent floodplain required to pass the 100-year flood without increasing flood heights. Typically, this is the most hazardous portion of the floodplain where the fastest flow of water occurs. Due to the high degree of hazard, most floodplain regulations require that proposed floodway developments do not block the free flow of flood water, as this could dangerously increase that water's depth and velocity. The flood fringe is the remaining portion of the floodplain, outside of the floodway, that usually contains slow-moving or standing water. Development in the fringe will not normally interfere as much with the flow of water. Therefore, floodplain regulations for the flood fringe typically allow development to occur but require protection from floodwaters through flood proofing so that water cannot enter the structure (ODNR, 2017a).

Surface water flow within the Project Area is generally to the northwest. The entire Project Area is located within the Lake Erie Drainage Basin. Surface water bodies present within the Project Area include several small streams, ditches, ponds, and above ground reservoirs. The streams generally flow from the southeast to the northwest. The majority of the surface water inside the Project Area flows into Emerson Creek and Royer Ditch, located in the central northern portion of the Project Area. These water bodies connect to Beaver Creek, which flows into Green Creek, which discharges into Lake Erie. Several small un-named tributaries in the southwestern portion of the Project Area, connect to the Sandusky River, which parallels the western Project Area, before discharging into Lake Erie.

Information on floodplains in the vicinity of the Project Area was obtained from the ODNR and FEMA, as part of the Groundwater Hydrogeological and Geotechnical Desktop Document Review Summary Report prepared by Hull (2017b) and attached hereto as Exhibit F. Areas designated as 100-year floodplains are present along portions of Royer Ditch and Emerson Creek, as well as several unnamed tributaries in the southern portion of the Project Area and portions of Raccoon Creek along the northern portion of the Project Area (see Figure 1 in Exhibit F). There are no turbine sites proposed within designated 100-year floodplains (Hull, 2017b).

(5) Geological Features Map

Figure 08-2 depicts the geologic features of the proposed Facility Site, as well as topographic contours, existing gas and oil wells, and injection wells.

As previously discussed, Hull prepared a desktop review of available hydrogeological and geotechnical information in the vicinity of the Project Area, which is attached hereto as Exhibit F. The data in Exhibit F were compiled by Hull (2017b) through a literature search of existing and readily available documents related to the surface and subsurface soils, agricultural resources, geologic/bedrock conditions, surface water flows, and groundwater resources in the Project Area. This information was reviewed to develop a generalized understanding of the suitability of the soils within the Project Area for grading, compaction, and drainage for the Project Area. Sources consulted include the FEMA; the Ohio Department of Agriculture (ODA); the ODNR; Ohio EPA; the Ohio Department of Transportation (ODOT) District 2; the Ohio State University Agricultural Extension Office; the Seneca and Sandusky County Engineers; the Logan County Engineer and Health Departments; the USDA Soil Conservation Service Soil Survey of Seneca and Sandusky Counties; and the USGS.

(a) *Geologic Suitability*

<u>Existing Conditions</u>

The Project Area lies entirely within the Bellevue-Castalia Karst Plains and the Maumee Lake Plains Region of the Huron-Erie Lake Plains Section of the Central Lowland Physiographic Province within the Interior Plains Division. The majority of the Project Area lies within the Bellevue-Castalia Karst Plain, which is characterized as a hummocky plain of rock knobs and numerous sinkholes, large solution features, springs and caves; thinly mantled by drift. The region straddles the Eastern Lake Plain (northeastern portion of the Project Area) and Till Plain (southern portion of the Project Area). Surface elevations range from 570 feet to 825 feet above mean sea level (amsl) (Hull, 2017b).

The northwestern portion of the Project Area lies within the Maumee Lake Plains Region and is characterized as a flat-lying Ice-Age lake basin containing beach ridges, bars, dunes, deltas, and clay flats. The region formerly contained the Black Swamp, which was a regional wetland extending southwest from present-day western Lake Erie through northwest Ohio into extreme northeastern Indiana. The Black Swamp consisted of an extensive swamps and marshes, with some higher dry ground interspersed. Low physiographic relief (less than five feet) is generally present in the region, which has been slightly dissected by modern streams. Surface elevations in the Maumee Lake Plains Region range from approximately 570 feet to 800 feet amsl (Hull, 2017b).

The surface topography within the Project Area is the result of ice-deposited ground moraine, which was planed by waves in glacial lakes following deposition, resulting in a relatively flat surficial topography. Small areas of lake-deposited material, or lacustrine deposits, are present on the surface in the extreme northeastern portion of the Project Area. The deposits have a greater thickness to bedrock (up to 147 feet) on the western portion of the Project Area, than they do on the eastern portion (less than 10 feet). The area was passed over by both Pre-Illinoian and Wisconsinan glaciers (Hull, 2017b).

Depths-to-bedrock within the Project Area were approximated based on information obtained from the ODNR database of water well drilling logs. Documented bedrock depths for water wells drilled into bedrock in the vicinity of the Project Area range from approximately 30 to 60 feet in the western portion of the Project Area, and between four and 30 feet in the eastern portion of the Project Area. Information obtained from ODNR, Division of Geological Survey, indicates that the majority of the eastern portion of the Project Area lies within a probable karst area. Twenty-seven (27) of the 64 proposed turbines are located in the probable karst area (see Figure 4 in Exhibit F).

Bedrock underlying the central-eastern portion of the Project Area is the Devonian Columbus Limestone, which consists primarily of limestone and dolomite. The Delaware Limestone is deposited beneath the Columbus Limestone and is located on the eastern portion of the Project Area. The remaining eastern portion of the Project Area is composed of Devonian units: Olentangy Shale, Prout Limestone, and Plum Brook Shale. The western half of the Project Area is composed of the Silurian Salina Group and Tymochtee and Greenfield formations, which consists of dolomite with occasional shale, anhydrite, and gypsum. The approximated bedrock topographic surface is shown on Figure 3 in Exhibit F, which shows that bedrock elevations in the vicinity of the Project Area range from approximately 600 in the northwest to approximately 850 in the south.

A review of documented geologic structural and seismic information was conducted for the Project Area. Seismic information was obtained from the ODNR, Division of Geological Survey. No epicenters lie within the Project Area. However, the Tiffin Fault extends to approximately one-quarter mile from the western boundary of the Project Area. The Seneca Anomaly covers the majority of the western portion of the Project Area, 11 turbines are located within the Seneca Anomaly boundary. The next closest fault or fault system is the Outlet Fault, part of the Bowling Green Fault System, and is located approximately 21 miles west-southwest of the Project Area. Six earthquakes have originated in Seneca and Sandusky Counties. The closest documented earthquake epicenter to the Project Area occurred in Seneca County in 1936. The earthquake epicenter was located approximately 3 miles west of the Project Area.

Site Suitability

Based on their experience with earthwork in the region, Hull (2017b) indicates that conventional, shallow foundations may be able to support the turbines. However, this assumption will need to be confirmed by a detailed geotechnical exploration and evaluation at each turbine site, access road, and the substation site. If it is determined that shallow foundations are not suitable for structural support, extended type foundation systems (such as driven H-piles or auger cast piles) may be necessary to bear in suitable material or on bedrock. Additionally, other suitable foundation types may be utilized according to their compatibility with the geotechnical parameters of the specific turbine site.

The geotechnical engineer, or a designated representative, will examine foundation designs and compatibility with the supporting soils, and approve the work prior to placement of foundation components. See Exhibit F for additional information.

Hull (2017b) contacted the ODOT District 2 to discuss typical maintenance issues encountered in the area. The Bryan Spero, Transportation Manager for Seneca County, ODOT District 2 indicated that the most common geotechnical issue encountered in the Project Area are sinkholes resulting from karstic features. These sinkholes are typically encountered within agricultural fields and have not impacted ODOT roads to Mr. Spero's knowledge. Mr. Spero further indicated that a sinkhole developed south of Bloomville, Ohio years ago but no new sinkholes have been reported within the last several years. Mr. Spero indicated that historical use of injections wells by industrial operations within the district may have enhanced or contributed to the development of karst. Finally, Mr. Spero mentioned that an "underground river" associated with the cave system in the area flows between Bloomville and Bellevue, Ohio.

Hull (2017b) also contacted the County Engineer's Offices in both Seneca and Sandusky Counties regarding their knowledge and experience of previous construction projects, subsurface conditions, and maintenance history within the Project Area, and to ask about permits that may be necessary for construction. The Sandusky County Design Engineer stated that sinkholes are the primary geotechnical issue encountered within the area. Hull contacted the Seneca County Engineer's Office. However, a response was not received by the time the report was prepared.

As previously mentioned, due to the glacial history and presence of karst topography within the Project Area, the depth to bedrock varies considerably throughout. Bedrock is generally shallower within the eastern portion of the Project Area and deeper within the western portion. Consequently, foundation considerations vary depending on the location of each turbine. Due to the anticipated depth of bedrock, excavation within bedrock may be necessary in the eastern portion of the Site to install foundations. Furthermore, karst areas may include sinkholes, solution cavities, and cave systems. These voids may need to be grouted in order to provide adequate foundation support. Initial geotechnical investigation and test borings will be conducted prior to construction to confirm/refine the information presented in Exhibit F and facilitate final foundation design and engineering. The locations of test borings will be at appropriate turbine sites and associated access roads, as determined necessary by the geotechnical engineer. In addition, borings will be taken at the proposed substation locations. The borings will extend to the proposed depth or competent bedrock, whichever is encountered first (Hull, 2017b).

(b) *Soil Suitability*

Existing Conditions

The USDA Soil Conservation Service Soil Surveys of Seneca and Sandusky Counties were reviewed. Soil surveys furnish surface soil maps and provide general descriptions and potentials of the soil to support specific uses and can be used to compare the suitability of large areas for general land uses. Surface soils in the vicinity of the Project Area are comprised mostly of Blount silt loams, Glynwood silt and clay loams, and Hoytville clay loam (see Figure 8 in Exhibit F). The soil survey information indicates that the Blount silt loams are somewhat poorly drained, have a moderately low to moderately high capacity to transmit water (0.06 to 0.60 inches/hour), with the depth to water table being 12 to 36 inches. The Glynwood silt and clay loams have a 0 to 12% slope, are moderately well drained, the permeability of the soil is slow, the available water capacity is moderate, and the depth to water table is 12 to 42 inches. The Hoytville clay loam has a 0 to 1% slope, are very poorly drained, permeability of the soil is slow, the water capacity is moderate, and the depth to water table is near the surface during times of extended precipitation. The soil surveys indicate that these soils do not frequently flood, however the Hoytville clay frequently ponds surface water runoff (Hull, 2017b). See Exhibit F for additional information.

Site Suitability

To maintain soil stability during construction, adequate surface water run-off drainage will be established and properly controlled at each proposed construction site to minimize any increase in the moisture content of the subgrade material. Positive drainage of each construction site will be created by gently sloping the surface toward drainage swales. It should be noted that sub-grade soils are subject to shrinking and swelling due to variation in seasonal moisture contents, and consideration should be given during constructability reviews to determine how best to deal with potential moisture fluctuations (Hull, 2017b).

Based on a review of the soil survey information and Hull's experience with earthwork in the area, the soils on-site should be suitable for grading, compaction, and drainage when each site is prepared as discussed in Attachment D of Exhibit F.

Site Restoration

Construction will involve topsoil stripping and grubbing of stumps, as necessary. Stripped topsoil will be stockpiled along the road corridor for use in site restoration. Following removal of topsoil, subsoil will be graded, compacted, and surfaced with gravel or crushed stone (depth to be determined on a case by case basis), and a geotextile fabric or grid will be installed beneath the road surface if necessary, to provide additional support. In agricultural areas, all topsoil within the work area will be stripped and segregated from excavated subsoil. Once construction is complete, the soil will be restored. Exposed subsoils will be de-compacted with a deep ripper or heavy-duty chisel plow to a minimum depth of 18 inches. Following de-compaction of the subsoil, the surface of the subsoil will be picked over to remove all rocks four inches in size or larger. Following rock picking, stockpiled topsoil will be returned to all disturbed agricultural areas. The topsoil will be re-graded to match original depth and contours to the extent possible. The surface of the re-graded topsoil will be disked, and any rocks over four inches in size will be removed from the soil surface. Restored topsoil will be stabilized with seeding and/or mulching, unless other arrangements have been made with the landowner. All access roads will be re-graded as necessary to create a smooth travel surface, allow crossing by farm equipment, and prevent interruption of surface drainage. Temporary water bars and culverts shall be removed if they are no longer necessary.

(c) *Plans for Test Borings*

Due to the glacial history and presence of karst topography within the Project Area, the depth to bedrock varies considerably throughout. Bedrock is generally shallower within the eastern portion of the Project

Area (evidenced by the presence of limestone quarries and karst) and deeper within the western portion (evidence by thick deposits of glacial drift). Consequently, foundation considerations vary depending the location of each turbine. Initial geotechnical investigation and test borings will be conducted prior to construction to confirm/refine the information presented in Exhibit F, and to facilitate final foundation design and engineering. A Generalized Geotechnical Exploration Work Plan is attached as Appendix E to Exhibit F. This work plan describes the planned reconnaissance, drilling/sampling, geotechnical laboratory testing, and report to be prepared.

After the geotechnical engineer has reviewed all available desktop information, s/he will determine the number of borings to be drilled for the initial geotechnical investigation. The locations of test borings will be at appropriate turbine sites. In addition, borings will be taken at the proposed substation locations. The borings will extend to the proposed depth or competent bedrock, whichever is encountered first. Split-barrel sampling of soil will be performed in accordance with American Society for Testing and Materials (ASTM) D1586 for each boring in increments of 2.5 feet to the depth of 10 feet, and at 5-foot intervals below 10 feet to the depth of the borings. In all the borings, Standard Penetration Test (SPT) data will be developed and representative samples preserved. Water observations in the boreholes will be recorded during (and at the completion of) drilling. A truck-mounted drill rig will be used to perform the borings, unless unfavorable weather conditions make the site inaccessible, in which case an ATV-mounted drill rig will be used. All borings will be backfilled at the completion of drilling with bentonite chips and drill cuttings (Hull, 2017b).

A laboratory testing program will be established by the geotechnical engineer based on the observations made during the drilling activities and experience. All samples will be classified in the laboratory based on the visual-manual examination (ASTM D 2488) Soil Classification System and the laboratory test results. Formal boring logs will be prepared using the field logs and the laboratory classifications. For a limited number of samples considered to be representative of the foundation materials encountered by the borings across the Project Area, laboratory testing will include moisture content, particle-size analyses, and Atterberg limits. Unconfined compression and consolidation tests will be performed if low strength and/or highly compressible cohesive soils are encountered, as deemed necessary by the geotechnical engineer. All laboratory testing will be performed in accordance with ASTM or other specified standards. A report will be prepared documenting the findings of the borings and laboratory testing, including subsurface soil properties, static water levels, rock quality descriptions, percent recovery, and depth and description of bedrock contact (Hull, 2017b). This report will be provided to OPSB Staff prior to commencement of Facility construction.

(6) Prospects of High Winds in the Area

The wind turbines proposed for the Facility are rated to withstand wind speeds well in excess of those likely to occur in the Project Area. International standards for wind turbines are developed by working groups of Technical Committee-88 of the International Electrotechnical Commission (IEC), a world-recognized body for standards development. All turbines under consideration for the Facility are designed to meet the standards of the IEC-61400 series and are rated to specific IEC wind classes. The Acciona AW132 and GE 3.6-137 are certified for class IIIb winds; and the Vestas V136 is certified for class IIIa winds. IEC IIIa and IIIb provides that the structure is designed to withstand average wind speeds of 7.5 m/s (17 mph) and extreme 10-minute average wind speeds of 37.5 m/s (84 mph). It is important to note that these IEC standards represent minimum design values.

(7) Blade Shear

A potential public safety concern with wind power projects is the possibility of a wind turbine tower collapsing or a rotor blade dropping or being thrown from the nacelle. While extremely rare, such incidents have occurred; however, to the best of the Applicant's knowledge, no member of the public has ever been injured as a result of these incidents because appropriate setbacks have proved to be sufficient to protect area homes and public roads.

The reasons for a tower collapse or blade throw vary depending on conditions and tower type. The main causes of blade and tower failure are a control system failure leading to an over speed situation, a lightning strike, or a manufacturing defect in the blade. Technological improvements and mandatory safety standards during turbine design, manufacturing, and installation have significantly reduced the instances of blade throw. The reduction in blade failures coincides with the widespread introduction of wind turbine design certification and type approval. The certification bodies perform quality control audits of the blade manufacturing facilities and perform strength testing of construction materials. These audits typically involve a dynamic test that simulates the life loading and stress on the rotor blade (Garrad Hassan, 2010).

Modern utility-scale turbines are certified according to international engineering standards. These include ratings for withstanding different levels of hurricane-strength winds and other criteria (ASCE & AWEA, 2011). The engineering standards of the wind turbines ultimately used for this Facility will meet all applicable engineering standards. State of the art braking systems, pitch controls, sensors, and speed controls on wind turbines have greatly reduced the risk of blade throw. It is anticipated that the wind turbines to be used for the Facility will be equipped with two fully independent braking systems that allow the rotor to be brought to a halt under all foreseeable conditions. In addition, it is anticipated that the turbines will automatically shut down at wind speeds over the manufacturer's threshold (i.e., 25 m/s [56 mph]). As described above, the turbines will also cease operation if significant vibrations or rotor blade stress is sensed by the monitoring systems. For all of these reasons, the risk of catastrophic blade throw is minimal.

Although the risk of blade throw is minimal, the Applicant will have procedures in place in the event of a blade throw incident. These procedures will include emergency shutdown procedures, post event site security measures, immediate notification of state and local officials, and the implementation of turbine manufacturer specific blade throw safety procedures, if any. In addition, the Applicant will conduct annual training for operating staff as well as local first responders on the procedures to be implemented in the event of a blade throw incident.

Given the low risk of tower collapse and blade throw, the potential impact is negligible. The Facility's setbacks from permanent residences and adjacent property lines will adequately protect the public from tower collapse and blade throw. The Facility setbacks consist of a minimum of 548 feet between turbine sites and adjacent property lines. As currently sited, the distance between proposed turbines and the nearest non-participating residential structure ranges from 1,457 to 2,692 feet, and averages 1,699 feet. The distance between proposed turbines and the nearest non-participating property line ranges from 548 feet to 2,078 feet, and averages 1,043 feet.

(8) Ice Throw

Ice shedding and ice throw refer to the phenomena that can occur when ice accumulates on rotor blades and subsequently breaks free and falls to the ground. Although a potential safety concern, no serious accidents caused by ice being "thrown" from an operating wind turbine have been reported (Garrad Hassan., 2007; Baring-Gould et al., 2012; Gipe, 2013). However, ice shedding and ice throw do occur, and could represent a potential safety concern.

Ice shedding and ice throw occur under certain weather conditions when ice builds up on the rotor blades and/or sensors, slowing the rotational speed, and potentially creating an imbalance in the weights of the individual blades. Such effects of ice accumulation can be sensed by the turbine's computer controls and would typically result in the turbine being shut down until the ice melts. Field observations and studies of ice shedding indicate that most ice shedding occurs as air temperatures rise and the ice on the rotor blades begins to thaw. Therefore, the tendency is for ice fragments to drop off the rotors and land near the base of the turbine (Morgan et al., 1998; Ellenbogen, et al., 2012). Ice can potentially be "thrown" when ice begins to melt and stationary turbine blades begin to rotate again, if ice falls from a stationary turbine during very high wind conditions that are strong enough to carry the ice some distance, or in the event of a failure of the turbine's control system.

The distance traveled by a piece of ice depends on a number of factors, including: the position of the blade when the ice breaks off, the location of the ice on the blade when it breaks off, the rotational speed of the blade, the shape of the ice that is shed (e.g., spherical, flat, smooth), and the prevailing wind speed. The risk of ice landing at a specific location is found to drop dramatically as the distance from the turbine increases. The European Union Wind Energy in Cold Climates research collaborative has studied ice throw at operational wind farms throughout Europe. The data gathered show that ice fragments typically land within 410 feet (125 meters) of the wind turbine (Seifert et al., 2003). Ice throw observations are also available from a wind turbine near Kincardine, Ontario, where the operator conducted approximately 1,000 inspections between December 1995 and March 2001. Thirteen of these inspections noted ice build-up on the turbine. No ice pieces were found on the ground further than 328 feet from the base of the turbine, with most found within 164 feet (Garrad Hassan, 2007). Studies conducted in the Swiss Alps found that the maximum throwing distance was 302 feet (Cattin et al., 2008, 2009). Almost fifty percent of the ice fragments weighed 0.1 pounds or less (Cattin et al., 2007) and the heaviest ice fragment weighed nearly four pounds (Cattin et al., 2008 and 2009). While the height of wind turbines is also a factor to be considered, the "Wind Turbine Health Impact Study" prepared by an independent expert panel for the Massachusetts Department of Public Health concluded that, "ice is unlikely to land farther from the turbine than its maximum vertical extent" (Ellenbogen et al., 2012).

Impacts related to ice shedding are unlikely because any ice shedding that could occur is likely to fall within established setbacks. The effects of ice accumulation can be sensed by the turbine's computer controls and typically result in the turbine being shut down until the ice melts. As ice builds up on the blades of an operating wind turbine, it can lead to vibration, caused by the mass of the ice or the aerodynamic imbalances. Modern commercial turbines are equipped with vibration monitors, which shut the machine down when vibrations exceed a pre-set level. Most modern wind turbines also monitor the wind speed to power output ratio. If ice accumulates on the blades, this ratio becomes too high and the turbine will stop itself.

The Facility's proposed setback distances, the results of studies/field observations at other wind power projects, modern turbine technological controls, the limited public access to the turbine sites, and the fact that no serious accidents caused by ice being "thrown" from an operating wind turbine have been reported (Garrad Hassan, 2007; Baring-Gould et al., 2012; Gipe, 2013), should adequately protect the public from falling ice, and therefore risk from ice throw or shedding is considered minimal in the Facility Site. In fact, recent data collected by the Global Wind Energy Council (2014) indicate that worldwide there were more than 268,000 turbines in operation by the end of 2014, and more have been constructed since. It is important to note that even with all of these turbines in operation, there has been no reported injury caused by ice being thrown from a turbine.

(9) Shadow Flicker

Shadow flicker refers to the moving shadows that an operating wind turbine casts at times of the day when the turbine rotor is between the sun and a receptor's position. These flickering shadows can cause an annoyance when cast of nearby residences ("receptors"). The spatial relationship between a wind turbine and a receptor, along with weather characteristics such as wind direction and sunshine probability, are key factors related to shadow-flicker impacts. At distances beyond roughly 10 rotor diameters (approximately 1,370 meters based on the General Electric GE 3.6-137 turbine model used in this case) shadow-flicker effects are generally considered negligible (BERR, 2009; DECC, 2011; DOER, 2011). This is because shadow flicker intensity diminishes as the distance between receptors and turbines increases.

Although shadow flicker has been alleged to cause or contribute to health effects, blade pass frequencies for modern commercial scale wind turbines are very low. According to the Epilepsy Society (2012), approximately five percent of individuals with epilepsy have sensitivity to light. Most people with photosensitive epilepsy are sensitive to flickering around 16-25 Hz (Hertz or Hz = 1 flash per second), although some people may be sensitive to rates as low as 3 Hz and as high as 60 Hz. Modern wind turbines (including the proposed General Electric GE 3.6-137) typically operate at a frequency of 1 Hz or less, and there is no evidence that wind turbines can trigger seizures (British Epilepsy Association, 2007; Ellenbogen et al., 2012; Parsons Brinckerhoff, 2011; NHMRC, 2010). The primary concern with shadow flicker is the annoyance it can cause for adjacent homeowners.

Although setback distances for turbines will significantly reduce shadow flicker impacts to homes, some impact may still occur. With respect to regulatory thresholds, no consistent national, state, county, or local standards exist for allowable frequency or duration of shadow flicker from wind turbines. In general, quantified limits on shadow flicker are uncommon in the United States because studies have not shown it to be a significant issue (USDOE, 2008a, 2012; NRC, 2007). However, standards developed by some states and countries provide guidance in this regard. The New Hampshire Office of Energy and Planning (2008) issued a model ordinance for small wind energy systems (<100 kW) that defines significant shadow flicker impacts as more than 30 hours per year on abutting occupied buildings. A model wind ordinance prepared by the North Carolina Wind Working Group in 2008 suggests a limit of 30 hours per year (generally less than 1% of annual daylight hours) at any occupied building on a non-participating landowner's property (NCWWG, 2008). The Wisconsin Administrative Code (WAC) specifies a limit of 30 hours per year at any non-participating residence or occupied community building (Wisconsin Public Service Commission, 2012). The WAC also requires mitigation for non-participating residences or occupied community buildings experiencing 20 hours or more per year of shadow flicker. The Ohio Power Siting Board uses 30 annual hours of shadow flicker as a threshold of acceptability in certifying commercial wind power projects (OPSB, 2011a, 2011b, 2012, 2013). Additionally, international guidelines from Europe and Australia have suggested 30 hours of shadow flicker per year as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance (NRC, 2007; DECC, 2011; DPCD, 2012). There are no local, county, or State regulations that govern shadow flicker in the Project Area. Accordingly, a threshold of 30 shadow flicker hours per year was applied to the analysis of the proposed Republic Wind Farm to identify any potentially significant impacts on residences.

EDR conducted a shadow flicker analysis for the Facility, attached hereto as Exhibit I. The study evaluates the General electric GE 3.6-137 turbine, which has the largest rotor diameter of the turbines under consideration and therefore represents a worst-case analysis with respect to shadow flicker. The shadow flicker analysis for the proposed Project used *WindPRO 2.9.285* software and associated Shadow module. *WindPRO* is a widely accepted modeling software package developed specifically for the design and evaluation of wind power projects. Input variables and assumptions used for shadow flicker modeling calculations for the proposed Project include:

- Latitude and longitude coordinates of 58 proposed wind turbine sites (provided by the Applicant).
- Latitude and longitude coordinates for 828 potential receptors located in the 10-rotor diameter (1,370 meters) Study Area (provided by the Applicant).
- USGS 1:24,000 topographic mapping and USGS 10-meter resolution digital elevation model (DEM) data.
- The rotor diameter (137 meters) and hub height (110 meters) for the General Electric GE 3.6-137.
- Annual wind rose data (provided by the Applicant), which is depicted in Table A1 of Attachment A (to determine the approximate directional frequency of rotor orientation throughout the year).
- To account for the occurrence of cloudy conditions, the average monthly percent of available sunshine for the nearest NOAA weather station with a similar latitude (Toledo, Ohio) was used. Data was obtained from NOAA's "Comparative Climatic Data for the United States through 2015" (see Table A2 of Attachment A) (http://www.ncdc.noaa.gov).

- No allowance was made for wind being below or above generation speeds. Blades are assumed to be moving during all daylight hours when the sun's elevation is more than 3 degrees above the horizon. Shadow flicker is generally considered imperceptible when the sun is less than 3 degrees above the horizon (due to the scattering effect of the atmosphere on low angle sunlight) (States Committee for Pollution Control, 2002).
- The possible screening effect of all existing trees and buildings adjacent to the receptors was not taken into consideration in the modeling. In addition, the number and/or orientation of windows in residential structures were not considered in the analysis.

The model calculations include the cumulative sum of shadow hours for all Project turbines. This omni-directional approach reports total shadow flicker results at a receptor regardless of the presence or orientation of windows at that particular residence (i.e., it assumes shadows from all directions can be perceived at a residence, which may or may not be true). A receptor in this "greenhouse" model is defined as a one square meter area located one meter above ground; actual house dimensions are not taken into consideration. Because the shadow flicker analysis conducted for the proposed Project was based on the conservative assumptions that 1) 58 turbines will be built, 2) the turbines are in continuous operation during daylight hours, and 3) that shadow flicker can be perceived at a receptor structure regardless of the presence or orientation of windows or the screening effects of all surrounding trees and buildings, the analysis presented herein is a conservative projection of the shadow-flicker effects at ground level. Local sunshine and wind direction frequency data were used to more accurately predict rotor alignment and the percent of daylight hours when shadows are likely to be cast. The analysis evaluated the potential impact of 58 GE 3.6-137 turbines, with a rotor diameter of 137 meters and a hub height of 110 meters.

Figure 3 in Exhibit I illustrates the results of the shadow flicker analysis. A summary of the projected shadow flicker at each of the 828 receptors located with 1,370 meters of a proposed turbine site is presented below:

- 232 (28%) of the receptors are not expected to experience any shadow flicker,
- 2 (0%) of the receptors may be affected 0-1 hour/year,
- 313 (38%) of the receptors may be affected 1-10 hours/year,
- 170 (21%) of the receptors may be affected 10-20 hours/year,
- 70 (8%) of the receptors may be affected 20-30 hours/year,
- 41 (5%) of the receptors may be affected for more than 30 hours/year.

Of the 41 receptors predicted to receive more than 30 hours of shadow flicker per year, 11 are located on participating parcels, while and 30 are non-participants. The details regarding anticipated shadow flicker at these 41 receptors are summarized below in Table 08-3.

Table 08-3. Daily Effect to Receptors Predicted to Exceed 30 Hours of Shadow Flicker

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm)	Turbines Contributing to Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]
6481	Non-Participating	30:00:00	A01, A02	3:30 PM – 5:00 PM
				7:45 AM – 9:45 AM
11902	Non-Participating	30:33:00	E01, E02, E03	7:30 AM – 9:45 AM
4939	Non-Participating	30:35:00	F03, F04	7:30 PM – 8:15 PM
				7:30 AM – 9:00 AM
6479	Non-Participating	30:43:00	A01, A02	4:15 PM – 6:15 PM
				7:30 AM – 9:45 AM
10701	Non-Participating	31:00:00	E07, E08	5:45 PM – 7:45 PM
6478	Non-Participating	31:47:00	A01, A02	5:00 PM – 7:00 PM
				7:30 AM – 9:30 AM
6483	Non-Participating	31:53:00	A01, A02	7:45 PM – 8:30 PM
				6:30 AM – 7:30 AM
6298	Non-Participating	32:07:00	F05, F06, F07, F09	4:00 PM – 7:45 PM
				8:15 AM – 9:00 AM
10774	Non-Participating	32:52:00	C01, C03, C04	5:30 PM – 7:15 PM
				7:00 AM – 8:30 AM
9922	Non-Participating	33:39:00	F04, F06	7:30 PM – 8:30 PM
				8:00 AM – 9:30 AM
4917	Non-Participating	35:32:00	F05, F06, F07, F09	7:00 PM – 9:00 PM
				7:30 AM – 9:00 AM
4841	Non-Participating	35:43:00	F10, F11	6:45 AM – 9:00 AM
4919	Non-Participating	36:19:00	F05, F06, F07, F09	7:30 AM – 9:15 AM
				6:45 PM – 8:45 PM
12760	Non-Participating	37:21:00	D01, E04, E05	7:30 AM – 9:45 AM
				4:15 PM – 6:45 PM
11371	Non-Participating	37:24:00	D05, D06	8:00 AM – 10:15 AM
				7:45 PM – 8:45 PM
4922	Non-Participating	38:08:00	F05, F06, F07, F09	7:45 AM – 9:00 AM
				6:45 PM – 8:45 PM

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm)	Turbines Contributing to Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]
9771	Non-Participating	38:29:00	F05, F06, F07, F09	7:15 AM – 9:00 AM
				6:45 PM – 8:45 PM
13435	Non-Participating	38:54:00	A04, A05	3:15 PM – 5:30 PM
				8:00 PM – 8:45 PM
10619	Non-Participating	39:38:00	F05, F06, F07, F09	7:30 AM – 9:15 AM
				5:15 PM – 8:30 PM
10615	Non-Participating	40:31:00	F05, F06, F07, F09	7:15 AM – 9:00 AM
				6:30 PM – 8:45 PM
6536	Non-Participating	40:53:00	D01, D02, E04	7:15 AM – 9:30 AM
				7:45 PM – 8:45 PM
10705	Non-Participating	41:13:00	E06, E07, E08	7:15 AM – 10:00 AM
				5:00 PM – 7:00 PM
6297	Non-Participating	41:32:00	F05, F06, F07, F09	7:45 AM – 9:00 AM
				4:15 PM – 8:00 PM
10616	Non-Participating	43:01:00	F05, F06, F07, F09	7:30 AM – 9:00 AM
				6:30 PM – 8:45 PM
10617	Non-Participating	44:24:00	F05, F06, F07, F09	7:30 AM – 9:15 AM
				6:15 PM – 8:45 PM
10618	Non-Participating	44:28:00	F05, F06, F07, F09	7:30 AM – 9:15 AM
				6:00 PM – 8:30 PM
1080	Non-Participating	45:24:00	D12, D13, D15	6:15 AM – 7:30 AM
				7:15 PM – 8:45 PM
13462	Non-Participating	46:27:00	C03, C04, C06, C07	6:15 AM – 6:45 AM
				7:30 AM – 8:15 AM
				4:45 PM – 7:00 PM
				7:15 PM – 8:15 PM
9520	Non-Participating	47:41:00	C05, C07, C09	6:15 AM – 7:15 AM
				5:45 PM – 7:15 PM
				8:00 PM – 9:00 PM
4484	Non-Participating	51:22:00	C05, C07, C08, C09	6:30 AM – 7:45 AM
				3:30 PM – 6:00 PM
				7:45 PM – 8:45 PM
9925	Participating	33:52:00	F04, F06	8:15 AM – 10:00 AM
				7:45 PM – 8:45 PM
1616	Participating	34:05:00	D01, D02	6:30 PM – 8:45 PM

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm)	Turbines Contributing to Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]
12064	Participating	34:38:00	D09, D10	7:00 PM – 8:30 PM
10760	Participating	36:44:00	C01, C02, C03, C04	6:15 AM – 9:00 AM
				3:45 PM – 5:30 PM
6537	Participating	37:39:00	D01, D02	6:45 AM – 8:45 AM
6296	Participating	38:10:00	F05, F06, F07, F09	7:45 AM – 9:00 AM
				5:00 PM – 8:15 PM
11160	Participating	40:52:00	D27, D09, D09, D10	7:00 AM – 9:15 AM
				4:00 PM – 6:00 PM
6600	Participating	42:42:00	B01, B02, B03, B04	6:45 AM – 7:30 AM
				8:45 AM – 10:30 AM
				6:15 PM – 7:45 PM
4852	Participating	43:56:00	F10, F11	6:45 AM – 9:15 AM
12051	Participating	60:35:00	C05, C06, C08, C09	7:30 AM – 8:45 AM
				7:00 PM –8:15 PM
10757	Participating	61:10:00	C02, C03, C05, C06	7:15 AM – 8:15 AM
				4:30 PM – 6:30 PM
				7:15 PM – 8:00 PM

[1]The times of day presented in Table 2 represent the range of times during which each structure could potentially experience shadow flicker throughout the year; however, no structures will experience shadow flicker every day during all those hours. See Attachment B for detailed calendars that illustrate the specific times of year and day that each structure may experience shadow flicker.

Although shadow flicker at these receptors exceeds the 30-hour per year threshold, these calculations do not take into account the actual location and orientation of windows, or the screening effects associated with existing, site-specific conditions such as vegetation and/or buildings. This analysis also assumes turbine rotors are continuously in motion during daylight hours, which will not necessarily be the case (i.e., the blades do not spin below the cut-in speed of 3 meters per second [6.7 miles per hour]). In addition, many of the modeled shadow-flicker hours are expected to be low intensity because they would occur during the early morning or late afternoon when the sun is low in the sky. As the sun sinks below the horizon, more of its light is scattered by the atmosphere, which has the effect of dampening its brightness and therefore reducing its ability to cast dark shadows (EMD, 2013).

It is important to note that shadow flicker from wind turbines can often be readily mitigated by planting of trees to screen the affected windows from the sun, or by the installation of blinds or curtains at the windows. By closing these blinds or curtains during periods of shadow flicker, the shadow flicker effect can be effectively mitigated.

As stated earlier, the number of turbines proposed for the Project will depend of the turbine model chose. This will provide additional opportunities for minimizing shadow-flicker effects. Specifically, if a 3.6 or 3.63 MW turbine is selected, it is expected that up to 55 turbines will be constructed. The only scenario under which 58 turbines would be constructed is if the Acciona AW132 turbine is selected. In that case, since the AW132 has a 132-meter rotor diameter, the turbines would cast shorter shadows, thereby potentially affecting fewer residences. However, because the final turbine model is not known, and to provide a conservative, worst-case analysis, this study evaluates the potential impact of 58 GE3.6-137 turbines, when in fact this scenario will never be implemented for this Project. Therefore, given all the worst-case scenario assumptions, shadow flicker impacts on non-participating and pending receptors will be significantly reduced prior to construction, and may possibly be entirely eliminated at some receptors. A pre-construction shadow flicker analysis will be conducted to determine the actual shadow flicker effects based on the final turbine model selected, and the associated turbine sites.

(10) Radio and Television Reception

To evaluate the potential for the Facility to impact existing telecommunication signals, Comsearch was contracted to conduct analyses of off-air television reception and AM/FM broadcast station operations in the vicinity of the Project Area (see Exhibit Z). Potential impacts to each of these resources are described below.

Off-Air Television Analysis: Off-air stations are television broadcasts that transmit signals that can be received directly by a television receiver or house-mounted antenna. The television reception analysis identified all off-air television stations within a 150-kilometer (93.2-mile) radius of an area of interest encompassing the proposed Facility, as illustrated in Figure 2 of the Off-Air TV Analysis report in Exhibit Z. The results of the study indicate that there are a total of 144 off-air television stations within 150 kilometers, including stations broadcast from both the United States (n=136) and Canada (n=8). However, the television stations most likely to produce off-air coverage to Seneca and Sandusky County residents in the vicinity of the Project Area are those located at a distance of 100 kilometers (62.1 miles) or less.

There are a total of 53 database records for stations within approximately 100 kilometers of the wind energy project, 48 in the United States and five in Canada. Of these stations, only 43 are currently licensed and operating, 14 of which are low-power digital stations or translators. Translator stations are low-power stations that receive signals from distant broadcasters and re-transmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna. The remaining 29 operational stations broadcast at full power.

Twelve of the 29 full-power digital stations and one Class A low-power digital station (WOHZ-CD) may have their reception disrupted in and around the proposed Facility. These stations are listed below in Table 08-4. The areas primarily affected would include TV service locations within 10 kilometers (6.2 miles) of the Facility that have clear line-of-sight to a proposed wind turbine but not to the respective station.

Table 08-4. Licensed Off-Air TV Stations Subject to Degradation

ID	Call Sign	Channel	Distance to Nearest Turbine (km)	Distance to Nearest Turbine (miles)
2	WGGN-TV	42	36.9	22.9
5	WMFD-TV	12	49.6	30.8
6	WOHZ-CD	41	49.6	30.8
8	WNWO-TV	49	54.6	33.9
9	WTOL	11	56.0	34.8
10	WGTE-TV	29	56.5	35.1
14	WUPW	46	56.9	35.4
21	WTVG	13	58.3	36.2
27	WBGU-TV	27	68.0	42.3
30	WJW	8	95.8	59.5
38	WEWS-TV	15	95.8	59.5
41	WBNX-TV	30	97.8	60.8
43	WKYC	17	98.4	61.1

Source: Comsearch, 2017a.

Communities and homes in these locations may have degraded reception of these stations after the wind turbines are installed, due to by signal scattering that can occur when TV signals are reflected by the rotating wind turbine blades and mast. In the event that interference is observed in any of the TV service areas, it is recommended that a high-gain directional antenna be used, preferably outdoors, and oriented towards the signal origin in order to mitigate the interference. Both cable service and direct broadcast satellite service will be unaffected by the Facility and may be offered to those residents who can show that their off-air TV reception has been disrupted by the presence of the wind turbines (2017a). Residents that experience degraded off-air television service after installation of the Facility can issue a formal complaint with Applicant. A hotline will be setup to receive and formally document all complaints, which will then be investigated by onsite Facility staff. The complaint resolution process will be developed with OPSB Staff before construction begins.

AM/FM Analysis: Comsearch identified six database records for AM stations within 30 kilometers (18.6 miles) of the proposed Facility. Potential problems with AM broadcast coverage can occur when stations with directive antennas are located within the lesser of 10 wavelengths or 3 kilometers (1.9 miles) of turbines, or when stations with non-directive antennas are located within one wavelength. As shown on Figure 1 in the Analysis of AM and FM Radio Report in Exhibit Z, all AM stations are located well outside the Project Area, with the closest station located approximately 13.7 kilometers (8.5) miles from the nearest proposed turbine site. Therefore, no degradation of AM broadcast coverage is anticipated (Comsearch, 2017b).

In addition, Comsearch determined that there are 24 database records for FM stations within 30 kilometers (18.6 miles) of the proposed Facility. However, only 23 of these stations are currently licensed and operating, seven of which are low-power or translator stations that broadcast with limited range. The coverage of FM stations is generally not susceptible to interference caused by wind turbines, especially when large objects, such as wind turbines, are sited in the far field region of the radiating FM antenna in order to avoid the risk of distorting the antenna's radiation pattern. As shown on Figure 2 in the Analysis of AM and FM Broadcast Station Operations report in Exhibit Z, the closest operational FM station to the Facility is more than 1.1 kilometers (0.7 mile) from the nearest turbine. At this distance there should be no degradation of FM broadcast coverage (Comsearch, 2017b).

(11) Military Radar Systems

Comsearch was also contracted to send written notification of the proposed Facility to the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce. Upon receipt of notification, the NTIA provides plans for the proposed Facility to the federal agencies represented in the Interdepartment Radio Advisory Committee (IRAC), which include the Department of Defense, the Department of Education, the Department of Justice, and the Federal Aviation Administration. The NTIA then identifies any Facility-related concerns detected by the IRAC during the review period. If the Facility had the potential to interfere with military or civilian radar systems, this conflict would be identified during IRAC review.

The notification letter was sent to NTIA on November 21, 2017. A response letter from NTIA was received on January 29, 2018 (see Exhibit Z). No concerns regarding blockage of communication systems were identified.

(12) Microwave Communication Paths

Microwave telecommunication systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. These systems are wireless point-to-point links that communicate between two antennas and require clear line-of-sight conditions between each antenna. To assure an uninterrupted line of communications, a microwave link should be clear, not only along the axis between the center point of each antenna, but also within a mathematical distance around the center axis known as the Fresnel Zone. Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz).

Comsearch identified 39 microwave paths in the vicinity of the Project Area. These paths are listed in Table 1 and illustrated in Figure 2 in the Licensed Microwave Report (see Exhibit Z). Comsearch verified the location of each tower location, then calculated a Worse Case Fresnel Zone for each microwave path. Based upon the dimensions of the largest turbine under consideration, Comsearch (2017c) determined that one of the proposed turbine sites could potentially obstruct one microwave path. This potential obstruction case is illustrated in Figures 4 Exhibit Z.

Because one turbine was found to intersect a two-dimensional Fresnel Zone, Comsearch conducted a cross-sectional analysis to calculate the clearance between the blades and the microwave Fresnel Zone. The cross-sectional analysis calculates the precise height and width of the Fresnel Zone at the turbine location, based on the antenna heights of the two link endpoints and the earth curvature bulge at the specific turbine location (see Table 08-5).

Table 08-5. Microwave Communications Cross-Sectional Analysis Results

Microwave Path ID	Fresnel Zone Width (meters)	Microwave Centerline Height (meters)	Turbine ID	Cross-Sectional Clearance (meters)
1	26.29	50.12	C08	10.54

Source: Comsearch, 2017c.

Based on the cross-sectional analysis, it was determined that the Fresnel Zone will pass below the blades and will not be affected by the proposed turbine. No other turbines are sited close enough to Fresnel Zones to require further analysis. Consequently, no degradation of microwave tele-communications is anticipated (Comsearch, 2017c).

(B) ECOLOGICAL IMPACT

(1) Ecological Resources in the Project Area

In support of the preparation of this Application, environmental consultants from various firms have made numerous site visits to the Project Area and completed extensive on-site ecological surveys during multiple growing seasons. Cardno ENTRIX (Cardno) prepared an Ecological Assessment, attached hereto as Exhibit J. The purpose of the Ecological Assessment was to provide a stream and wetland delineation of Facility locations including turbines, access roads, and electrical interconnect lines; to map and characterize vegetative communities; and to screen for potential occurrence of rare, threatened, and endangered plant and animal species.

In addition, numerous bird and bat surveys were completed in the vicinity of and within the Project Area. BHE Environmental, Inc. (BHE) completed diurnal bird/raptor migration surveys during the spring and fall of 2011, and a raptor nest survey in the spring of 2011 to characterize raptor activity in the vicinity of the Project Area. BHE also completed passerine migration surveys in the fall and spring of 2011, and a breeding bird survey in the summer of 2011 to document the diversity and abundance of songbirds in the vicinity of the Project Area. In addition, BHE completed bald eagle point count surveys and bald eagle nest monitoring during the 2011 and 2012 breeding/nesting seasons to evaluate eagle use of the Project area. Tetra Tech, Inc. (Tetra Tech) completed acoustic surveys during the spring, summer, and fall of 2011 to assess bat use and phenology in the Project Area, and Environmental Solutions & Innovations, Inc. (ESI) and Copperhead Environmental Consulting, Inc. (Copperhead) completed bat mist-netting surveys in the summers of 2011, 2015, and 2016 to evaluate bat activity and use in the Project area. Survey methodologies for all surveys were based on the ODNR's "On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind" and recommendations from ODNR and U.S. Fish and Wildlife Service (USFWS) staff. The bird and bat surveys completed for the Facility are attached hereto as follows:

- Diurnal Bird/Raptor Migration Survey (Exhibit K),
- Raptor Nest Survey (Exhibit L),
- Bald Eagle Survey (Exhibit M),
- Passerine Migration Survey (Exhibit N),
- Breeding Bird Survey (Exhibit O),
- Acoustic Bat Survey (Exhibit P),
- 2011 Bat Mist-Netting Report (Exhibit Q), and
- 2015 Bat Mist-Netting Report (Exhibit R).

These field surveys are described below in Section 4906-4-08(B)(1)(b) and (d).

In addition to the site-specific studies, the Ecological Assessment discusses four additional bird and bat studies conducted at the proposed Emerson West Wind Project, located in Seneca County, Ohio, immediately south of the Project Area. A portion of the study areas evaluated in the Emerson West Wind surveys now lies within the current Republic Wind Farm Project Area. The full reports for the three avian surveys and one bat surveys completed for the Emerson West Wind Project are included in Appendix E of Exhibit J.

(a) *Ecological Resources Map*

Figure 08-3 shows the proposed Facility and lands within a 0.5-mile radius of the Project Area. This mapping was developed from ESRI ArcGIS Online "World Topographic Map" map service. Among other information, Figure 08-3 shows the following features:

(i) The proposed Facility and Project Area boundary
(ii) Undeveloped or abandoned land such as wood lots or vacant fields
(iii) Wildlife areas, nature preserves, and other conservation areas
(iv) Surface bodies of water
(v) Highly erodible soils and steep slopes

(b) *Field Survey and Map of Vegetative Communities and Surface Waters within 100 Feet of Construction*

Cardno completed a preliminary desktop review of the Project Area and surrounding areas, incorporating environmental datasets such as Ohio Wetland Inventory (OWI), National Wetland Inventory (NWI), streams and rivers, historic and current aerial photographs, land use/land cover, and soils. This database was used to systematically screen the Project Area for environmentally sensitive areas, which were avoided to the extent practicable during the turbine siting process. Wetland and waterbody delineation surveys were subsequently completed to determine the extent and jurisdiction of wetlands and waterbodies in the areas to be disturbed by Facility construction ("Survey Area"). Field surveys were completed in the fall of 2016, and in the spring and fall of 2017. The data obtained during the desktop review was found to be generally consistent with the results of the field survey.

Vegetative Communities

The dominant ecological communities in the Survey Area are agricultural (crops), with lesser amounts of developed/open space (residences/yards) and deciduous forest areas (woodlots). Each of these vegetative communities is described below:

Agricultural fields consist primarily of corn and soybean. The type of crop in any given field may change seasonally, but the general extent of the crop area typically remains consistent. Many of the fields and roadsides have man-made or modified ditches that help maintain drainage for proper growing conditions. Intermittent and ephemeral ditch channels are often vegetated with reed canary grass (*Phalaris arundinacea*) and narrow-leaf cattail (*Typha angustifolia*) indicating the presence of water during portions of the year. Some ditches that rarely receive runoff except during severe storm events lack vegetation in the channel, or contain a mix of upland grasses (e.g., *Festuca* spp.). The majority of ditches appear to be mowed seasonally, which reduces the development of mature riparian buffers along the banks. Many of ditches have bank areas covered in weedy species such as Canada goldenrod (*Solidago canadensis*), pokeweed (*Phytolacca americana*), Queen Anne's lace (*Daucus carota*), common teasel (*Dipsacus fullonum*), and white oldfield American aster (*Symphyotrichum pilosum*). Where limited woody vegetation and shrub growth was observed, species included willows *(Salix* sp.), black locust (*Robinia pseudoacacia*), catalpa (*Catalpa bignonioides*), and sycamore (*Platanus occidentalis*).

Developed/disturbed lands are found in low densities throughout the Survey Area, and are characterized by the presence of buildings, parking lots, paved and unpaved roads, and lawns/landscaped areas. Vegetation in these areas is generally either lacking or highly managed (i.e., ornamental plantings and managed lawns of tall fescue [*Festuca arundinacea*]). In areas that are not intensely managed, weedy herbaceous species such as dandelion (*Taraxacum officinale*), thistle (*Cirsium vulgare*), ragweed (*Ambrosia artemesiifolia*), clover (*Trifolium* spp.), and common purslane (*Portulaca oleracea*) may develop.

Forestland within the Survey Area is limited to isolated woodlots between crop areas and along roads. Many had vehicle trails throughout, either from landowners or as part of land management activities. Aggressive weedy species such as pokeweed and poison ivy (*Toxicodendron radicans*) often occurred along the woodlot edges, with the interiors of woodlots comprised predominately of maples (*Acer* spp.), oaks (*Quercus* spp.), American elm (*Ulmus americana*), American beech (*Fagus grandifolia*), and shagbark hickory (*Carya ovata*). Though shagbark hickories can be used as roosting habitat for many bat species, the Cardno field teams did not observe any bats during surveys; however, surveys were completed during daylight hours when bats are generally inactive.

The habitats surveyed during field efforts appeared to lack significant or obvious evidence of rare, threatened, or endangered species due to the high level of habitat fragmentation and degradation by current and historic land use manipulation and practices. Many of the waterbodies delineated were identified as potentially providing habitat, but at reduced quality due to surrounding land use impacts on water quality (i.e., high sediment loading during storms and fertilizer in runoff). During the field surveys, minimal wildlife use was observed in the Survey Area and no rare, threatened, or endangered species were observed.

Wetland and Stream Delineations

Wetland delineations were completed throughout the Survey Area in accordance with the 1987 U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual and the applicable regional supplements. The wetland delineations consisted of field jurisdictional determinations and documentation of regulated waters using USACE criteria. All stream features were documented for their general dimensional, substrate, morphology, and flow regimen characteristics where possible. Potentially regulated water boundaries were mapped with sub-meter accuracy Global Positioning System (GPS) equipment. Data points were recorded to represent the upland and wetland boundary interface as well as stream centerlines.

Wetland qualitative assessments were completed by the Cardno team utilizing the Ohio EPA's Ohio Rapid Assessment Method for Wetlands (ORAM). The ORAM wetland functional assessment was developed to determine the ecological "quality" and level of function of a particular wetland in order to meet requirements under Section 401 of the Clean Water Act. Wetlands are scored on the basis of hydrology, upland buffer, habitat alteration, special wetland communities, and vegetation communities. Each of these subject areas is further divided into sub-categories under ORAM v5.0 resulting in a score that describes the wetland using a range from 0 (low quality and high disturbance) to 100 (high quality and low disturbance). Based on these scores, there are three possible categories to which wetlands may be assigned:

- Category 1 – Lowest value category. Wetlands in this category are generally limited to small, low-diversity wetlands and wetlands with a predominance of non-native invasive species. The designation 'Category 1' is assigned to wetlands whose ORAM scores fall between 0 and 29.9.

Wetlands whose ORAM scores fall between 30 and 34.9 fall in a scoring 'gray area', and additional testing is needed to determine whether they belong in Category 1 or the next higher Category.

- Category 2 – Middle value category. Wetlands in this category are of moderate diversity but do not contain rare, threatened or endangered species. They are generally degraded but are capable of restoring some of the lost functionality and attaining a higher value. Most wetlands in Ohio are expected to fall into this category. The designation of 'Modified' is assigned to wetlands whose ORAM scores fall within the lower end (ORAM = 35-44.9) of the scoring range that defines Category 2 (ORAM = 35-59.9). Wetlands whose ORAM scores fall between 60 and 64.9 in a scoring 'gray area', and additional testing is needed to determine whether they belong in Category 2 or the next higher Category.

- Category 3 – Highest value category. Wetlands in this category have high levels of diversity, a high proportion of native species, and/or high functional values. The designation 'Category 3' is assigned to wetlands whose ORAM scores fall between 65 and 100.

A total of 106 wetlands covering 155.23 acres[9] were identified within the Survey Area. The majority (n=62) of wetlands were identified as forested, followed by emergent (n=32). The remaining wetlands were a mix of multiple types, including scrub/shrub, forested, or emergent. In general, wetlands in the Survey Area exhibited characteristics as expected given their position in a landscape dominated by working agriculture. Emergent wetlands typically were of low quality, often dominated by reed canary grass (*Phalaris arundinacea*) and narrow-leaved cattail (*Typha angustifolia*). Forested wetlands typically occurred in isolated woodlots between crop areas and along roads, many with vehicle trails throughout.

Many of the waterbodies delineated were identified as potentially providing wildlife habitat, but at reduced quality due to surrounding land use impacting the water chemistry (i.e., high sediment loading during storms and fertilizer in runoff). During the field surveys, Cardno staff observed minimal wildlife use in the Survey Area. Based on the ORAM scores, 39 of the wetlands were classified as Category 1 wetlands, 55 as Category 2 or Modified Category 2 wetlands, and 12 as Category 3 wetlands.

[9] Wetland acreages reported are representative of the portion of the wetland located within the Survey Area only; many wetlands extend beyond the portion of the Project Area subject to disturbance from Facility construction.

Thirty seven of the 106 wetlands delineated are non-isolated and are expected to fall under the Clean Water Act jurisdiction of federal and state government. These jurisdictional wetlands are located either in the fringe of, or directly adjacent to, delineated streams. The remaining 69 wetlands are isolated and under the sole jurisdiction of the Ohio Isolated Wetland Permitting Program. Delineated wetlands are mapped in Figure 08-4, which illustrates all delineated resources and vegetative communities within 100 feet of Facility components at a 1:12,000 scale. Additional information on the wetland delineation, including a more zoomed in view of each delineated feature.

Cardno (2018) evaluated streams with potential to be impacted using the Ohio Headwater Habitat Evaluation Index (HHEI) and/or the Ohio Qualitative Habitat Evaluation Index (QHEI) scoring method, as applicable. Both methods yield a numerical score for the section of streams evaluated, which Cardo used to estimate the probable existing aquatic life use of each stream. Jurisdictional streams were identified as those waters that had an Ordinary High Water Mark (OHWM), a defined channel, and an open water feature, such as surface water or at least a non-vegetated area through the channel that indicated periodic flowing water. Channels that parallel the roadway, do not have an identifiable OHWM, are dominated by upland vegetation, and do not represent a relocation of a natural channel are not considered jurisdictional.

All streams delineated in the field were assessed using the HHEI as outlined in the Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams Review. The HHEI is used to determine the status of smaller streams as one of three classes of primary headwater habitats (PHWH). The method scores streams on a range of 0 to 100 based on physical characteristics. Scores less than 30 indicate a Class I PHWH (ephemeral streams); scores 30 to 70 indicate a Class II PHWH (intermittent, interstitial or perennial, warm water streams); scores greater than 50 can be either Class II or Class III depending on their conditions; and Scores 70 or greater indicate a Class III PHWH (perennial, cool water streams).

Additional assessments were performed on streams which were identified as potentially having a drainage area of greater than one square mile (259 ha) or with predominant pools having maximum pool depths over 40 cm using the OEPA's QHEI. The QHEI assessment examines a number of stream characteristics and yields a score ranging from 0 to 100. A score of 60 typically indicates a stream has the physical characteristics needed to support diverse macroinvertebrate and fish populations and attain the WWH designation. Scores of 32 to 60 may be indicative of a modified warmwater habitat, meaning a WWH that has been disturbed but could potentially recover. Scores less than 32 typically indicate a limited resource water (LRW). Scores that are greater than 75 are indicative of a possible exceptional warmwater habitat (EWH).

A total of 123 waterbodies were delineated in the Survey Area. Of these, the majority (n=83) were identified as ditches. An additional 32 stream reaches and eight ponds were identified in the Survey Area. Since the HHEI is used to evaluate flowing, linear waterbodies, this assessment process was not conducted for the eight ponds in the Survey Area. Thirty-six (36) of the linear waterbodies were identified as Class I according to the HHEI scoring matrix, with an additional 56 scoring as Class II. Only 23 features scored highly enough on the HHEI score to be considered Class III waterbodies. The majority (85%) of the waterbodies were considered modified. Additional information on the delineated waterbodies, including detailed descriptions of each Class III waterbody delineated within the Survey Area, can be found in Appendix G of Exhibit J.

(c) *Literature Review of Plant and Animal Life within 0.25 Mile of Construction*

This section provides the results of a literature survey of the plant and animal life within at least one-fourth mile of the Project Area boundary. The literature survey is broken out into two sections: (i) for plant and (ii) for animals.

(i) Aquatic and Terrestrial Plants

The review of plant resources within 0.25 mile of the Project Area boundary focuses on species of commercial or recreational value, and species designated as endangered or threatened. This information was compiled through review and analysis of existing data sources, including Natureserve, USDA Plants, and ODNR natural heritage databases.

<u>Species of Commercial or Recreational Value</u>

American ginseng (*Panax quinquefolia*) occurs from Quebec, Canada, west to Minnesota and south to Georgia and Oklahoma. American ginseng is a slow-growing perennial herb that grows in the understory of deciduous forests. It typically grows to a height of 8 to 15 inches. Ginseng prefers mature woodlands, frequently on slopes, where it favors rich soil and dense shade. It is a plant that can be found throughout Ohio, but its populations are often small and scattered (ODNR, 2016a). There are no records of American ginseng in Sandusky County; however, it has been documented in Seneca County (USDA NRCS, 2016). Although the Project Area is predominantly open agricultural land, ginseng could occur in low numbers in area woodlots.

American ginseng has long been valued for the medicinal qualities of its roots. It can be considered a commercial species because collectors harvest the roots from wild plants and sell them to ginseng dealers, who must hold a Ginseng Dealer Permit from the ODNR Division of Wildlife. The rules for ginseng harvest in Ohio are prescribed in Sections 1533.86 to 1533.90 of the Ohio Revised Code (ORC), adopted pursuant to Section 1533.88 of the ORC. Ginseng harvesting is enforced by the Division of Wildlife, much like hunting seasons for game animals, with a digging season running from September 1 to December 31 of each year (ODNR, 2016a). These regulations are designed to prevent overharvesting of ginseng. American ginseng is listed in Appendix II of the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), an international agreement between countries to ensure that international trade in certain plants and animals does not threaten their survival in the wild. Appendix II includes species that are not currently threatened with extinction but may become so without trade controls. Legal trade is allowed, provided that is biologically sustainable. In order to ensure that American ginseng roots are legally and sustainably harvested, CITES permits issued by the USFWS are required to export American ginseng. There are no Ginseng Dealer Permit holders in either Seneca or Sandusky Counties, nor in any adjacent county except Crawford County (ODNR, 2016a). This suggests that ginseng harvesting may not be a common pursuit in the area.

Agricultural impacts, including impacts to crops and other commodity plants, are addressed in Section 4906-4-08(E). Aside from crops and possibly American ginseng, there are no other plant species of commercial or recreational value within 0.25 mile of the Project Area boundary.

Threatened and Endangered Species

Based on ODNR records for state-listed species, there are four endangered and eight threatened plant species known to occur in Seneca and/or Sandusky Counties (ODNR, 2016b). The status and generalized habitat requirements for each of these species are summarized below in Table 08-6.

Table 08-6. Threatened and Endangered Plant Species in Seneca and Sandusky Counties

Scientific Name	**Common Name**	**General Habitat**	**Ohio Status[1]**
Betula pumila	swamp birch	open and forested wetlands	T
Carex pseudocyperus	northern bearded sedge	sunny wet areas	E
Carex viridula	little green sedge	sunny wet areas	T
Cypripedium candidum	white lady's-slipper	sunny wet areas with basic substrates	E
Descurainia pinnata	tansy mustard	dry open areas, fields, disturbed areas	T

Scientific Name	Common Name	General Habitat	Ohio Status[1]
Eleocharis engelmannii	Engelmann's spike-rush	mudflats, lake and pond edges	E
Eleocharis quinqueflora	few-flowered spike-rush	open wet calcareous sites	T
Packera paupercula	balsam squaw-weed	open calcareous sites	T
Platanthera leucophaea	prairie fringed orchid	open wet neutral to calcareous sites	T[2]
Potamogeton gramineus	grass-like pondweed	lakes, ponds, streams	E
Sphenopholis obtusata var. obtusata	prairie wedge grass	various open, both dry and wet	T
Viola nephrophylla	northern bog violet	open wet neutral to calcareous sites	T

Source: ODNR, .2016b.
[1] E = Endangered, T = Threatened.
[2] This species is also federally-listed as Threatened.

As shown above in Table 08-6, the majority of state-listed plant species that are found in Seneca and Sandusky Counties occur in wetland habitats, which are uncommon within the Project Area and have been avoided during Facility siting to the extent practicable. Furthermore, most of the water features in the Project Area are part of a regional ditch and agricultural drainage system. These wetlands consist of man-made drainages that have become dominated by emergent wetland vegetation and are unlikely to provide habitat for any threatened or endangered plant species. The modification of a waterbody reduces the likelihood of significant rare, threatened, or endangered species populations developing, since the habitat and/or water chemistry is constantly impacted by land use.

(ii) Aquatic and Terrestrial Animals

Animal resources within 0.25 mile of the Project Area boundary were identified through review and analysis of existing data sources, including the North American Breeding Bird Survey, the Audubon Christmas Bird Count, the Hawk Migration Association of North America, the American Society of Mammalogists, the Ohio Frog and Toad Calling Survey, the Ohio Salamander Monitoring Program, the National Amphibian Atlas, and ODNR field guides. These various sources of information have been synthesized and are presented below for birds, mammals, reptiles/amphibians, aquatic species, commercial species, and recreational species. Each of these discussions identifies potential presence of species designated as endangered or threatened in accordance with the U.S. and Ohio threatened and endangered species lists. See Section 4906-4-08(B)(1)(d) below for discussion of field surveys conducted on-site.

Birds

Breeding Birds: The North American Breeding Bird Survey (BBS), overseen by the Patuxent Wildlife Research Center of the USGS, is a long-term, large-scale, international avian monitoring program that tracks the status and trends of North American bird populations. Each survey route is 24.5 miles long, with 3-minute point counts conducted at 0.5-mile intervals. During the point counts, every bird seen or heard within a 0.25-mile radius is recorded. The Vickery Survey Route runs north-south through the eastern portion of the Project Area, approximately 700 feet from the nearest proposed turbine site. Data on breeding birds was collected on this route during 16 of the 20 years between 1996 and 2015. There have been 92 species recorded on this route since 1996, the most commonly observed of which include European starling (*Sturnus vulgaris*), common grackle (*Quiscalus quiscula*), house sparrow (*Passer domesticus)*, American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius phoeniceus*), horned lark (*Eremophila alpestris*), song sparrow (*Melospiza melodia*), mourning dove (*Zenaida macroura*), American goldfinch (*Spinus tristis*), chipping sparrow (*Spizella passerina*), and killdeer (*Charadrius vociferus)*. Two state-listed endangered species (northern harrier [*Circus* cyaneus] and cattle egret [*Bubulcus ibis*]), one state-listed threatened species (black-crowned night heron [*Nycticorax nycticorax*]), and three state-listed species of concern (great egret [*Ardea alba*], sedge wren [*Cistothorus platensis*], and bobolink [*Dolichonyx oryzivorous*]) were observed during these surveys. These state-listed species have generally been detected in very low numbers. For example, one cattle egret was observed (in 2004), and none have been detected since; similarly, only one black-crowned night heron was observed (in 2002), one sedge wren (in 2015), etc. No federally-listed endangered or threatened species were observed (Pardiek et al., 2016; ODNR, 2017b).

Wintering Birds: Data from the Audubon's Christmas Bird Count (CBC) provides an overview of the birds that inhabit the region during early winter. Counts take place on a single day during a three-week period around Christmas, when birdwatchers comb a 15-mile (24 km) diameter circle in order to count the number of bird species and individuals observed. The Tiffin count circle, centered approximately 6 miles southwest of the nearest proposed turbine, overlaps the western portion of the Project Area. The number of wintering birds observed in this count circle ranged between 50 and 62 species/year over the last 10 years, with a total of 84 different species recorded. The most common wintering bird species observed were European starling, Canada goose (*Branta canadensis*), house sparrow, common grackle, American crow (*Corvus brachyrhyncos*), horned lark, dark-eyed junco (*Junco hyemalis*), rock pigeon (*Columba livia*), mourning dove, red-winged blackbird, and American tree sparrow (*Spizelloides arborea*). The following state-listed avian species were documented over the past 10 years of the Tiffin CBC: northern harrier (endangered); sandhill crane (*Grus canadensis;* threatened); and sharp-shinned hawk (*Accipiter striatus;* species of concern); no federally-listed endangered or threatened species were recorded (National Audubon Society, 2016; ODNR, 2017b).

Migratory Birds: The Hawk Migration Association of North America (HMANA) collects hawk count data from almost two hundred affiliated raptor monitoring sites throughout the United States, Canada, and Mexico. There are no hawk watch sites in the state of Ohio, nor in Indiana. The closest hawk watch sites are the Detroit River Hawk Watch in Michigan (approximately 58 miles north of the Project Area) and the Freedom Area Hawk Watch in Pennsylvania (approximately 142 miles southwest of the Project Area (HMANA, 2018). Data from Detroit River and Freedom Area Hawk Watches were reviewed, but due to the distances to the Project Area and the marked differences in landform, these sites were not considered representative of conditions for migrating raptors in the vicinity of the proposed Facility. See Section 4906-4-08(B)(1)(d) below for description of site-specific surveys that were completed to evaluate passerine migration and raptor migration through the Project Area.

<u>Mammals</u>

The occurrence of mammalian species was documented through evaluation of species range and available habitat, including data from the American Society of Mammalogists, NatureServe, and ODNR field guides. This effort suggests that approximately 40 species of mammal could occur in the area, including white-tailed deer (*Odocoileus virginianus*), Eastern cottontail rabbit (*Sylvilagus floridanus*), eastern chipmunk (*Tamias striatus*), coyote (*Canis latrans*), red fox, raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), woodchuck (*Marmota monax*), Eastern gray squirrel (*Sciurus carolinensis*), Eastern fox squirrel (*Sciurus niger*), striped skunk (*Mephitis mephitis*), American beaver (*Castor canadensis*), common muskrat (*Ondatra zibethicus*), American mink (*Mustela vison*), long-tailed weasel (*Mustela frenata*), big brown bat, little brown bat (*Myotis lucifugus*), Indiana bat *(Myotis sodalist*), northern long-eared bat *(Myotis septentrionalis*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), tri-colored bat (*Perimyotis subflavus*), evening bat (*Nycticeius humeralis*), and a variety of small mammals such as mice, moles, voles, and shrews. Most of the mammal species likely to occur in the area are common and widely distributed throughout Ohio. However, Indiana bat is both state- and federally-listed as endangered, while northern long-eared bat is both state- and federally-listed as threatened (ODNR, 2017b). Presence of both these bat species has been confirmed in the Project Area, as have little brown bat, big brown bat, tri-colored bat, hoary bat, and eastern red bat (ESI, 2011), all of which are listed as species of concern (ODNR, 2017b). See 4906-4-08(B)(1)(c)(ii) for further discussion of on-site surveys. Several other mammal species of concern could also occur in the area, including star-nosed mole (*Condylura cristata*), North American deermouse (*Peromyscus maniculatus*), woodland vole (*Microtus pinetorum*), and gray fox (*Urocyon cinereoargenteus*) (ASM, 2016; NatureServe, 2015; ODNR, 2012a, 2016c; 2017b).

Amphibians and Reptiles

Reptile and amphibian presence in the vicinity of the Project Area was determined through review of the Ohio Frog and Toad Calling Survey, the Ohio Salamander Monitoring Program, the National Amphibian Atlas, and ODNR data and correspondence (Appendix D of Exhibit J). Based on this information, along with documented species ranges, it is estimated that approximately 25 reptile and amphibian species could occur within 0.25 mile of Facility construction. These species include, but are not limited to, small-mouth salamander (*Ambystoma texanum*), red-backed salamander (*Plethodon cinereus*), Eastern American toad (*Bufo americanus*), Fowler's toad (*Bufo fowleri*), Blanchard's cricket frog (*Acris crepitans*), spring peeper (*Pseudacris crucifer*), western chorus frog (*Pseudacris triseriata*), gray treefrog (*Hyla versicolor*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*), snapping turtle (*Clelydra serpentina*), midland painted turtle (*Chrysemys picta*), Eastern garter snake (*Thamnophis sirtalis*), common water snake (*Nerodia sipedon*), and Eastern milksnake (*Lampropeltis triangulum*) (Davis & Lipps, 2016; ODNR, 2008, 2012b, 2016c; USGS, 2014). Most of the amphibian and reptile species likely to occur in the area are generally common and widely distributed throughout Ohio.

Aquatic Species

The potential occurrence of aquatic species in the vicinity of the Project Area was determined through review of the Ohio Aquatic Gap Analysis Program and ODNR data. Based on this information, it is estimated that approximately 70 fish species, 30 mollusk species, and 10 crayfish species could occur in the area (Covert et al., 2007). Fish species likely to occur within the Facility boundary include bigeye chub (*Notropis amblops*), black bullhead (*Ameiurus melas*), blacknose dace (*Rhinichthys atratulus*), blackside darter (*Percina maculata*), bluntnose minnow (*Pimephales notatus*), bluegill (*Lepomis macrochirus*), brown bullhead (*Ictalurus nebulosus*), common shiner (*Luxilus cornutus*), central mudminnow (*Umbra limi*), central stoneroller (*Campostoma anomalum*), creek chub (*Semotilus atromaculatus*), fathead minnow (*Pimephales promelas*), fantail darter (*Etheostoma flabellare*), golden shiner (*Notemigonus crysoleucas*), grass pickerel (*Esox americanus*), green sunfish (*Lepomis cyanellus*), greenside darter (*Etheostoma blennioides*), Johnny darter (*Etheostoma nigrum*), largemouth bass (*Micropterus salmoides*), northern hogsucker (*Hypentelium nigricans*), pumpkinseed (*Lepomis gibbosus*), redfin shiner (*Lythrurus umbratilis*), rock bass (*Ambloplites rupestris*), sand shiner (*Notropis stramineus*), silverjaw minnow (*Notropis buccatus*), spotfin shiner (*Cyprinella spiloptera*), striped shiner (*Luxilus chrysocephalus*), white sucker (*Catostomus commersoni*), and yellow bullhead (*Ameiurus natalis*).

Mollusk species likely to occur within the Facility boundary include creek heelsplitter (*Lasmigona compressa*), cylindrical papershell (*Anodontiodes ferussacianus*), fatmucket (*Lampsilis radiata*), giant floater (*Pyganodon grandis*), long fingernailclam (*Musculium transversum*), slippershell mussel (*Alasmidonta viridis*), striated fingernail clam (*Sphaerium striatinum*), and threehorn wartyback (*Obliquaria reflexa*).

Crayfish species likely to occur within the Facility boundary include big water crayfish (*Cambarus robustus*), devil crayfish (*Cambarus diogenes*), digger crayfish (*Fallicambarus fodiens*), Great Lakes crayfish (*Orconectes propinquus*), Ortmann's mudbug (*Cambarus ortmanni*), paintedhand mudbug (*Cambarus polychromatus*), papershell crayfish (*Orconectes immunis*), rusty crayfish (*Orconectes rusticus*), Sanborn's crayfish (*Orconectes sanbornii*), and white river crayfish (*Procambarus acutus*).

These aquatic species are generally common and widely distributed throughout Ohio. However, the following state-listed aquatic species are thought to occur in watersheds in the vicinity of the Project Area: the endangered rayed bean, white catspaw, and purple lilliput; and the threatened greater redhorse, bigmouth shiner, black sandshell, and threehorn wartyback; and the purple wartyback, round pigtoe, salamander mussel, elktoe, kidneyshell, creek heelsplitter, and Great Lakes crayfish (species of concern) (Covert et al., 2017; ODNR, 2017b). Rayed bean mussel and white catspaw are also federally-listed as endangered species (ODNR, 2017b). Both federally-listed aquatic species and the majority of the state-listed aquatic species predicted to occur within the Project Area are restricted to the Sandusky River watershed (below Morrison Creek to above Wolf Creek; hydrologic unit code [HUC] 04100011090040), which drains portions of Pleasant Township in the far western portion of the Project Area. Exceptions consist of bigmouth shiner, threehorn wartyback, creek heelsplitter, and Great Lakes crayfish. Bigmouth shiner and Great Lakes crayfish are predicted to occur in the Frink Run watershed (HUC 04100012020040), located at the far southeastern edge of the Project Area, while threehorn wartyback and creek heelsplitter are predicted to occur throughout the Project Area (Covert et al., 2007).

Commercial Species

Commercial species consist of those trapped or hunted for fur. The ODNR regulates the hunting and trapping of the following furbearers in Seneca and/or Sandusky Counties: Common muskrat, raccoon, red fox (*Vulpes vulpes*), gray fox, coyote, American mink, Virginia opossum, striped skunk, long-tailed weasel, and American beaver (ODNR, 2016d). Each of these species is briefly described below, based on habitat and distribution data published by the ODNR (2012a, 2016b) and the American Society of Mammalogists (ASM, 2016).

- Common muskrat: Muskrat are abundant throughout Ohio, and prefer habitats with slow-moving water, such as creeks and wetlands. This species is likely to occur in the vicinity of the Project Area.
- Raccoon: Raccoon are common statewide, occupying a wide variety of habitats near water, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Red fox: Red fox are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Gray fox: Less common in Ohio than the red fox, gray fox prefer forested and shrubland habitats, avoiding open areas. Although the Project Area is predominantly open agricultural land, this species could occur in low numbers in area woodlots and shrubland.
- Coyote: Once extirpated in Ohio, coyotes are now common statewide, occupying a wide variety of habitats, including forests, cropland, shrubland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- American mink: This semi-aquatic weasel has a statewide distribution and favors forested wetlands with abundant cover. Although the Project Area is predominantly open agricultural land, this species could occur in low numbers in the area woodlands.
- Virginia Opossum: Opossum are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Striped skunk: Skunk are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed lands. This species is likely to occur in the vicinity of the Project Area.
- Long-tailed weasel: Found in a wide variety of habitats (including forests, cropland, and shrubland), this species is Ohio's most common weasel, and is likely to occur in the vicinity of the Project Area.

- American beaver: Beaver are common statewide, inhabiting and modifying permanent sources of water of almost any type, particularly low gradient streams and small lakes/ponds with outlets. This species is likely to occur in the vicinity of the Project Area.

Recreational Species

Recreational species consist of those hunted as game. The ODNR regulates the hunting of the following species in Seneca and/or Sandusky Counties: white-tailed deer, gray squirrel, red squirrel, fox squirrel, cottontail rabbit, woodchuck, wild turkey (*Meleagris gallopavo*), ring-necked pheasant (*Phasianus colchicus*), American crow, mourning dove, and various waterfowl (ODNR, 2016d). Each of these species are briefly described below, based on habitat and distribution data published by the ODNR (2012a, 2013, 2016c), American Society of Mammalogists (ASM, 2016), USGS Breeding Bird Survey (Pardiek et al., 2016), and Christmas Bird Count (National Audubon Society, 2016).

- White-tailed deer: Deer are common statewide, occupying a wide variety of habitats, including forests, shrubland, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Gray, red, and fox squirrels: The fox squirrel is primarily an inhabitant of open woodlands, while the gray squirrel and the red squirrel prefer more extensive forested areas. However, all three species have adapted well to landscaped suburban areas and are often found around structures. These tree squirrels occur throughout Ohio and are likely to occur in the vicinity of the Project Area.
- Eastern cottontail: Cottontails are widespread and abundant statewide. The species prefers open areas bordered by brush and open woodlands and have adapted well to developed areas. This species is likely to occur in the vicinity of the Project Area.
- Woodchuck: Woodchuck are common statewide, occupying a wide variety of habitats, including pastures, grasslands, and open woodlands. This species is likely to occur in the vicinity of the Project Area.
- Wild turkey: Once extirpated in Ohio, this species has re-established populations statewide, and is especially common in the southern and eastern parts of the state. Wild turkey is an adaptable species that prefers mature forest habitats, but live successfully in areas with as little as 15% forest cover. This species has been documented in the vicinity of the Project Area in the Audubon CBC.
- Ring-necked pheasant: Although not native to North America, the pheasant is naturalized in northern and western Ohio, and occupies open habitats such as agricultural landscapes and old

fields. This species has been documented in the vicinity of the Project Area in the USGS BBS and the Audubon CBC.

- American crow: Crow are common statewide, occupying a wide variety of habitats, including forests, cropland, shrubland, and developed land. This species has been documented in the vicinity of the Project Area in the USGS BBS and the Audubon CBC.
- Mourning dove: Mourning doves are common statewide, occupying a wide variety of habitats, including cropland, shrubland, and developed land. This species was documented in the USGS BBS and the Audubon CBC.
- Waterfowl: The following waterfowl game species have been recorded in the vicinity of the Project Area in the USGS BBS and/or the Audubon CBC: Canada goose, snow goose (*Chen caerulescens*), Ross's goose (*Chen rossii*), mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), and wood duck (*Aix sponsa*).

(d) *Field Surveys for Plant and Animal Life Identified in Literature Review*

The literature review discussed in Section 4906-4-08(B)(1)(c) identified plant and animals likely to occur in the vicinity of the Project Area, based on previously published data. This review largely identified common species, but also indicated that some endangered, threatened, and special concern species could occur in the area. A series of site-specific field surveys were subsequently completed to further evaluate the plants and animals found on-site. The site-specific wildlife studies focused on endangered, threatened, and special concern species, as well as birds and bats, which are more vulnerable to operational impacts from wind energy facilities than flightless wildlife species. The site-specific vegetation studies focused on identifying plant communities/habitats, and on delineating sensitive features such as wetlands and streams. Numerous avian and bat studies were completed throughout the Project Area and surrounding area between 2011 and 2017 by BHE, Tetratech, ESI, and Copperhead (see Exhibits K, L, M, N, O, P, Q, and R). These surveys were designed and completed in accordance with ODNR's ON-Shore Bird and Bat Pre-and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio (2009), as well as USFWS and ODNR recommendations.

<u>Raptor Nest Survey</u>

BHE (2011a) completed a raptor nest search in March 2011 (Exhibit L) to investigate the potential breeding presence of any state- or federally-listed raptor species. Survey timing and methods were based on recommended protocol developed by the ODNR. The Project Area, as well as a 2-mile buffer, was searched by automobile during leaf-off conditions when large stick nests are more conspicuous.

Biologists drove all public roads between March 17 and 25, 2011. In addition, three larger woodlots in the southern portion of the Project Area were searched on foot.

Eleven raptor nests and one great blue heron (*Ardea herodias*) breeding colony were identified during the survey. Two nests had red-tailed hawks (*Buteo jamaicensis*) perched nearby and may have been in the early stages of nesting (i.e., nest construction, egg laying); the same may have been true for a third nest, which had a red-tailed hawk circling above. The remaining eight raptor nests appeared to be inactive and the species associated with these nests are unknown. In addition, a great blue heron breeding colony was identified within the current Project Area boundary. This colony included 12 to 15 nests, each with an adult great blue heron perched nearby. No nests of state- or federally-listed species were identified during the survey (BHE, 2011a).

<u>Breeding Bird Survey</u>

BHE (2011b) conducted on-site breeding bird surveys during the spring and summer of 2011 (Exhibit O), to provide site-specific information on nesting birds in the vicinity of the Project Area. Survey timing and methods were based on recommended protocol developed by the ODNR. Three 10-minute point-count surveys were completed at each of 24 points during May and June. Since certain bird species don't sing frequently until later in the season an additional single-day point-count survey was completed in July at an additional eight sites with suitable habitat for Henslow's sparrow, dickcissel, and sedge wren.

A total of 1,359 individual birds representing 64 species were observed during the point count surveys. Most of the species observed utilize open habitats, with 51.6% of the documented species classified as birds of open woodlands (31.3%) and grasslands (20.3%). Many of the open woodland bird species are ubiquitous and highly adaptable species, such as the American robin, American crow, common grackle, northern cardinal (*Cardinalis cardinalis*), and mourning dove. Others are birds of woodland edges and open thickets (e.g., song sparrow, American goldfinch, chipping sparrow, indigo bunting [*Passerina cyanea*], gray catbird [*Dumetella carolinensis]*, and house wren [*Troglodytes aedon*]). The most frequently observed grassland species were also common birds adaptable to open settings, including intensively managed agricultural lands (i.e., horned lark, savannah sparrow [*Passerculus sandwichensis*], brown-headed cowbird [*Molothrus ater*], and killdeer). Forest birds comprised 21.9% of observed bird species and were characterized by common species adapted to more open habitats such as edges and urban settings (e.g., blue jay [*Cyanocitta cristata*], tufted titmouse [*Baeolophus bicolor*], red-bellied woodpecker [*Melanerpes carolinus*], black-capped chickadee [*Poecile atricapillus*], white-breasted nuthatch [*Sitta carolinensis*], and downy woodpecker [*Picoides pubescens*]). Species associated with "town" or urban setting, and birds classified as marsh birds each comprised 7.8% of the observed species. The town birds were primarily comprised of introduced exotics (e.g., European starling, house sparrow) or birds that will build nests on or in man-made structures (e.g., barn swallow [*Hirundo rustica*], house finch [*Haemorhous mexicanus*], chimney swift [*Chaetura pelagica*]). The common red-winged blackbird represented ninety percent of the individual marsh birds observed in the Project Area; the remaining ten percent were wading birds and the willow flycatcher (*Empidonax traillii*). Common birds associated with scrub vegetation or with lakes/ponds made up the balance of the breeding bird observations. Eighty-six percent of the individual birds associated with lake/pond habitats were observed in a single flock of Canada geese (BHE, 2011b).

No federally-listed species were observed. Two Ohio-listed species of concern were observed during the surveys, the bobolink (n=3) and Henslow's sparrow (n=1). Incidental observations of Ohio-listed bird species during the summer breeding season included two endangered species (northern harrier [n=2] and upland sandpiper [*Bartramia longicauda; n=1*]), and one Ohio Species of Concern (great egret, n=1) (BHE, 2011b).

<u>Passerine Migration Survey</u>

To gauge passerine migration rates through the Project area, BHE (2011c) completed weekly spring and fall migration surveys during seasonally favorable weather for migration (Exhibit N) in accordance with ODNR guidelines. Eleven survey points were established near wooded areas that are utilized by migrating passerines to forage and replenish fat reserves. Bird migration surveys were completed April 4 through May 30, 2011 and August 18 through November 18, 2011. Every bird seen or heard during a 10-minute period at each established survey point was identified to species.

A total of 15,525 birds of 98 species were identified. Twenty-two percent of birds were observed during spring surveys (3,225 individuals from 84 species) and 78 percent were observed during fall surveys (12,300 individuals from 69 species). Red-winged blackbirds comprised over half (62 percent) of the birds observed with European starling the second most common species encountered. Other species with large numbers of birds encountered included: American crow (514 birds, 16.6 birds/day), common grackle (510 birds, 16.5 birds/day), American robin (484 birds, 15.6 birds/day), tree swallow (*Tachycineta bicolor,* 450 birds, 14.5 birds/day), and blue jay (346 birds, 11.2 birds/day). Large flocks (>100) of birds were limited to red-winged blackbirds, European starlings, and tree swallows.

No federally-listed species were observed. Two individual state-listed endangered northern harriers were observed, one in the spring and one in the fall. The following state-listed avian species of concern were also documented: bobolink (n=3) and northern bobwhite (n=1). The Project Area is largely covered with row crops and does not contain features known to attract large concentrations of migrating birds. Observed passerine use was consistent with a landscape dominated by row crop monoculture, and the Project Area does not appear to be an important part of a passerine migratory pathway (BHE, 2011c).

Diurnal Bird/Raptor Migration Survey

BHE (2011d) completed spring and fall migration surveys from three observation points with largely unobstructed views (Exhibit K) to document diurnal bird migration rates through the Project Area. Survey timing and methods were based on recommended protocol developed by the ODNR. Diurnal bird/raptor migration surveys took place from 9:00 a.m. to 4:00 p.m. three times a week during seasonally favorable weather for migration (northerly winds in fall, southerly winds in spring). A total of 42 days of surveys were completed in 2011, 20 days in spring (between March 17 and April 30) and 22 days in fall (between September 4 and October 28).

A total of 12,337 birds representing 52 species were observed during the diurnal migration surveys. Forty-six percent of birds were observed during spring surveys (5,725 individuals from 40 species) and 54 percent were observed during fall surveys (6,612 individuals from 40 species). Red-winged blackbirds, European starlings, and common grackles comprised over half of the birds observed. Red-winged blackbirds were the most numerous birds, observed at an average of 119 birds per day for a total of 4,986 birds. A total of 1,974 European starlings were recorded at an average of rate of 47 birds per day, and 1,376 common grackles at an average of 33 birds per day. The majority (6,614 birds; 80 percent) of blackbirds, starlings, and grackles observed were at low heights (0 to 40 meters above ground), with 20 percent (1,725) observed between 40 and 180 meters above ground. A flock of Bonaparte's gulls (62 birds) observed between 40 and 180 meters on April 7, 2011 was the only other large flock of birds observed.

Eight species of raptors were observed during the surveys, of which turkey vultures (*Cathartes aura*) were the most commonly observed. Sightings of turkey vultures averaged 12.55 birds per day for a total of 527 birds. The second most common species observed was red-tailed hawk, which were observed an average of 1.7 birds per day for a total of 71 birds. Other raptor species observed include: Cooper's hawk (*Accipiter cooperii*, 28 birds, 0.66 birds/day); northern harrier (13 birds; 0.31 birds/day); American kestrel (*Falco sparverius*, 10 birds, 0.23 birds/day); bald eagle (*Haliaeetus leucocephalus,* 4 birds; 0.10

birds/day); osprey (*Pandion haliaetus,* 1 bird, 0.02 birds/day); and red-shouldered hawk (*Buteo lineatus,* 1 bird, 0.02 birds/day).

A total of four bald eagles were observed over 294 hours of survey, all during the spring migration period. Three of the observations were of juvenile birds flying in the northwestern portion of the Project Area, while the single adult bird occurred in the southern portion of the Project Area. All four eagles were flying between 40 and 180 meters above the ground (i.e., within the rotor swept zone). In addition, two state-listed species were observed, northern harrier (endangered) and sandhill crane (threatened). A single sandhill crane was observed during spring surveys, flying low to the ground (less than 40 meters above ground level). Northern harriers were observed using the Project Area multiple times during both the spring (10 observations) and autumn (three observations) surveys. Northern harriers were frequently observed flying in their characteristically close-to-the-ground manner and are generally considered to be low risk of impact. No state-listed species of concern were observed, nor were any federally-listed species (BHE, 2011d; ODNR, 2017b).

Bald Eagle Survey

BHE (2012) completed eagle point-count surveys and bald eagle nest monitoring at three bald eagle nests located in proximity to the Project Area (Exhibit M) to determine use of the Project Area by bald eagles. Survey timing and methods were based on recommended protocol developed by the ODNR and USFWS.

BHE monitored three bald eagle nests identified during the 2011 raptor nest surveys to assess daily movement patterns and attempt to identify the productivity success of each nest during the 2011 and 2012 breeding/nesting seasons. Nest monitoring surveys were completed at each nest twice a week for at least 4 hours per survey during the incubation and rearing stages. Only one of the three nests, the Fort Seneca nest that is located approximately 6 miles west of the Project Area, remained active in 2011 and produced two eaglets. The eagles were observed to use the Sandusky River and surrounding area almost exclusively and were not observed using the Project Area. Due to a variety of constraints, BHE was unable to determine the productivity status of any of the bald eagle nests in the 2012 survey period.

In addition to the nest monitoring, BHE completed point count surveys throughout the Project Area. Survey locations, timing, and methods were developed in consultation with the ODNR and USFWS. The survey locations were selected using a random-systematic approach to distribute 20 points so that suitable habitat was represented in proportion to the extent of its occurrence within the Project Area. The point count surveys were completed twice a month from August 2011 through July 2012, with each point surveyed for 20 minutes. Survey start times varied throughout the course of the study, so that each point was surveyed during a range of daylight hours.

A total of two bald eagles were recorded over 154 hours of survey, both at point count location 19, located in the southeastern portion of the Project Area. No activity was observed at the remaining 19 point-count locations during the survey period. At no time were the eagles observed within the assumed rotor-swept zone (40 to 120 meters [131 to 394 feet]) of the proposed wind turbines (BHE, 2012). This information was provided to USFWS to assist in determining the potential risk to bald eagles posed by the proposed Project.

Bat Acoustic Monitoring Survey

Tetra Tech completed bat acoustic surveys from March 16-November 16, 2011 (Exhibit P) to characterize seasonal bat activity within the Project Area. Survey timing and methods were based on recommended protocol developed by the ODNR. Bat activity was monitored using two ultrasonic acoustic recorders (Anabat SD-2, Titley Scientific, Inc.) suspended from a meteorological tower at different heights to capture information about bat species flying at variable altitudes: one at 45 meters (148 feet) and one at 5 meters (16 feet) above ground level (henceforth referred to as the 'High' and 'Low' detectors, respectively). Detectors were programmed to begin recording 30 minutes before sunset and stop recording 30 minutes after sunrise. Each detector was manually checked by trained technicians approximately every 2 weeks during the survey period.

A total of 534 bat call sequences were recorded over the 245-night survey period (490 detector nights). Relative abundance, or the magnitude of each species' contribution to spatial and temporal use, was determined by calculating an Index of Activity (IA). The method is based on the presence/absence of a species call sequence within one-minute time increments. Thus, IA was calculated as the sum of minute-increments with a species presence divided by the unit effort (IA = # minutes ÷ detector-nights * 100). The IA calculations allows for samples with different levels of effort (i.e., different total number of detector-nights) to be accurately compared, thereby reducing the potential bias associated with differences in study effort (Tetra Tech, 2011). Bat activity was higher at the ground detector (197.1 IA) when compared to the raised detector (19.6 IA), with overall activity highest during August. Sixty-six percent of the calls were further classified to species (hoary bat, silver-haired bat, eastern red bat, evening bat, big brown bat, tri-colored bat, and little brown bat), the majority of which were silver-haired bats (35%). Calls that could not be accurately identified to species or guild level were classified as Unknown.

No calls of federally-listed bat species were positively identified during the survey. Indiana bats are known to occur in the vicinity of the Project Area, and species classifications for many Myotis calls recorded during the 2011 surveys (n = 44) was not feasible; therefore, it is possible that Indiana bats were recorded but not identified in the dataset. The location of the met tower (over 670 meters [0.4 mile] away from wooded areas) could attribute to the low occurrence of acoustic calls during this survey. The increase in activity of hoary bat, silver-haired bat, and eastern red bat during September was almost certainly attributable to migration and/or pre-migration staging. Overall, patterns of activity do not suggest the presence of a large bat migration corridor through the previous project area (Tetra Tech, 2011).

2011 Bat Mist-Netting

ESI completed a bat mist-netting survey during the summer of 2011 to assess the presence, or probable absence, of listed bat species using summer habitat within the Project Area using guidelines recommended by the USFWS and the ODNR (Exhibit Q). A secondary objective of mist-netting survey was to collect information on the bat community in general, such as species diversity and potential centers of activity. Each of 25 net sites was sampled on two non-consecutive nights between July 12 and 30, 2011. Mist-net sites were located within or to adjacent to upland forest woodlots or creek corridors. Nets were erected at dusk and kept in place for at least 5 continuous netting hours. The nets were attended continuously and checked at least every 10 minutes; a pulley system allowed biologists to raise and lower nets to retrieve bats.

A total of 907 bats representing eight species were captured, with bats netted at all 25 sites. The mean number of bats captured per site was 36, with an average of 3.9 species captured per site. The most common species captured was big brown bat (n=650), which represented nearly 72% of all bats netted. The remaining 28% of captures was distributed among the following species: northern long-eared bat (n=95), eastern red bat (n=82), little brown bat (n=52), hoary bat (n=16), tri-colored bat (n=9), evening bat (n=2), and Indiana bat (n=1).

The one Indiana bat captured during the survey was a post-lactating adult female, which was fitted with a 0.35-gram radio transmitter and released at the capture site. Over the next six days, the bat was tracked to six different roost trees in two different woodlots. All roost trees were live shagbark hickories (*Carya ovata*). The night of 30 July, the radio-tag remained in the tree following emergence, indicating it had been shed by the bat. Bat emergence from roost trees were counted on three nights at five of the six roost trees, with emergence only monitored at the remaining site once due to restricted access. As many as seven bats were observed exiting any one roost.

ESI biologists also radio-tagged a total of nine big brown bats from nine net sites whose conditions indicated recent reproduction. Seven of these bats were successfully tracked to roosts in anthropogenic structures consisting of five barns, one garage, and one house. These structures are scattered throughout the Project Area. No tagged bats changed roosts (all returned daily to the same roost), and no roosts were shared by tagged bats. Emergence counts indicated that each roost was occupied by numerous additional untagged bats, ranging from 15 to 218, suggesting that each roost is occupied by a separate colony. The presence of multiple colonies of big brown bats in the Project Area is typical of the Midwest. This species forages in open areas and is associated with human activities during all parts of its life (ESI, 2011).

<u>2015 Bat Mist-Netting</u>

Copperhead completed an additional bat mist-netting surveys during the summer of 2015 (Exhibit R). Each of 35 net sites was sampled on two non-consecutive nights between July 23 and 31, 2015; one additional site was surveyed for just one night (access issues prevented the second survey). Mist-net sites were selected to maximize coverage of flight paths used by bats along suitable travel corridors, foraging areas, or drinking areas. Nets were deployed at sunset and left open for at least 5 continuous netting hours. The nets were attended continuously and checked at least every 10 minutes.

A total of 429 bats of six species were captured, including one female Indiana bat and fourteen (12 female, 2 male) northern long-eared bats. Big brown bats comprised 75 percent of total captures (n=320) and eastern red bats comprised 21 percent of total captures (n=88). The remaining 4% of captures was distributed among the following species: northern long-eared bat (n=14), hoary bat (n=5), tri-colored bat (n=1), and Indiana bat (n=1).

In accordance with the ODNR- and USFWS-approved study plan, seven of the northern long-eared bats and the Indiana bat were radio-tagged and tracked to identify diurnal roost trees. Of the eight bats that were radio-tagged, three female northern long-eared bats and one female Indiana bat were tracked for seven days each. Two additional female northern long-eared bats were tracked for two days, and another for three days. The male northern long-eared bat was not tracked during diurnal telemetry because the target number of females were met. Fourteen northern long-eared bat roost trees and two Indiana bat roost trees were located during the radio telemetry effort. Tree species used as roost trees include ash, silver maple, black cherry, oak, and shagbark hickory. A total of 37 emergence counts were conducted between July 25 and August 2, 2015. The highest emergence count from a single roost tree was five bats, which occurred at two northern long-eared bat roost trees and one Indiana bat roost tree.

Foraging telemetry was additionally completed on the Indiana bat and five of the northern long-eared bats from July 27 to 31, 2015. Two northern long-eared bats, one adult male and one adult female, were tracked for less than five nights; all other radio-tagged bats were tracked for five nights each. The number of foraging points collected for each bat ranged from 10 to 87, with an average of 54.5 points per bat. Foraging areas of northern long-eared and Indiana bats were primarily restricted to forest and forest edges, with 61 percent of foraging points located within forested habitats and 39 percent located outside forested habitats. The mean distance bats foraged from the forest edge ranged from 0.2 meters (0.7 feet) to 379.3 meters (1,244 feet), averaging 57.5 meters (188.6 feet). All northern-long eared bats were captured within their respective estimated foraging areas. However, the Indiana bat was captured in a woodlot that it did not revisit during the collection of foraging data. The Indiana bat utilized several woodlots in close proximity to one another during foraging bouts, suggesting that this Indiana bat was more likely than the northern long-eared bats to travel between noncontiguous woodlots while foraging.

Capture data and diurnal and foraging telemetry data from this study suggest that at least eight surveyed areas are being used by northern long-eared bats. The close proximity of the 2015 and 2011 Indiana bat captures and the overlap in foraging areas from both studies suggests that 2015 and 2011 captures are from the same colony (Copperhead, 2015). Notably fewer bats were captured during 2015 than during 2011, particularly among bats susceptible to white-nose syndrome. For example, 14 northern long-eared bats were captured in 2015 over 284 net nights, compared to 95 northern long-eared bats over 200 net nights in 2011. One female Indiana bat was captured during the mist-netting surveys in both 2015 and 2011 (ESI, 2011; Copperhead, 2015).

<u>2016 Bat Mist-Netting</u>

After the completion of Copperhead's 2015 mist-net survey, the Project Area was modified to add an additional 7,882-acres on the north and west. As a result, Copperhead completed mist-netting surveys at an additional five mist net sites from July 19 through 22, 2016. Mist-net sites were chosen based on the best available habitat present within parcels where landowner access was granted and deemed most likely to yield Indiana and northern long-eared bat captures. A total of 78 bats, representing three species, were captured during this survey. Big brown bats comprised the majority of the captured bats (85%, n=66), ten eastern red bats were captured comprising 13%, and two hoary bats were captured (7%). No federally or state-listed species were captured during this survey. Copperhead (2016) concluded that the lack of Indiana and northern long-eared bat captures suggests that these species are not using this portion of the previous project during the summer maternity season, or that the species are present at such low densities that the survey techniques failed to detect them.

The Project Area was again modified in June 2017 resulting in a small area where presence/ probable absence surveys had not been completed. USFWS confirmed that additional survey was not needed in the un-surveyed portion of the current Project Area given the extensive survey effort completed for the Facility to date (see Appendix D of Exhibit J). The full text of Copperhead's Summer 2016 Bat Survey report is included in Appendix E of Exhibit J.

(e) *Summary of Additional Ecological Impact Studies*

All of the ecological impacts studies are discussed above in Sections 4906-4-08(B)(1)(b) and (d).

(2) Construction Impacts

(a) *Estimation of Impact of Construction on Undeveloped Areas, Plants, and Animals*

Since the Facility is located entirely on leased private land, there will be no construction-related impacts to recreational areas, parks, wildlife areas, nature preserves, or other conservation areas. Potential impacts to undeveloped areas, plants, and animals may occur during construction as a result of the installation of turbines, access roads, and electrical interconnects; the upgrade of local public roads or intersections; the development and use of the laydown yards and temporary workspaces around the turbine sites; and the construction of the substations and O&M building. Anticipated impacts to these resources are discussed below.

<u>Impacts to Plants</u>

Construction activities that will result in impacts to vegetation include site preparation, earth-moving, and excavation/backfilling activities associated with construction/installation of the laydown yards, access roads, foundations, and buried electrical interconnect. These activities will result in the cutting and clearing of vegetation, the removal of stumps and root systems, and increased exposure/disturbance of soil. Along with direct loss of (and damage to) vegetation, these impacts can result in a loss of wildlife food and cover, increased soil erosion and sedimentation, increased risk of colonization by non-native invasive species, and disruption of normal nutrient cycling; however, it is not anticipated that any plant species occurring in the Project Area will be extirpated or significantly reduced in abundance as a result of construction activities.

<u>Impacts to Wildlife Species</u>

Construction-related impacts to wildlife are anticipated to be very limited but could include incidental injury and mortality due to vegetation clearing and vehicular movement, potential silt and sedimentation impacts on aquatic organisms, habitat disturbance/loss associated with clearing and earth-moving activities, forest fragmentation, and displacement of wildlife due to increased noise and human activities. Based on the studies conducted to date, none of the construction-related impacts will be significant enough to affect local populations of any resident or migratory wildlife species. Each of these potential impacts is described below.

Incidental Injury and Mortality: Incidental injury and mortality should be limited to sedentary/slow-moving species such as small mammals, reptiles, and amphibians that are unable to move out of the area being disturbed by construction. If construction occurs during the nesting season, wildlife subject to mortality could also include the eggs and young offspring of nesting birds, as well as immature mammalian species that are not yet fully mobile. More mobile species and mature individuals should be able to vacate areas that are being disturbed. Furthermore, because most Facility components are sited in active agricultural land that provides limited wildlife habitat, and which currently (and historically) experiences frequent agricultural-related disturbances, such impacts are anticipated to be very minor.

Siltation and Sedimentation: Earth-moving activities associated with Facility construction have the potential to cause siltation and sedimentation impacts down slope of the area of disturbance. Facility components will be sited away from wetlands and streams to the extent practicable. To prevent adverse effects to water quality and aquatic habitat during construction, runoff will be managed under an NPDES construction storm water permit and the associated SWP3. An erosion and sediment control plan will be developed prior to construction that will use appropriate runoff diversion and collection devices. Also, because the majority of Facility components are being sited in active agricultural land, soil disturbance/exposure due to Facility construction will generally occur in areas already subject to regular plowing, tilling, harvesting, etc.

Habitat Loss: The majority of the Facility will be built in or adjacent to agricultural land, which generally provides habitat for only a limited suite of wildlife species. In addition, most of these areas are already subject to periodic disturbance in the form of mowing, plowing, harvesting, etc. Scrub-shrub and forested communities have largely been avoided and will experience less construction-related disturbance. Based on the current Facility layout, approximately 16.9 acre of forest and 0.4 acres of scrub-shrub habitat will be directly impacted by Facility construction. However, most of these impacts will be temporary (see Table 08-7).

Forest Fragmentation: The proposed Facility will result in the conversion of approximately 16.1 acres of forest to successional communities. However, the forested habitat being impacted by the Facility generally occurs at the edge of relatively small blocks or woodlots. This being the case, it is not anticipated that any forests will be significantly fragmented by construction of the proposed Facility.

Disturbance/Displacement: Some wildlife displacement will also occur due to increased noise and human activity as a result of Facility construction. The significance of this impact will vary by species and the seasonal timing of construction activities. Because most of the Facility occurs in agricultural land, species utilizing those habitats are most likely to be temporarily disturbed/displaced by Facility construction.

Impacts to Upland Habitats

Table 08-7 quantifies impacts to ecological communities, including undeveloped areas, based on the typical area of vegetation clearing column presented in Table 03-1.

Table 08-7. Impacts to Ecological Communities

Community[1]	Total Disturbance (acres)	Temporary Disturbance (acres)	Permanent Loss (acres)
Forestland	16.9	16.1[2]	0.8
Scrub-Shrub	0.4	0.4	0.0
Non-Forested Wetlands[3]	0.1	0.1	0.0
Agricultural Lands	684.7	629.6	55.1
TOTAL	**702.1**	**646.2**	**55.9**

[1] Ecological community types were obtained from Land Use/Land Cover shapefiles for Sandusky (ODNR, 1994a) and Seneca (ODNR, 1994b) Counties, and verified/updated using recent aerial imagery.
[2] The 16.1 acres of temporary impact to forestland includes 3.3 acres of permanent forest conversion (along buried collection line routes), and 12.8 acres that will be allowed to revert to forestland (along the edges of access roads and turbine workspaces).
[3] This value should be treated as an estimate. Impacts to wetlands and surface water habitats have been calculated separately based on the on-site field delineations and are presented below. The field delineation data is more accurate and supersedes this estimate.

Although they don't represent undeveloped lands, agricultural and residential lands have been included in Table 08-7 above to fully account for all anticipated impacts. Please refer to Table 08-16 for a more detailed breakdown of impacts to various types of agricultural lands (i.e., pasture vs. cultivated croplands, etc.). Impacts to natural communities have been avoided to the extent possible. Of the 55.9 acres of permanent disturbance, 55.1 acres will occur within agricultural lands and 0.8 acre will occur within forestland. Native vegetation or agricultural crops will be reestablished during restoration of the 629.6 acres of agricultural land, 16.1 acres of forestland, and 0.4 acre of scrub-shrub communities temporarily disturbed as a result of construction activities.

Impacts to Wetland and Surface Water Habitats

The proposed Facility has been designed to avoid impacting wetlands and surface waters, to the extent practicable, and to minimize such impacts where avoidance is not possible. All large permanent components (i.e., the turbines, substation, O&M Facility, and met towers) have been sited in upland areas, currently or recently used for agricultural production. Therefore, no direct temporary or permanent impacts to wetlands or waterbodies will result from construction of these components, and the potential for indirect impacts to wetlands and surface waters in the vicinity of these components will be negligible as result of required SWPPP BMPs.

The construction of access roads and the installation of electrical line interconnections among the turbine arrays presents the greatest potential for direct and/or indirect impacts to surface water and wetlands. Through an iterative design process, access roads were successfully sited to avoid all impacts to wetlands. Facility-wide, the only wetland impacts will occur as a result of collection line installation, and these impacts will all be temporary in nature. A total of six wetlands will be crossed by collection lines, resulting in a cumulative 0.10 acre of temporary impact; of these, four wetlands are anticipated to be jurisdictional, with a total 0.03 acre of temporary impact, and two isolated wetlands are anticipated to be non-jurisdictional, with a total of 0.07 acre of temporary impact. Anticipated wetland impacts are summarized below in Table 08-8. Additional information about each wetland impact can be found in Appendix F of Exhibit J.

Table 08-8. Wetland Impacts

Wetland ID	Wetland Type	ORAM Score	Wetland Category	Anticipated Jurisdictional (Yes/No)	Crossed (Yes/No)	Collection Lines Temporary Impact	
						square feet	acre
WOH-002	PEM	10	1	Yes	Yes	175	0.00
WOH-101	PEM	54	1	Yes	Yes	641	0.01
WOH-107	PEM	28	1	Yes	Yes	356	0.01
WOH-128	PFO	31	1	No	Yes	2,323	0.05
WOH-222	PSS/PFO	52	2	Yes	Yes	266	0.01
WOH-266	PFO	53	2	No	Yes	547	0.01
Total						**4,308**	**0.10**

Source: Cardno, 2018.

As indicated above, construction, operation, and maintenance of Facility access roads will not impact any wetlands. However, there will be both temporary and permanent impacts to waterbodies as a result of access road installation. Based on the current layout design, up to 23 miles of new, permanent gravel roads will be installed. There will be no temporary or permanent impacts to delineated stream reaches due to access roads. However, construction of the Project access roads is expected to require up to five ditch crossings, which will collectively result in a total of 103 linear feet or 0.04 acre of temporary impact and 82 linear feet or 0.03 acre of permanent impact. Each ditch crossing will utilize a standard culvert with rock fill to create stable road crossing. The Applicant will design these crossing to allow adequate flow during storm conditions, and not affect the flow of water within the Project Area.

There will also be temporary impacts to waterbodies as a result of collection line installation. Collection line installation will involve crossing a total of 74 waterbodies, consisting of 62 ditch crossings and 12 stream crossings (some waterbodies are crossed multiple times). Of the 74 collection line crossings, 16 will be completed via HDD resulting in no temporary or permanent impacts to the waterbody. A total of 58 waterbodies are planned to be crossed via open cut method for a total temporary impact of 0.57 acres or 1,633 linear feet, of which 0.52 acre and 1,523 linear feet consist of temporary impacts to ditches, while 0.05 acre and 110 linear feet consist of temporary impact to streams. No permanent waterbody impacts are associated with collection line installation.

Anticipated waterbody impacts are summarized below in Table 08-9. Additional information about each waterbody impact can be found in Appendix F of Exhibit J.

Table 08-9. Waterbody Impact

Waterbody ID	Flow Regime	PHWH Class	Anticipated Jurisdictional (Yes/No)	Access Road Crossing Method	Access Roads				Number of Collection Line Crossings	Collection Line Crossing Method	Collection Lines	
					Temporary Impact		Permanent Impact				Temporary Impact	
					square feet	acres	square feet	acres			square feet	acres
DOH-001	Ephemeral	I	Yes	–	0	0.00	0	0.00	2	Open Cut	57	0.02
DOH-005	Perennial	II	Yes	--	0	0.00	0	0.00	1	HDD	0	0.00
DOH-008	Ephemeral	I	No	--	0	0.00	0	0.00	1	Open Cut	21	0.00
DOH-010	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	23	0.01
DOH-011	Intermittent	I	No	–	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-024	Intermittent	II	Yes	–	0	0.00	0	0.00	4	Open Cut	86	0.03
DOH-027	Intermittent	II	Yes	Culvert	22	0.01	17	0.00	3	Open Cut	84	0.02
DOH-028	Ephemeral	I	Yes	–	0	0.00	0	0.00	1	Open Cut	65	0.02
DOH-035	Intermittent	I	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
DOH-036	Ephemeral	I	No	–	0	0.00	0	0.00	1	HDD	0	0.00
DOH-037	Intermittent	II	Yes	–	0	0.00	0	0.00	6	Open Cut	164	0.04
DOH-038	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	26	0.01
DOH-040	Perennial	III	Yes	--	0	0.00	0	0.00	2	HDD	0	0.00
DOH-041	Perennial	III	Yes	--	0	0.00	0	0.00	1	HDD	0	0.00
DOH-042	Intermittent	II	No	–	0	0.00	0	0.00	1	Open Cut	26	0.01
DOH-044	Ephemeral	II	Yes	–	0	0.00	0	0.00	2	Open Cut	43	0.02
DOH-047	Intermittent	II	Yes	–	0	0.00	0	0.00	2	Open Cut	77	0.05
DOH-051	Intermittent	I	Yes	–	0	0.00	0	0.00	3	Open Cut	73	0.02
DOH-055	Intermittent	I	Yes	–	0	0.00	0	0.00	2	Open Cut	155	0.04
DOH-057	Intermittent	I	Yes	–	0	0.00	0	0.00	1	Open Cut	35	0.03
DOH-058	Ephemeral	II	Yes	–	0	0.00	0	0.00	1	Open Cut	25	0.02
DOH-059	Intermittent	II	Yes	Culvert	20	0.01	16	0.01	1	Open Cut	20	0.01
DOH-104	Intermittent	II	No	–	0	0.00	0	0.00	1	Open Cut	20	0.01
DOH-105	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.01
DOH-111	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-114	Intermittent	II	Yes	Culvert	20	0.01	16	0.00	1	--	0	0.00
DOH-115	Intermittent	II	No	–	0	0.00	0	0.00	1	Open Cut	25	0.01
DOH-116	Perennial	III	Yes	--	0	0.00	0	0.00	2	HDD	0	0.00
DOH-120	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-123	Intermittent	II	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
DOH-125	Ephemeral	I	No	Culvert	20	0.00	16	0.00	1	Open Cut	20	0.00
DOH-126	Ephemeral	I	No	--	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-152	Ephemeral	I	No	Culvert	21	0.01	17	0.01	1	–	0	0.00

Waterbody ID	Flow Regime	PHWH Class	Anticipated Jurisdictional (Yes/No)	Access Road Crossing Method	Access Roads				Number of Collection Line Crossings	Collection Line Crossing Method	Collection Lines	
					Temporary Impact		Permanent Impact				Temporary Impact	
					square feet	acres	square feet	acres			square feet	acres
DOH-156	Intermittent	I	No	–	0	0.00	0	0.00	1	Open Cut	22	0.01
DOH-159	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-165	Ephemeral	II	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.01
DOH-168	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-204	Ephemeral	II	No	--	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-205	Ephemeral	II	No	--	0	0.00	0	0.00	1	Open Cut	20	0.00
DOH-207	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	26	0.02
DOH-209	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	40	0.03
DOH-210	Ephemeral	I	Yes	–	0	0.00	0	0.00	1	Open Cut	57	0.01
DOH-211	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	27	0.01
DOH-213	Ephemeral	I	No	--	0	0.00	0	0.00	2	Open Cut	84	0.02
DOH-219	Perennial	II	Yes	--	0	0.00	0	0.00	1	Open Cut	20	0.00
Ditch Totals												
Access Road Totals					**103**	**0.04**	**82**	**0.03**	**Collection Line Totals**		**1,523**	**0.52**
SOH-002	Perennial	III	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
SOH-003	Perennial	III	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
SOH-004	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	23	0.00
SOH-005	Intermittent	III	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
SOH-011	Perennial	III	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
SOH-014	Perennial	III	Yes	–	0	0.00	0	0.00	1	HDD	0	0.00
SOH-016	Intermittent	II	Yes	–	0	0.00	0	0.00	2	Open Cut	42	0.03
SOH-017	Intermittent	II	Yes	–	0	0.00	0	0.00	1	Open Cut	23	0.01
SOH-018	Intermittent	I	Yes	–	0	0.00	0	0.00	1	Open Cut	20	0.01
SOH-154	Perennial	III	Yes	–	0	0.00	0	0.00	2	HDD	0	0.00
Stream Totals												
Access Road Totals					0	0.00	0	0.00	**Collection Line Totals**		**110**	**0.05**
Cumulative Waterbody Totals (Ditches and Streams Combined)												
Access Road Totals					**103**	**0.04**	**82**	**0.03**	**Collection Line Totals**		**1,633**	**0.57**

Source: Cardno, 2018.

As the impacts presented above in Tables 08-8 and 08-9 illustrate, the Facility has been designed and will be constructed so that impacts to waters of the United States meet the requirements for authorization under Nationwide Permit (NWP) 12, Utility Line Activities, with no preconstruction notification requirement to the USACE and no mitigation requirements.

(b) *Description of Short-term and Long-term Mitigation Procedures*

To minimize Facility-related impacts on surface waters and wetlands, preliminary and final Facility designs were guided by the following criteria during the siting of wind turbines and related infrastructure:

- Large built components of the Facility, including wind turbine generators, meteorological towers, and the substation are sited to completely avoid wetlands and surface waters.
- The number and overall impacts due to access road crossings were minimized by routing around wetlands and streams whenever possible, and by utilizing existing crossings and narrow crossing locations to the extent practicable.
- Buried electric interconnect lines will avoid crossing wetlands where possible, will cross streams at existing or previously disturbed locations to the extent practicable, and will utilize installation techniques that minimize construction-related impacts to surface waters.

Other on-site environmental or logistical constraints, (such as stands of mature forest, landowner concerns, and other current land use), may make further avoidance of streams unfeasible. Where crossings of wetlands or surface waters are required, the Applicant will employ applicable best management practices. Specific mitigation procedures for protecting wetlands, surface water resources, vegetation, and major species and their habitats are described below.

(i) Site restoration and stabilization of disturbed soils

Following completion of construction, temporarily impacted areas will be restored to their pre-construction condition. Restoration activities are anticipated to include the following:

- The 300-foot radius turbine workspaces will be reduced to a permanent footprint of 0.03 acre (60-foot by 100-foot gravel crane pad, 18-foot diameter turbine pedestal, and a 10-foot wide gravel skirt around the tower base).
- Pre-construction contours and soil/substrate conditions will be established in all disturbed areas, to the extent practicable.
- Disturbed stream banks will be stabilized per the conditions of any formal state-issued permit.

- Buried electrical interconnect routes will be restored to pre-construction contours (as necessary) and allowed to regenerate naturally.
- Restoration of disturbed agricultural fields will be accomplished by de-compacting the soil, removing rocks, and re-spreading stockpiled topsoil.
- Disturbed soils throughout the Project Area will be re-seeded with an annual cover crop to stabilize exposed soils and control sedimentation and erosion. Seeding outside of active agricultural fields will be restricted to native seed mixes, unless otherwise requested by the landowner.

These actions will assure that, as much as possible, the site is returned to its pre-construction condition and that long-term impacts are minimized.

(ii) Frac out contingency plan

Facility construction will include the use of trenchless excavation methods known as horizontal directional drilling (HDD). This widely used technique accomplishes the installation of buried utilities with minimal impact, by routing the utility under a sensitive feature (such as a stream, river or wetland). HDD operations have the potential to inadvertently release drilling fluids into the surface environment from pressurization of the drill hole beyond the containment capability of the overburden soil material or through fractured bedrock into the surrounding rock ("frac out"). The HDD procedure uses a bentonite slurry, a fine clay material as a drilling lubricant. Although bentonite is non-toxic and non-hazardous, it has the potential to adversely impact aquatic species if released into waterbodies. Seepage of drilling fluid is most likely to occur near the bore entry and exit points where the drill head is shallow. Frac-outs can occur, however, in any location along a directional bore.

The HDD Frac Out Contingency Plan, included as Appendix G of Exhibit J, sets forth procedures to avoid, minimize, and remediate potential environmental impacts resulting from an inadvertent return of drilling fluids during HDD operations. Measures to be deployed as part of the contingency plan include site inspection, proper training of the contractor and construction personnel, development of response procedures, provision of containment materials, and implementation of appropriate clean up procedures. For more information, see Appendix G of Exhibit J.

(iii) Methods to demarcate surface waters and wetlands during construction

The boundaries of jurisdictional streams and wetlands within and immediately adjacent to the construction limits of disturbance will be demarcated with highly visible flagging, staking, or fencing prior to construction. These sensitive areas will also be depicted on construction drawings. All contractors and subcontractors working on-site will be provided with training to understand the significance of the types of flagging used, and the importance of staying within defined limits of work areas, especially in and adjacent to marked sensitive resource areas such as wetlands.

(iv) Inspection procedures for erosion control measures

Erosion and sediment control measures will be inspected by a duly qualified individual throughout the period of construction to assure that they are functioning properly until completion of all restoration work. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of or the potential for pollutants entering the drainage system. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site vehicle tracking. Inspections will be conducted at least once every seven calendar days, and within 24 hours after any storm event with 0.5 inch or greater of rain. This inspection frequency may be reduced to once every month if the entire site is temporarily stabilized and runoff is unlikely due to weather conditions (e.g., site is covered with snow, ice, or the ground is frozen).

Following each inspection, the qualified inspector will complete and sign a checklist/inspection report. At a minimum, the inspection report shall include:

- the inspection date;
- names, titles, and qualifications of personnel making the inspection;
- weather information for the period since the last inspection (or since commencement of construction activity if the first inspection) including a best estimate of the beginning of each storm event, duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any discharges occurred;
- weather information and a description of any discharges occurring at the time of the inspection;
- locations of any BMPs that need to be maintained; and
- any corrective actions recommended.

For three years following the submittal of a notice of termination form, the Applicant will maintain a record summarizing the results of the SWP3 inspections described above, including the names(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWP3, and a signed certification as to whether the facility is in compliance with the SWP3.

(v) Measures to divert stormwater runoff

To avoid and minimize impacts to aquatic resources resulting from construction-related siltation and sedimentation, an approved SWP3 will be implemented. To protect surface waters, wetlands, groundwater, and storm water quality, erosion and sediment control measures will be installed and maintained throughout site development. Such measures could include silt fence, hay bales, and/or temporary siltation basins. The location of these features will be detailed on the construction drawings, approved by the Ohio EPA as part of the NPDES review, and reviewed by the contractor prior to construction. As described above, a duly qualified individual will also inspect these features throughout the period of construction to assure that they are functioning properly until completion of all restoration work (final grading and seeding).

(vi) Measures to protect vegetation

Mitigation measures to avoid or minimize impacts to vegetation will include identifying/delineating sensitive areas (such as wetlands) where no disturbance or vehicular activities will be allowed, limiting areas of disturbance to the smallest size practicable, siting Facility components in previously disturbed areas (e.g., existing farm lanes), educating the construction workforce on respecting and adhering to the physical boundaries of off-limit areas, employing best management practices during construction, and maintaining a clean work area within the designated construction sites. Following construction activities, temporarily disturbed areas will be seeded (and stabilized with mulch and/or straw if necessary) to reestablish vegetative cover in these areas. Native species will be allowed to re-vegetate these areas, except in active agricultural fields or to otherwise meet the desires of the landowner.

(vii) Options for clearing methods and disposing of brush

Facility construction will require clearing or disturbance of approximately 702.5 acres of vegetation (see Table 08-7). Although the majority of this disturbance (more than 97%) will occur in agricultural lands, Facility construction will require the clearing of 16.9 acres of forestland and 0.4 acre of shrubland. Trees cleared from the work area will be cut into logs and either left for the landowner or removed, while limbs and brush will be buried, chipped, or otherwise disposed of as directed by the landowner and as allowed under federal, state, and local regulations.

(viii) Avoidance measures for major species and their habitats

To minimize impacts to wildlife species and their habitats, Facility components have been sited away from sensitive habitats, such as forestland, streams and wetlands, to the extent practicable. As a result, construction-related impacts to wildlife are anticipated to be very limited. The following avoidance measures will further reduce construction impacts to major species and their habitats:

- To avoid impacts to roosting bats, any necessary tree clearing will be completed between October 1 and May 31 if located within 2.5 miles of the documented Indiana bat roost, and between August 1 and May 31 if located within 150 feet of a documented northern long-eared bat roost.
- To prevent adverse effects to aquatic species and their habitats during construction, runoff will be managed under an NPDES construction storm water permit and the associated SWP3. An erosion and sediment control plan will be developed prior to construction that will use appropriate runoff diversion and collection devices.

Most of state-listed plant species found in Seneca and Sandusky Counties occur in wetland habitats, which are uncommon within the Project Area, and as indicated above, have been avoided during Facility siting to the extent practicable. Republic Wind LLC has made a strenuous effort to avoid federally regulated surface water impacts from discharge of fill material via rerouting access roads, repositioning turbines, and other approaches, and is exploring methods for crossing streams during construction that do not involve any impacts to streams, including using large steel plates as temporary spans. These avoidance efforts notwithstanding, a limited amount of minor permanent and temporary surface water impact from discharge of fill material is unavoidable during construction of the Project.

Specific mitigation measures for protecting wetlands and surface water resources will include designating no equipment access areas and restricted activity areas and employing low impact stream crossing techniques. Each of these mitigation measures is described below.

No Equipment Access Areas: Except where crossed by permitted access roads, wetlands and surface waters will be designated "No Equipment Access," thus prohibiting the use of motorized equipment in these areas.

Restricted Activity Areas: A buffer zone of 50 feet, referred to as a "Restricted Activity Area", will be established wherever Facility construction traverses, or comes in proximity to, wetlands and surface waters. The 50-foot buffer zones will be depicted on construction drawings. Construction vehicles will be allowed in this zone, if necessary; however, in order to provide further protection to wetlands and surface waters, restricted activities within this buffer zone will include:

- No deposition of slash
- No accumulation of construction debris
- No application of herbicide
- No degradation of stream banks
- No equipment washing or refueling and
- No storage of any petroleum or chemical material

Low Impact Stream Crossing Techniques: Where crossings of surface waters are required, best management practices associated with applicable streamside activities will be implemented. The Applicant will adhere to any permit conditions pertaining to low impact stream crossing techniques, including seasonal restrictions and/or alternative stream crossing methods, such as temporary bridging and installation of crossings "in the dry." Open-bottomed or elliptical culverts may be utilized on certain streams to minimize loss of aquatic habitat and restriction of fish passage. Utilizing these techniques should avoid or minimize any adverse impacts on fish and other aquatic organisms.

(3) Operation Impacts

(a) *Estimation of Impact of Operation on Undeveloped Areas, Plants, and Animals*

Aside from minor disturbance associated with routine maintenance and occasional repair activities, no other disturbance to plants, vegetative communities, wetlands, or surface waters are anticipated as a result of Facility operation. As previously indicated, the Facility is located entirely on leased private land. Therefore, the built Facility will not result in physical disturbance/impacts to recreational areas, parks, wildlife areas, nature preserves, or other conservation areas as identified in Section 4906-4-08(B)(1)(a). However, Facility visibility will extend beyond the boundaries of leased private land. Such impacts are discussed in detail below in Sections 4906-4-08(D)(3) and (4).

Operational impacts to wildlife are expected to be limited to possible displacement of wildlife due to the presence of the wind turbines, and some level of avian and bat mortality as a result of collisions with the wind turbines. Each of these potential impacts is described below.

Disturbance/Displacement

Habitat alteration and disturbance resulting from the operation of turbines and other wind farm infrastructure has the potential to make a site unsuitable or less suitable for some species of wildlife. As mentioned above, the footprint of turbine pads, roads, and other Facility infrastructure represents a very small percentage of the site following construction. Therefore, overall land use is relatively unchanged by wind power development. However, due to the presence of tall structures and increased human activity, the amount of wildlife habitat indirectly affected by a wind power project can extend beyond the functional Facility footprint. Some wildlife may become habituated to the presence of wind turbines over time; however, the rate and degree of habituation is currently unknown because few studies have evaluated this effect.

Results from the Buffalo Ridge Wind Power Project in Minnesota (Leddy et al., 1999), the Stateline wind energy facility in Oregon and Washington (Erickson et al., 2004), the Combine Hills wind energy facility in Oregon (Young et al., 2006), the Noble Wethersfield Windpark in western New York (Kerlinger & Guarnaccia, 2010), and three wind energy facilities in North and South Dakota (Johnson & Shaffer, 2012; Shaffer & Buhl, 2016) suggest that impacts of wind-energy facilities on grassland nesting passerines vary somewhat between species and sites and are generally minor. For example:

- At the Buffalo Ridge facility, overall bird density was lower within 262 feet (80 meters) of wind turbines, but at distances of 590 feet (180 meters) from the turbines, bird density did not differ from grasslands with no turbines (Leddy et al., 1999).
- At the Stateline facility, horned lark and savannah sparrow showed increased usage post-construction, while grasshopper sparrow (*Ammodramus savannarum*) and western meadowlark (*Sturnella neglecta*) showed decreased use within 50 meters (164 feet) of turbine strings; areas further away from turbines did not exhibit reduced bird use (Erickson et al., 2004).
- At the facility in New York State, bobolink showed an effect of turbine displacement following construction, with significantly fewer bobolinks within 246 feet (75 meters) of turbines situated in hayfields, but savannah sparrows did not show a significant difference in abundance based on distance from turbines (Kerlinger & Guarnaccia, 2010).
- At the three facilities in the Dakotas, grasshopper sparrow showed displacement effects in the areas adjacent to turbines, but western meadowlarks did not (Johnson & Shaffer, 2012). Most of the nine grassland bird species studied showed some displacement at at least one of the three facilities, although vesper sparrow and killdeer did not (Shaffer & Buhl, 2016).

Leddy at al. (1999) specifically recommended that wind turbines be placed within cropland to reduce displacement impacts to grassland passerines. Given that all 58 of the turbine sites proposed for the Republic Wind Facility are located within cultivated croplands as opposed to grasslands, birds using these areas are generally common and accustomed to disturbance. Therefore, displacement effects to grassland birds are not expected.

The potential impacts of the Facility on waterfowl, including foraging Canada geese and snow geese, should not be significant, even though migrating waterfowl can be expected to forage in the farm fields in the vicinity of the Project Area. This conclusion is based on the results of a study conducted by the Iowa Cooperative Fish and Wildlife Research Unit at the Top of Iowa Wind Farm located in Worth County, Iowa. Due to its proximity to three state-owned Wildlife Management Areas, the Top of Iowa Wind Farm experiences very high use by waterfowl (over 1.5 million duck and goose use-days per year). Observations at that site revealed that the wind turbines did not affect the use of the fields by Canada geese or other species of waterfowl (Koford et al., 2005). At the Buffalo Ridge wind-energy facility in Minnesota, the abundance of several bird types, including shorebirds and waterfowl, were found to be significantly lower at survey plots with turbines than at reference plots without turbines. However, the report concluded that the area of reduced use was limited primarily to within 328 feet (100 meters) of the turbines (Johnson et al., 2000). Based on these study results, and observations at other wind power projects, the proposed Facility is not anticipated to have a significant, long-term displacement effect on resident or migrating waterfowl.

Forest and forest edge birds should not be significantly disturbed because there is so little of this habitat in the vicinity of the Project Area.

Landowners and recreational users are often concerned over the potential displacement effect of wind turbines on game species such as deer and wild turkey. While habituation may not be immediate, species such as deer and wild turkey generally adapt quickly to the presence of man-made features in their habitat, as evidenced by the abundance of these species in suburban settings. Specific to wind turbines, EDR personnel observed deer and wild turkey foraging at the base of wind turbines that had just been erected a few months before at multiple wind energy facilities, including the Maple Ridge Wind Farm in Lewis County, New York; the Hardscrabble Wind Power Project in Herkimer County, New York; and the Hoosac Wind Power Project in Berkshire County, Massachusetts. Significant displacement of game species from a wind power site has not been reported.

Avian Collision Mortality

Collision with wind turbines is a documented source of avian fatality, with levels varying by bird species, season, and region. A 2014 study reviewed data from a total of 116 studies at 70 wind energy facilities across the U.S. and Canada, representing over 100,000 turbine searches demonstrated low levels of collision fatality at most projects. Small passerines (i.e., songbirds) were the most common among bird fatalities caused by collision with turbines at wind energy facilities, comprising an estimated 62.5% of all bird fatalities. By region, the eastern and prairie avifaunal biomes generally have higher fatality rates than those northern forests and various western biomes (Erickson et al., 2014), but these are well below levels that would be likely to adversely affect any particular species' population.

Collision risk to resident waterbirds (waterfowl, long-legged waders, shorebirds, rails, etc.) in the Project Area is likely to be minimal. There are small wetlands in the vicinity of the Project Area, so some waterbirds may be present; however, research has demonstrated that very few waterfowl, waterbirds, or shorebirds collide with wind turbines or other tall structures. Shorebirds are extremely rare on the lists of birds killed at wind power projects (Erickson et al., 2001). Risk of collision to waterfowl and other waterbirds during migration is also likely to be minimal, because these birds typically migrate at high altitudes, and because this group of birds has not demonstrated a propensity to collide with wind turbines or communication towers. The Canada geese and snow geese that forage on nearby agricultural fields may experience a slightly higher level of risk due to abundance; however, Canada geese have never demonstrated susceptibility to colliding with turbines. A study at the Top of Iowa Wind Power Project site revealed no fatalities to waterfowl despite documented use in proximity to turbines (Koford et al., 2005). Therefore, waterbirds are not likely to be at significant risk of colliding with wind turbines in the Project Area.

Similarly, raptor mortality from collision with turbines has also been low at most operating wind power projects outside of California (Whitfield & Madders, 2006; Chamberlain et al., 2006; Kerns & Kerlinger, 2004; Gruver et al., 2009; Derby et al., 2007; Jain, 2005). As described in Section 4906-4-08(B)(1)(d) of this Application, raptor use of the Project Area was evaluated during 2011. Even where concentrated hawk migration does occur around wind energy sites, evidence suggests that risk to migrating raptors is not great, and not likely to be biologically significant. Reports from Tarifa, Spain, where raptor migration is highly concentrated, strongly suggest that migrating raptors rarely collide with turbines (DeLucas et al., 2004). Based on post-construction monitoring studies at other operating wind energy facilities, the raptor species most likely to be impacted are resident birds that forage in open country, such as red-tailed hawk and American kestrel, as opposed to migrating raptors that pass through the area. These species are common and widespread throughout their ranges; therefore, the low impacts expected by the project are not likely to affect local or regional populations.

As these studies illustrate, bird collisions are relatively infrequent events at wind farms. Only occasional raptor, waterfowl, or shorebird fatalities have been documented. In the Midwestern and Eastern United States, night migrating songbirds have accounted for a majority of the fatalities at wind turbines. In general, the documented level of fatalities has not been large in comparison with the source populations of these species and has been minor when compared to other potential sources of avian mortality (see Table 08-10 below). When scavenging and observer efficiency are factored in, studies of avian mortality suggest that wind turbines account for 1-9 avian fatalities per turbine per year (Erickson et al., 2001; Jain et al., 2007).

There currently is no predictive model available to quantify expected avian collision mortality as a result of wind power project operation. Therefore, risk assessments must be based on pre-construction indices and indicators of risk (e.g., avian use surveys), along with empirical data from operating facilities (e.g., avian mortality surveys). Because pre-construction surveys revealed no indicators of elevated risk (e.g., unusually high numbers, habitat that would act as an ecological magnet, or abundance of rare species), collision risk to birds in the Project Area is likely to be consistent with other wind sites in the Mid-Western United States. Using the national average of 2.8 birds killed per MW per year (Erickson et al., 2012), the 200 MW proposed for the Facility would result in a total of 560 bird deaths per year. Although this number may appear large, it is distributed across many species and the individuals affected represent a fraction of a percent of the populations that migrate through the area, which would not reasonably be considered a biologically significant impact.

Table 08-10 summarizes estimated annual avian mortality from anthropogenic causes, including wind turbines. The cumulative level of avian fatalities from wind turbines is quite minor when compared to other anthropogenic sources of mortality. Other sources of avian mortality that each greatly exceed that caused by wind turbines include collision with buildings, collision with power lines, predation by domestic cats, collision with vehicles, use of agricultural pesticides, collision with communication towers, and poisoning in oil pits (USFWS, 2002; NRC, 2007; Erickson et al., 2005, 2014).

Table 08-10. Estimated Annual Avian Mortality from Anthropogenic Causes

Mortality Source	Estimated Annual Mortality	Citation
Collisions with Buildings	1 – 1,000 million	Klem, 1990 Bracey et al., 2016
Collisions with Power Lines	130 – 174 million	Erickson et al., 2005 USFWS, 2002
Predation by Domestic Cats	100 million	Coleman & Temple, 1996
Automobiles	57 – 80 million	Banks, 1979 Hodson & Snow, 1965
Pesticides	72 million	USFWS, 2002
Communication Towers	4 - 50 million	USFWS, 2002
Oil Pits	1.5 – 2 million	USFWS, 2002
Wind Turbines	368,000	Erickson et al., 2014

Bat Collision Mortality

As with avian risk, there are currently no predictive models available to quantify expected bat collision mortality as a result of wind energy facility operation, and risk assessments must be based on pre-construction indices and indicators of risk (e.g., acoustic surveys), along with empirical mortality data from operating facilities. Because the Project Area reveals no indicators of elevated risk (e.g., landscape position), collision risk to bats in the Project Area is likely to be consistent with other wind energy projects in agricultural landscapes in the mid-west. In an overview of post-construction mortality studies conducted in the U.S. and Canada from 2000 to 2011, Arnett and Baerwald (2013) found that annual bat fatality rates in the Midwestern deciduous forest-agricultural region, where the proposed Facility is located, ranged from 4.9 to 11.0 bats/MW, averaging 7.9 bats/MW and generally occur in greater frequency during the fall migration period (during which time the Project has committed to raising cut in speeds to reduce impacts).

Using the range of 4.9 to 11.0 bat fatalities/MW, the 200 MW Facility would result in a total of 980 to 2,200 bat deaths per year. Using the average of 7.9 bat fatalities/MW, the 200 MW Facility would result in a total of 1,580 bat deaths per year. However, many of the wind energy facilities at which the post-construction studies were conducted operate without any feathering or curtailment designed to minimize bat mortality. Most bat fatalities occur during relatively low-wind conditions during bat migration periods (Arnett et al., 2008). Studies have shown that altering blade angles to either stop or slow rotor movement in low wind speeds (i.e., feathering) below the manufacturer's cut-in speed ($\geq$3.5 m/s [7.8 mph) is expected to reduce overall bat mortality by a minimum of 35 percent (Good et al., 2012; Young et al., 2011; Baerwald et al., 2009). Arnett et al. (2011) found that nightly reductions in bat fatality ranged from

44 to 93% when turbine cut-in speed was raised from 3.5 m/s to either 5.0 m/s (11.2 mph) or 6.5 m/s (14.5 mph). The resulting economic loss was less than 1% of the total annual energy output for the facility (Arnett et al., 2011). Similarly, Good et al. (2011) reported an approximate 50% reduction in overall bat fatalities when turbine cut-in speed was raised from 3.5 m/s to 5.0 m/s and approximately 78% fewer fatalities when cut-in speed was raised from 3.5 m/s to 6.5 m/s.

As summarized below in Section 4906-4-08(B)(3)(b), the proposed Facility will operate under a strict curtailment regime developed in consultation with the USFWS and ODNR that will significantly reduce bat fatalities. Consequently, actual mortality at the proposed Facility is expected to be much lower than the above predictions based on average mortality across the Midwestern deciduous forest-agricultural region.

(b) *Procedures to Avoid/Minimize/Mitigate Short-term and Long-term Operational Impacts*

Aside from minor disturbance associated with routine maintenance and occasional repair activities, no other disturbance to plants, vegetative communities, wetlands, or streams are anticipated as a result of Facility operation. Since no significant operational impacts to these resources are anticipated, no mitigation measures are proposed.

The anticipated short-term and long-term operational impacts of the Facility on wildlife are expected to be minor. The Facility has been designed to minimize bird and bat collision mortality. The following measures will avoid take of state and federally protected bats (as per recommendations of the USFWS; see Appendix D of Exhibit J), and will minimize and mitigate operational impacts to other wildlife species:

- The turbines will be placed much further apart than in older wind farms where high rates of avian mortality have been documented, such as those in California.
- Turbines will be placed in agricultural fields to the extent practicable, avoiding wooded areas that provide habitat for bats. Where tree clearing is necessary, it will be avoided within 2.5 miles of the documented Indiana bat roost from April 1-October 31, and within 150 feet of identified northern long-eared bat roost trees from June 1-July 31.
- Towers will be tubular structures (rather than lattice), which prevent perching and nesting by birds.
- Lighting of turbines and other infrastructure will be minimized to the extent allowed by the FAA, and will follow specific design guidelines to reduce collision risk (e.g., using flashing lights with the longest permissible off cycle).
- Turbines have been sited to avoid bald eagle nests and areas of concentrated eagle use.

- Turbine blades will be feathered below 6.9 m/s from 30 minutes before sunset to 30 minutes after sunset during spring (March 15 to May 15) and fall (August 1 to October 31) migration.
- The blades of turbines within 2.5 miles of the documented Indiana bat roost will be feathered below 6.9 m/s from 30 minutes before sunset to 30 minutes after sunset during summer (May 16 to July 31).
- Turbines will be set back a minimum of 1,000 feet from suitable Indiana bat habitat within 2.5 miles of the documented Indiana bat roost.

(c) *Post-Construction Monitoring Plans*

A post-construction avian and bat fatality monitoring program will be implemented. Although this study will not directly mitigate Facility-specific impacts, it will help to advance understanding of avian and bat collision impacts and inform response plans if necessary. Experts have indicated that, although the impact of wind power projects on wildlife has been studied more intensively than comparable infrastructure, such as communication towers, important research gaps remain. These gaps result primarily from the limited number of post-construction monitoring studies that have been completed and made publicly available.

The Applicant will implement post-construction monitoring protocols to evaluate bird and bat impacts in accordance with ODNR and USFWS guidelines. Results of these studies will be discussed with ODNR and USFWS to evaluate impacts and determine if additional monitoring or changes in operational protocols is appropriate to ensure regulatory compliance.

(C) LAND USE AND COMMUNITY DEVELOPMENT

(1) Land Use

(a) *Land Use Map*

Land uses within the one-mile study area of the Facility are shown on Figure 08-5. The land use mapping was developed from ODNR Land Use/Land Cover data for Sandusky (ODNR, 1994a) and Seneca (ODNR, 1994b) Counties, as well as land use data associated with parcel data. Among other information, Figure 08-5 shows the following features:

(i) The Proposed Facility

(ii) Land use

(iii) Structures

(iv) Incorporated Areas and Population Centers

(b) *Structures Table*

(i) Distance between structures and the nearest turbine

There are five agricultural structures within 1,000 feet of a proposed turbine site. For each of these barns, Table 08-11 presents the distance to the nearest turbine and the lease status of the underlying parcel (i.e., whether the structure is located on a participating or non-participating parcel).

Table 08-11. Structures Within 1,000 Feet of a Wind Turbine

Structure Type	Distance to Project Component	Closest Wind Turbine	Lease Status of Underlying Parcel
Barn	608 feet	F08	Non-Participating
Barn	611 feet	F08	Non-Participating
Barn	781 feet	F08	Non-Participating
Barn	786 feet	F08	Non-Participating
Barn	795 feet	E07	Participating

(ii) Distance between structures and associated facilities

There are 141 structures within 250 feet of an associated facility (i.e., a collection line, access road, laydown yard, O&M facility, or the collection substation). Of these, 22 structures are within 250 feet of two different associated facilities. For each occurrence of an associated facility within 250 feet of a structure, Table 08-12 presents the structure type, the distance to the nearest component by type, and the lease status of the underlying parcel (i.e., whether the structure is located on a participating or non-participating parcel).

Table 08-12. Structures Within 250 Feet of an Associated Facility

Structure Type	Distance to Project Component	Closest Facility Component	Lease Status of Underlying Parcel
Silo	29 feet	Collection Line	Participating
Silo	32 feet	Collection Line	Participating
Silo	34 feet	Collection Line	Participating
Silo	37 feet	Access Road	Participating
Silo	39 feet	Access Road	Participating

Structure Type	Distance to Project Component	Closest Facility Component	Lease Status of Underlying Parcel
Silo	42 feet	Access Road	Participating
Barn	44 feet	Access Road	Participating
Barn	44 feet	Access Road	Participating
Barn	51 feet	Access Road	Participating
House	70 feet	Collection Line	Non-Participating
Barn	71 feet	Access Road	Participating
House	71 feet	Collection Line	Non-Participating
House	73 feet	Access Road	Participating
House	74 feet	Laydown	Non-Participating
Barn	76 feet	Collection Line	Participating
Barn	80 feet	Collection Line	Participating
Barn	81 feet	Collection Line	Participating
House	83 feet	O&M	Participating
House	83 feet	Laydown	Participating
House	89 feet	Access Road	Participating
Substation	90 feet	Access Road	Non-Participating
Barn	97 feet	O&M	Participating
Barn	97 feet	Collection Line	Participating
Substation	97 feet	Access Road	Non-Participating
Barn	97 feet	Laydown	Participating
Barn	97 feet	Collection Line	Non-Participating
Barn	99 feet	Collection Line	Participating
Barn	101 feet	Collection Line	Non-Participating
House	103 feet	Collection Line	Participating
Barn	103 feet	Collection Line	Non-Participating
House	104 feet	Access Road	Non-Participating
House	105 feet	Access Road	Participating
Barn	108 feet	Access Road	Non-Participating
Barn	109 feet	Collection Line	Participating
House	110 feet	Access Road	Non-Participating
Barn	115 feet	Access Road	Participating
Barn	116 feet	Access Road	Participating
Barn	116 feet	Collection Line	Participating
House	116 feet	Access Road	Participating
House	119 feet	Access Road	Non-Participating
House	122 feet	Collection Line	Non-Participating
House	122 feet	Collection Line	Participating

Structure Type	Distance to Project Component	Closest Facility Component	Lease Status of Underlying Parcel
Barn	122 feet	Collection Substation	Participating
House	124 feet	O&M	Participating
House	124 feet	Laydown	Participating
Barn	128 feet	Collection Line	Participating
Barn	129 feet	Collection Line	Non-Participating
Silo	130 feet	Collection Substation	Participating
House	130 feet	Collection Line	Non-Participating
House	130 feet	Access Road	Non-Participating
House	132 feet	Collection Line	Non-Participating
Barn	133 feet	Access Road	Non-Participating
House	133 feet	Access Road	Non-Participating
Barn	136 feet	Collection Line	Non-Participating
House	138 feet	Collection Line	Non-Participating
House	140 feet	Collection Line	Participating
Barn	142 feet	Collection Line	Non-Participating
Silo	144 feet	Access Road	Participating
House	146 feet	Access Road	Non-Participating
House	146 feet	Collection Line	Non-Participating
House	146 feet	Access Road	Participating
Barn	146 feet	Collection Line	Non-Participating
Barn	148 feet	Collection Line	Participating
House	150 feet	Collection Line	Non-Participating
Barn	150 feet	Collection Line	Non-Participating
Barn	151 feet	Collection Line	Non-Participating
House	152 feet	Collection Line	Non-Participating
House	152 feet	Access Road	Participating
House	153 feet	Collection Line	Non-Participating
House	153 feet	Collection Line	Participating
House	156 feet	Collection Line	Non-Participating
House	156 feet	Collection Line	Non-Participating
House	157 feet	Access Road	Non-Participating
House	158 feet	Collection Line	Non-Participating
Silo	158 feet	Collection Line	Participating
Barn	160 feet	Collection Line	Participating
Barn	160 feet	Collection Line	Participating
House	161 feet	Collection Line	Non-Participating
House	163 feet	Laydown	Non-Participating

Structure Type	Distance to Project Component	Closest Facility Component	Lease Status of Underlying Parcel
Barn	164 feet	Collection Line	Participating
House	165 feet	Collection Line	Participating
Barn	167 feet	Collection Line	Non-Participating
Barn	168 feet	Access Road	Participating
Silo	168 feet	Collection Substation	Participating
House	168 feet	Access Road	Non-Participating
House	170 feet	Collection Line	Non-Participating
Barn	171 feet	Access Road	Participating
Barn	173 feet	Collection Line	Non-Participating
Barn	173 feet	Collection Line	Non-Participating
Barn	173 feet	Access Road	Non-Participating
House	174 feet	Collection Line	Non-Participating
Substation	174 feet	Access Road	Non-Participating
House	174 feet	Collection Line	Participating
House	175 feet	Collection Line	Participating
House	176 feet	Collection Line	Non-Participating
Substation	180 feet	Collection Line	Non-Participating
Silo	180 feet	Access Road	Participating
House	181 feet	Collection Line	Participating
Barn	181 feet	Collection Line	Participating
House	182 feet	Laydown	Non-Participating
House	182 feet	Access Road	Non-Participating
House	184 feet	Collection Line	Non-Participating
Substation	184 feet	Access Road	Non-Participating
House	185 feet	Collection Line	Non-Participating
Barn	185 feet	Access Road	Non-Participating
House	185 feet	Access Road	Participating
House	187 feet	Collection Line	Non-Participating
Barn	187 feet	Access Road	Participating
Barn	187 feet	Collection Line	Participating
Barn	188 feet	Collection Line	Non-Participating
Barn	189 feet	Collection Line	Participating
House	190 feet	Collection Line	Non-Participating
Barn	191 feet	Collection Line	Participating
Barn	193 feet	Collection Line	Participating
House	193 feet	Collection Line	Non-Participating
House	196 feet	Collection Line	Participating

Structure Type	Distance to Project Component	Closest Facility Component	Lease Status of Underlying Parcel
House	199 feet	Collection Line	Participating
House	200 feet	Collection Line	Participating
House	200 feet	Collection Line	Non-Participating
Barn	202 feet	Collection Line	Participating
House	203 feet	Access Road	Non-Participating
House	203 feet	Collection Line	Non-Participating
Barn	203 feet	Collection Line	Participating
House	204 feet	Access Road	Participating
House	206 feet	Access Road	Participating
House	210 feet	Collection Line	Non-Participating
House	212 feet	Access Road	Non-Participating
House	212 feet	Access Road	Non-Participating
House	213 feet	Laydown	Non-Participating
House	213 feet	O&M	Non-Participating
House	214 feet	Collection Line	Non-Participating
Barn	215 feet	Access Road	Participating
Barn	216 feet	Collection Line	Participating
Barn	217 feet	Collection Line	Non-Participating
House	218 feet	Access Road	Participating
House	218 feet	Access Road	Non-Participating
House	219 feet	Collection Line	Non-Participating
House	219 feet	Access Road	Participating
House	219 feet	Collection Line	Participating
Barn	219 feet	Collection Line	Participating
Barn	220 feet	Collection Line	Participating
Barn	220 feet	Collection Line	Non-Participating
House	221 feet	Collection Line	Participating
Barn	223 feet	Collection Line	Non-Participating
Substation	223 feet	Collection Line	Non-Participating
Barn	225 feet	Collection Line	Participating
Barn	225 feet	Collection Line	Non-Participating
Substation	226 feet	Collection Line	Non-Participating
Barn	226 feet	Collection Line	Participating
Barn	232 feet	Collection Line	Non-Participating
Barn	233 feet	Access Road	Non-Participating
Barn	233 feet	Collection Line	Participating
House	238 feet	Collection Line	Non-Participating

Structure Type	Distance to Project Component	Closest Facility Component	Lease Status of Underlying Parcel
Barn	238 feet	Access Road	Non-Participating
House	239 feet	Collection Line	Non-Participating
House	241 feet	Collection Line	Non-Participating
House	241 feet	Access Road	Non-Participating
House	241 feet	Access Road	Non-Participating
House	242 feet	Collection Line	Participating
Barn	243 feet	Collection Line	Non-Participating
Silo	246 feet	Collection Line	Participating
Silo	249 feet	Collection Line	Participating
House	250 feet	Collection Line	Participating

(iii) Land/lease status of the property for each structure

The lease status for each structure within 1,000 feet of a turbine and each structure within 250 feet of an associated facility is presented above in Table 08-11 and Table 08-12, respectively.

(c) *Land Use Impacts*

Table 08-13 presents the total, temporary, and permanent land use impacts on the land uses illustrated in Figure 08-5, in total for each land use type, and by project component. Facility-related impacts to land use were calculated based on the impact assumptions provided in Table 03-1 of this Application and the land use codes for each parcel, found in parcel shapefiles for Seneca and Sandusky Counties. In ArcGIS, Facility components were intersected with the parcel shapefiles, resulting in shapefiles of impacts to each land use associated with the respective Facility component, and then the impact areas or lengths for all Facility components were entered into a spreadsheet. For example, wind turbines were buffered by 300 feet (to generate a shapefile representing the area of total disturbance) and the parcel shapefiles were clipped to the buffer, resulting in the total land use that will be impacted by wind turbines. To determine the temporary impacts to each land use associated with wind turbines, 0.03 acres per turbine (area of the 20-foot radius permanent impacts) were subtracted from the total land use impacts associated with wind turbines that were calculated in ArcGIS. For linear components (access roads and collection lines), the appropriate impact widths were multiplied by the lengths to create an area of impact. Finally, using the spreadsheet, the separate areas of impact for each Facility component were added together, resulting in the temporary, permanent, and total areas of impact associated with each component and for each land use type.

Table 08-13. Land Use Impacts

Land Use	Total Disturbance (acres)	Temporary Disturbance (acres)	Permanent Loss (acres)
Agricultural (100)	685.2[2]	630.1	55.1
Wind Turbines and Workspaces	*363.3*	*361.6*	*1.7*
Access Roads	*97.7*	*54.3*	*43.4*
Buried Electrical Collection Cable	*200.2*	*200.2*	*0.0*
O&M Buildings	*5.0*	*0.0*	*5.0*
Laydown Yards	*12.0*	*12.0*	*0.0*
Substation	*5.0*	*0.0*	*5.0*
Meteorological Towers	*2.0*	*2.0*	*0.0*[3]
Commercial (400)	0.8[2]	0.8	0.0
Wind Turbines and Workspaces	*0.0*	*0.0*	*0.0*
Access Roads	*0.0*	*0.0*	*0.0*
Buried Electrical Collection Cable	*0.8*	*0.8*	*0.0*
O&M Buildings	*0.0*	*0.0*	*0.0*
Laydown Yards	*0.0*	*0.0*	*0.0*
Substation	*0.0*	*0.0*	*0.0*
Meteorological Towers	*0.0*	*0.0*	*0.0*
Residential (500)	16.1[2]	15.3	0.8
Wind Turbines and Workspaces	*12.6*	*12.5*	*0.1*
Access Roads	*1.6*	*0.9*	*0.7*
Buried Electrical Collection Cable	*1.9*	*1.9*	*0.0*
O&M Buildings	*0.0*	*0.0*	*0.0*
Laydown Yards	*0.0*	*0.0*	*0.0*
Substation	*0.0*	*0.0*	*0.0*
Meteorological Towers	*0.0*	*0.0*	*0.0*
Total	**702.1**	**646.2**	**55.9**

[1] From land use codes in Seneca and Sandusky County parcel shapefiles.
[2] This breakdown of impact acreages differs slightly from those presented in Table 08-7, because the data were derived from different sources. Land uses were derived from property tax codes, which are assigned by parcel, while ecological communities were derived from ODNR data, which are not assigned by parcel. For example, the 0.8 acre of commercial impact is not reflected in the ecological community impacts, because it is vacant commercial land that is forested; in Table 08-7, this same 0.8-acre impact is reported as an impact to forestland. Please note that total impact acreages are consistent regardless of data source (i.e., 702.1 acres total impact, 646.2 acres temporary impact, and 55.9 acres permanent impact).
[3] Permanent impacts from meteorological towers will be 10 square feet (0.0002 acre) per tower, or a total of 0.0004 acre. For purposes of this table, that value rounds to 0.0 acre.

Only very minor changes in land use are anticipated within the Project Area as a result of Facility operation, and no changes are predicted outside the Project Area. The presence of the turbines bases, the collection substation, and other ancillary structures will result in the cumulative conversion of approximately 55.9 acres of land from its current use to built facilities (less than 1% of the 24,221 acres of leased land). During Facility operation, additional impacts over the years on land use should be infrequent and minimal. Aside from occasional maintenance and repair activities, Facility operation will not interfere with on-going land use (i.e., farming activities).

More than 97% of the total impacts from Facility construction and operation will occur in land used for agriculture. While both temporary impacts and permanent impacts to land use could occur, these changes will affect a tiny percentage of leased lands, and the Facility will be compatible with the agricultural land uses that dominate the Project Area. The transportation and use of construction equipment and material could impact growing crops, fences and gates, subsurface drainage systems (tile lines), and/or temporarily block farmers' access to agricultural fields. However, construction impacts will be temporary in nature, and confined to the properties of participating landowners. As described in Section 4906-4-08(E)(2)(b), the Applicant has developed construction specifications for construction activities occurring partially or wholly on privately owned agricultural land. These specifications, along with special siting considerations will minimize impacts to agricultural land uses in the Project Area.

(d) *Structures That Will Be Removed or Relocated*

The Applicant does not anticipate the removal or relocation of any existing structure as a result of construction or operation of the proposed Facility.

(2) Parcel Status Map

Figure 08-6 illustrates the proposed facility, habitable residences, and parcel boundaries of all parcels within a half-mile of the Project Area. This map also shows the lease status for each parcel, along with setbacks from property lines, pipelines, and major roads.

(a) *Setback to Wind Farm Property Line*

As per OAC 4906-4-08(C)(2)(a), the distance from a wind turbine base to the property line of the wind farm property must be at least one and one-tenth times the total height of the turbine structure as measured from its tower's base (excluding the subsurface foundation) to the tip of a blade at its highest point. As shown in Table 03-2, the maximum total height of the tallest turbine model under consideration for the Facility is 591 feet. Therefore, setback to the wind farm property line for the proposed Facility is 650.1 feet (591 feet x 1.1).

(b) *Setback to Property Line of Nearest Adjacent Property*

As per OAC 4906-4-08(C)(2)(a), the wind turbine must be at least one thousand, one hundred, twenty-five feet in horizontal distance from the tip of the turbine's nearest blade at ninety degrees to the property line of the nearest adjacent property at the time of the certification application. As shown in Table 03-2, the maximum rotor diameter for the turbine models under consideration for the Facility is 449 feet. Therefore, the setback to the property line of the nearest adjacent property is 1,349.5 feet [(449 feet ÷ 2) + 1,125 feet = 224.5 feet + 1,125 feet].

(c) *Setback Waivers*

Minimum setbacks from property lines and residences may be waived in the event that all owners of property adjacent to the turbine agree to such waiver.

(3) Land Use Plans

(a) *Formally Adopted Plans for Future Use of Site and Surrounding Lands*

Several of the municipalities within the five-mile study area have adopted comprehensive land use plans, strategic downtown plans, and/or economic development plans. Each of these are summarized below:

- City of Bellevue Vision 2025 Comprehensive Master Plan: This plan, adopted in 2005 by the Bellevue City Council, identifies the need for a 20-year vision, in which the issues, concerns, goals, and priorities of the community are addressed through civic engagement. High-paying job creation in the manufacturing sector, as well as the retention of existing jobs and the preservation of existing farming operations are goals and issues presented in the plan (City of Bellevue, 2005).

- 2016 City of Tiffin Downtown Strategic Growth and Development Plan: This strategic plan complements the previously-created 2010 Strategic Downtown Tiffin Plan, which "creates urban design solutions with policy recommendations to invigorate the urban core and community as a whole, with a revitalized and enhanced downtown" (City of Tiffin, 2010). Guided by revitalization principles for downtown areas and the local economy, the plan recommends that infill development utilize alternative energy when possible and support opportunities to develop local green tech industries.

- 1995 Erie County Comprehensive Development Plan: This plan "determines the immediate and future needs of the community and provides ways to allow the County to guide appropriate land uses to the most suited areas for that kind of development" (Erie County, 1995). By analyzing the existing conditions and growth trends of the County, along with issues facing the region, the plan identifies goals for future land use and policy making.

- 2017 Huron County Comprehensive Land Use Plan: Originally developed in 2007 and last revised in 2017, the Huron County Commissioners, the Huron County Comprehensive plan aims to manage future growth within the County to cohesively guide development patterns over the next thirty years. A key goal is to promote Huron County as a development destination and to retain and expand existing businesses (Huron County, 2017).

- 2013 Sandusky County Comprehensive Plan: This plan is an update to the 2003 Comprehensive Plan and is intended to be long-range plan used to guide growth and development using current existing condition, along with updated trends and priority project. A major goal of the plan is to facilitate the economic health and growth of the County and its municipalities by expanding on the tax and employment base. Furthermore, the plan "promotes and facilitates the proper placement and provision of energy infrastructure components throughout the County, including but not limited to wind farms and solar arrays" (Sandusky County, 2013).

- 2011 Seneca County Comprehensive Economic Development Strategy: The plan is intended to position Seneca County as a "redevelopment area," as defined by the EDA, and thus to make its political subdivisions eligible to apply from the EDA Public Works and other programs. As specified by the plan, "the assumptions, goals, and strategies laid out in the plan create a blueprint for the County's overall economic development and a summary of what is considered the most effective and proactive, targeted strategy to improve the economic position and climate of Seneca County" (Seneca County, 2011).

(b) *Applicant's Plans for Concurrent or Secondary Uses of the Site*

The Applicant has no plans for concurrent or secondary uses of the site. Facility components will be located on portions of leased land with existing rural residential or agricultural uses. Wind power projects are compatible with agricultural practices, and because this Facility has been sited and designed to maximize such compatibility, existing land uses will continue concurrently with Facility operation.

(c) *Impact on Regional Development*

The regional economy surrounding the Facility is shaped in large part by the agricultural industries of Erie, Huron, Sandusky, and Seneca Counties. While the five-mile study area is predominantly rural, the City of Toledo (west of the study area) and the City of Cleveland (east of the study area), both significant metropolitan regions, are each in relative proximity to the study area. Erie, Huron, Sandusky, and Seneca Counties are primarily agricultural in nature. The regional context for the development of this Facility is discussed in further detail below, concentrating on five primary components: housing, commercial and industrial development, schools, transportation, and other public services and facilities. In addition, the compatibility of the proposed Facility with regional developmental goals and plans is reviewed.

Housing

As with all sectors of the economy, the housing market throughout the region has felt the impact of population loss. Owner-occupied vacancy rates in Erie, Huron, Sandusky, and Seneca Counties (ranging from 2.0% to 2.3%) are slightly higher than the statewide average of 1.9%. The rental vacancy rate in Huron County (11.7%), Sandusky County (9.7%), and Seneca County (7.1%) is substantially higher than the statewide average of 6.5%, while the rental vacancy rate in Erie County is only 0.1% higher than the statewide average.

Erie, Huron, Sandusky, and Seneca Counties feature a median monthly gross rent level of $707, $630, $634, $645, respectively, all of which is below the statewide average of $730/month. Each county has a lower than statewide percentage of households whose rent accounts for more than 35% of their household income. In addition, the median housing values of Huron, Sandusky, and Seneca Counties are below the statewide average of $129,900, while Erie County's median housing value ($131,400) is slightly above the statewide average.

It is estimated that 13,631 housing units within Erie, Huron, Sandusky, and Seneca Counties are currently vacant. Given these figures, in addition to the population projections discussed in Section 4906-4-08(C)(3)(e) below, it is not expected that the development of the Facility will have a significant impact on the regional housing market. While the Facility development may not represent a widespread boom for rental property owners, it is worth noting that the availability of vacant rental housing also indicates that the Facility should not have a destabilizing effect on current renters.

Commercial and Industrial Development

The diversification of Ohio's energy portfolio will have significant and positive economic impacts beyond a reduced dependence on coal imported from outside of the state. The Environment Ohio Research & Policy Center estimated that if the State of Ohio increased wind power production to 20% of the state's total energy portfolio by 2020, such development would create 3,100 permanent, full-time positions within the state, and result in cumulative wages totaling $3.7 billion. This same analysis estimated that such a commitment would result in an increase in gross state product of approximately $8.2 billion by 2020 (Environment Ohio, 2007).

These impacts are principally due to the impact of wind energy development on the manufacturing sector. The State of Ohio is uniquely positioned to take advantage of advanced manufacturing opportunities for the development and distribution of wind power technology, according to the Renewable Energy Policy Project's (2004) report, "Wind Turbine Development: Location of Manufacturing Activity." This analysis estimates that if the United States were to invest $50 billion into 50,000 MW of new wind power production, Ohio manufacturers could stand to create 11,688 jobs in wind turbine and related manufacturing, accounting for 1.95% of the total investment; by way of comparison, the American Wind Energy Association estimates that the State of Ohio alone has enough wind resources to generate nearly 359 MW at 80 meter hub height and 110,439 MW at 110 meter hub height of onshore wind energy (AWEA, 2015).

The Environmental Law & Policy Center estimated that the State of Ohio is currently home to 106 wind power supply chain businesses, providing 1,000 to 2,000 jobs throughout the state (ELPC, 2011). Wind energy technology manufacturing opportunities include rotors, controls, drive trains, generators, and towers. Several of these manufacturers and other wind power-related businesses are located in the Greater Cleveland Region (AWEA, 2015).

Specific short- and long-term economic impacts of this Facility on commercial and industrial development throughout the region are described in further detail in Section 4906-4-06(E)(4) of this Application.

Schools

The proposed Facility will have a significant positive impact on the local tax base, including local school districts that serve the area where the wind farm is to be located. However, aside from increased tax revenue for the local school districts, no significant impact on schools or school facilities is anticipated. The Facility is not expected to have significant growth-inducing effects on the surrounding locales. Local employees would be hired to the extent possible. In the event that non-resident workers are hired, it is expected that they would commute or stay in regional transient housing or motels and would not bring families that might require additional school facilities.

Transportation System Development

The region surrounding the Project Area features numerous Interstates, U.S, and State highways, as well as county and local roadway networks, in addition to freight rail lines and small airports. The main transportation route to the Project Area is I-80/90 (Ohio Turnpike), which runs just north of the five-mile study area. U.S. Route 20 (north) and State Route 4 (east) run adjacent to the Project Area. State Routes 53 and 269 provide direct access into the Project Area. These and other primary routes facilitate transportation between the Project Area and the surrounding metropolitan areas.

Workers coming to and from the site will most likely enter via State Route 4 or 20 from I-80/90. Construction traffic bound for the substations will likely use State Route 53 as the primary route, while traffic bound for the Operations and Maintenance area will most likely use U.S. Route 20 as the primary route. The proposed Facility is not expected to cause any substantial disruption to major transportation corridors serving the five-mile study area.

Freight rail lines connect several of the municipalities throughout the five-mile study area. CSX and Norfolk Southern operate the majority of Ohio's freight rail system, although smaller operators such as Ashland Railway, Northern Ohio and Western Railway, and Wheeling and Lake Erie Railway also operate in the area. Municipalities within the five-mile study area that are connected to freight rail lines include the Cities of Bellevue, Clyde, and Tiffin; the Townships of Adams, Ballville, Bloom, Clinton, Green Creek, Groton, Hopewell, Jackson, Liberty, Lyme, Norwich, Pleasant, Reed, Scipio, Thompson, Venice, and York; and the Village of Green Springs. The rail system may be used for the transportation of a very small number of turbine component and equipment suppliers, but the Applicant does not anticipate making any modifications to the existing system.

The Project Area is also in proximity to the Huron County Airport, the Sandusky County Regional Airport, the Seneca County Airport, the Bandit Field Airdrome, the Fremont Airport, the Fostoria Airport, and the Willard Airport. However, as indicated in Section 4906-4-07(E)(1), only Sandusky County Regional Airport and Bandit Field Airdrome are located within five miles of the Project Area. Construction and operation of the Facility will be designed according to FAA standards, and as such, are not expected to result in any adverse impacts to the regional air transportation network. The Applicant has filed Form

7460-1 with the FAA for each proposed turbine site (see Exhibit V) to confirm that the Facility will not cause any adverse impacts to the existing air travel network.

Other Public Services and Facilities

The Facility is not expected to have significant growth-inducing effects on the surrounding locales. Therefore, no significant impact on local public services and facilities is expected. Workers will commute to the work site on a daily basis. Local employees would be hired to the extent possible. Hiring of non-resident workers would occur only when local residents with the required skills were not available or competitive. It is expected that non-resident workers would commute or stay in regional transient housing or motels, and not require new housing, and would not bring families that might require family healthcare or additional school facilities. The principal impact on public services in the site locale would be a temporary increase in traffic on roads leading to the Project Area, due to deliveries of equipment and materials during construction.

(d) *Regional Plan Compatibility*

As discussed in Section 4906-4-08(C)(3)(a), several of the municipalities within the five-mile study area have adopted comprehensive land use plans, strategic downtown plans, and/or economic development plans. Compatibility with each of these plans is discussed below:

- City of Bellevue Vision 2025 Comprehensive Master Plan: In terms of economic development, the Facility offers an opportunity for the use of local goods and services, including but not limited to labor, equipment, and maintenance. In addition, the payments associated with land leases provide additional income for landowners, including agricultural producers, and in doing so, improves the economic conditions for existing farming practices.

- 2016 City of Tiffin Downtown Strategic Growth and Development Plan: While the Facility does not directly impact the downtown area, it is compatible with the strategic plan through its diversification of the region's energy resource portfolio, adding resilience and reliability to the supply of energy resources to local businesses. The Facility also offers an opportunity for the use of local goods and services, including those provided by businesses located in the downtown area.

- 1995 Erie County Comprehensive Development Plan: The Facility is compatible with the Plan's goal to "promote community development through the improvement of infrastructure that meets development demands".

- 2017 Huron County Comprehensive Land Use Plan: A key goal is to promote Huron County as a development destination and to retain and expand existing businesses. The Facility is compatible with this goal due to the positive impacts it will create for the local economy.

- 2013 Sandusky County Comprehensive Plan: A major goal of the plan is to facilitate the economic health and growth of the County and its municipalities by expanding on the tax and employment base. Furthermore, the plan "promotes and facilitates the proper placement and provision of energy infrastructure components throughout the County, including but not limited to wind farms and solar arrays" (Sandusky County, 2013). The Facility is compatible with these goals, specifically the placement and provision of alternative energy infrastructure.

- 2011 Seneca County Comprehensive Economic Development Strategy: The Facility is compatible with the plan's priority action to improve the local economy and implement alternative energy. Recently, the County approved a resolution to make Seneca County an "Alternative Energy Zone", making it eligible for state tax incentives.

The Facility is located in an area that is largely rural in nature with a majority of impacts from the Facility construction and operation occurring on land used for agriculture. The economic benefits of the turbines for local agriculturalists, as well as their overall compatibility with farming practices, will support and aid in the preservation of local farming operations. Furthermore, the jobs and economic development created by Facility may help to create and retain existing local employment opportunities. Therefore, the development of this Facility is compatible with the goals and strategies of existing local and regional plans.

(e) *Current and Projected Population Data*

Census data reveals that these communities have experienced a varied history of small population growth and decline over the past two decades. Table 08-14 presents the population trends for the State of Ohio and counties within five miles of the Project Area, including percent change in population numbers from 1990 to 2010. The population of the entire state showed a notable increase (6.36%) from 1990 to 2010, as did Huron County (6.0%), with Erie County experiencing a much smaller population increase of 0.4% during the same time span. Meanwhile, Sandusky and Seneca Counties experienced an overall decrease in population from 1990 to 2010, declining by 1.6% and 5.0%, respectively.

Table 08-14. Population Trends

Area	1990 Population	2000 Population	2010 Population	% Change 1990-2010
Erie County	76,779	79,551	77,079	0.4%
Huron County	56,240	59,487	59,626	6.0%
Sandusky County	61,963	61,792	60,944	-1.6%
Seneca County	59,733	58,683	56,745	-5.0%
State of Ohio	10,847,115	11,353,140	11,536,504	6.36%

Source: U.S. Census Bureau (2015), 2000 and 2010 Decennial Census

Table 08-15 present population estimates for 2015, and population projections for 2020 and 2030 for each community within five miles of the Project Area. Population within the local cities, townships, and village mostly decreased from 2000 to 2015. However, the Village of Green Springs experienced a population increase of 50.6% over the same time span. The City of Tiffin is the largest of the 23 municipalities within a five-mile radius of the proposed turbines, and has experienced the least decline of growth (-1.9%) of all the local municipalities from 2000 to 2015.

In general, the trends experienced by each community from 2000 to 2015 are expected to continue regardless of whether the proposed Facility is built. Over the next two decades, the total population within the five-mile study area is projected to increase by 2% from 2010 to 2030, from 71,927 to 73,369; compared to the projected statewide increase of 4% during the same time span. Meanwhile, county population projections are expected to decline over the same time span. Seneca County is projected to experience the greatest decrease in population (-11%) from 2010-2030, while Huron County is projected to experience only a -3% decline in population during the same time span.

Table 08-15. Population Projections

Community	Population			% Change 2000-2015	Estimated Population		% Change 2010-2030
	2000	2010	2015		2020	2030	
City of Bellevue (Erie County)[10]	-	-	26	-	-	-	-
City of Bellevue (Huron County)	3,841	3,673	3,613	-5.9%	3,399	3,197	-13.0%
City of Bellevue (Sandusky County)	4,352	4,527	4,470	2.7%	4,591	4,716	4.2%
City of Clyde	6,064	6,325	6,305	4.0%	6,556	6,816	7.8%
City of Tiffin	18,135	17,963	17,793	-1.9%	17,457	17,128	-4.6%
Adams Township	1,337	1,320	1,435	7.3%	1,540	1,653	25.2%
Ballville Township	6,395	5,985	5,911	-7.6%	5,464	5,050	-15.6%
Bloom Township	1,937	1,799	1,591	-17.9%	1,307	1,073	-40.3%
Clinton Township	4,188	4,109	4,052	-3.2%	3,920	3,793	-7.7%
Green Creek Township[11]	-	3,646	3,520	-3.5%	3,398	3,281	-10.0%
Groton Township	1,384	1,427	1,344	-2.9%	1,305	1,267	-11.2%
Hopewell Township	2,874	2,774	2,725	-5.2%	2,584	2,450	-11.7%
Jackson Township	1,609	1,608	1,702	5.8%	1,800	1,904	18.4%
Liberty Township	2,340	2,035	2,184	-6.7%	2,038	1,903	-6.5%
Lyme Township	968	853	690	-28.7%	492	351	-58.9%
Norwich Township	1,072	1,070	1,176	9.7%	1,290	1,415	32.3%
Pleasant Township	1,685	1,635	1,397	-17.1%	1,158	960	-41.3%
Reed Township	949	848	820	-13.6%	709	612	-27.8%
Scipio Township	1,831	1,729	1,704	-6.9%	1,586	1,476	-14.6%
Sherman Township	501	510	405	-19.2%	327	265	-48.1%
Thompson Township	1,422	1,443	1,446	1.7%	1,470	1,495	3.6%
Townsend Township	1,670	1,620	1,327	-20.5%	1,054	838	-48.3%
Venice Township	1,871	1,758	1,737	-7.2%	1,613	1,497	-14.8%
York Township	2,512	2,532	2,516	0.2%	2,520	2,524	-0.3%
Village of Green Springs	599	738	902	50.6%	1,358	2,045	177.1%
Total[12]	**69,536**	**71,927**	**70,791**	**1.8%**	**72,069**	**73,369**	**2.0%**

Source: U.S. Census Bureau, 2000 and 2010 Decennial Census and American Community Survey 5-Year Estimates 2011-2015, projections derived from each municipality's respective 2000-2015 growth rates.

[10] This entity did not exist as currently structured at the time of the 2000 and 2010 Censuses, and population projections are not available.
[11] This entity did not exist as currently structured at the time of the 2000 Census. Percent change is calculated from 2010-2015.
[12] Totals calculated by formula, may reflect rounding errors.

Although construction employment related to the construction of the Facility will be substantial, this employment is relatively short term and is not expected to result in the permanent relocation of construction workers to the area. Therefore, the Facility is not anticipated to generate significant population growth within the five-mile study area. The number of potential short- and long-term employment opportunities associated with the construction and operation of the Facility is discussed in further detail above in Section 4906-4-06(E)(2).

(D) CULTURAL AND ARCHAEOLOGICAL RESOURCES

(1) Landmarks of Cultural Significance Map

Figure 08-7 depicts formally adopted land and water recreation areas, recreation trails, scenic rivers, scenic routes or byways, and registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significant within five miles of the Project Area.

EDR conducted a cultural resources records review (Exhibit S) through online resources from the Ohio Historic Preservation Office (OHPO). The purpose of this review was to identify known cultural resources in the vicinity of the Facility so that impacts to these resources can be minimized. Cultural resources include archaeological and historical sites, such as cemeteries, buildings, structures, objects, and districts. The literature review included the following records from OHPO:

- OHPO previous Phase I, II, and III cultural resources surveys
- National Register of Historic Places (NRHP)
- NRHP Determination of Eligibility (DOE) properties
- National Historic Landmarks (NHL) List
- Ohio Historic Inventory (OHI)
- Ohio Department of Transportation (ODOT) Historic Bridge Inventory
- Ohio Archaeological Inventory (OAI)
- Ohio Genealogical Society (OGS) cemetery files
- Mills *Archaeological Atlas of Ohio* (1914)

The records review for the five-mile study area identified 11 historic properties listed on the NRHP (two within the Project Area); four properties determined eligible for listing in the NRHP; 390 previously identified historic structures recorded in the OHI; two historic bridges listed on the Ohio Historic Bridge Inventory, 698 archaeological sites recorded in the OAI, and 65 cemeteries recorded by the OGS. Appendix B in Exhibit S contains a complete list of NRHP-listed properties within the 5 miles of the Project Area. A list of properties previously determined eligible for listing on the NRHP within 5 miles of the Project Area can be found in Appendix C in Exhibit S. Additional information on all cultural resources can be found in Exhibit S.

(2) Impact to Landmarks and Mitigation Plans

EDR concluded that there will be no direct impacts to aboveground cultural resources (i.e., cemeteries or historic structures) within the Project Area from construction or operation of the proposed Facility, and no specific mitigation measures are proposed at this time. However, the impacts to previously recorded and hereto unidentified archaeological resources are currently unknown.

The proposed Project has the potential to cause indirect (visual) impacts to aboveground historic and recreational resources within the Study Area. However, the rural nature and low population density of the area, as well as the general lack of major thoroughfares, limits the number of viewers potentially affected by the proposed Facility. A complete visual impact analysis has been completed for the proposed Facility and is discussed below in Section 4906-04-08(D)(4).

(3) Impact to Recreational Areas and Mitigation Plans

Existing recreational areas within a five-mile radius of the proposed Facility are depicted on Figure 08-7 and listed in Table 08-16 below. Recreational areas were identified through ODNR Lands and Facilities online mapping (2018), ESRI StreetMap North America (2008), and ESRI ArcGIS Online map services.

Table 08-16. Recreational Areas Within a Five-Mile Radius of the Facility

Recreational Area	Location	Distance from Nearest Turbine
Sandusky River	· Town of Ballville, Sandusky County and · Towns of Pleasant, Clinton, Hopewell, and Seneca, Seneca County	1.7 miles
North Coast Inland Trail	· Towns of Sandusky and Ballville, Sandusky County · Towns of Green Creek, York, Lyme, and Ridgefield, Huron County	0.8 mile
Buckeye Trail	· Towns of Washington, Sandusky, and Ballville, Sandusky County · Towns of Pleasant, Adams, Thompson, and Reed, Seneca County · Towns of Norwich, Peru, and Greenfield, Huron County	0.3 mile

As listed in Table 08-16 above, three state-designated recreation areas occur within five-miles of the proposed Facility. Each of these recreational sites is described below, along with an assessment of potential impacts from the proposed Facility.

The Sandusky River is a state-designated scenic river located 1.7 miles at its closest point to a turbine. The Sandusky River was designated an Ohio scenic river in 1970. The river is Ohio's longest river within the Lake Erie watershed, and offers several public access sites that are open for hunting and canoeing, as well as fishing along most of its length. The Seneca and Wyandot Indians lived along the river and the Sandusky River Valley has played a role in Ohio's history. Four forts were located along the river's banks including Fort Stephenson, where the Americans won a decisive victory in the War of 1812 (ODNR, 2017c). Factoring topography, vegetation, and structures into the viewshed, visibility will be eliminated in small areas throughout the 10-mile visual study area where blocks of forest vegetation occur, along forested stream corridors (see Appendix A in Exhibit AA). Sizable areas of no visibility or limited visibility includes the Sandusky River. In general, areas of screened views increase in size with distance from the project (EDR, 2018a). The project visual impact analysis (VIA) (see Exhibit AA) further discusses visual impacts to visually sensitive resources and mitigation of such impacts. Facility sound levels along the Sandusky River will always be less than 46 dBA Leq, even under high winds and anomalous meteorological conditions (RSG, 2017). There will be no shadow flicker along the Sandusky River (EDR, 2018b).

The North Coast Inland Trail state bike route traverses the northern portion of the visual study area and comes within approximately 0.8 mile from the nearest proposed turbine at its closest point. The trail is currently 71.8 miles, but when completed the bike trail will extend approximately 105 miles, from Lorain, Ohio to Toledo, Ohio (Ohio Bikeways, 2017). As shown in Appendix A of Exhibit AA, turbines will likely be visible along portions of the North Coast Inland Trail. In general, areas of screened views increase in size with distance from the project (EDR, 2018a). The project VIA (see Exhibit AA) further discusses visual impacts to visually sensitive resources and mitigation of such impacts. Facility sound levels along the North Coast Inland Trail will always be less than 46 dBA Leq, even under high winds and anomalous meteorological conditions (RSG, 2017). There will be no shadow flicker along the North Coast Inland Trail (EDR, 2018b).

The Buckeye Trail, which is located 0.3 mile at its nearest point from a proposed turbine, was first proposed by Merrill Gilfillan in 1958. The trail was originally planned to be a 500-mile path from the Ohio River to Lake Erie, but evolved into the nation's longest loop trail, winding 1,444 miles around Ohio. The trail extends from the farmland of the northwest, to the hills of Appalachia, the Blackhand sandstone cliffs of the Hocking Hills regions, the Bluegrass region of southwest, scenic wetlands and forests across the state, and many historic towns, canal towpaths, and abandoned rail grades. There are 26 sections of the trail, each named for a town or feature within that section. Portions of two sections, Pemberville and Norwalk, pass through the central portion of the 10-mile visual study area (Buckeye Trail Association, 2017). As shown in Appendix A of Exhibit AA, turbines will likely be visible along portions of the Buckeye Trail. In general, areas of screened views increase in size with distance from the project (EDR, 2018a). The project VIA (see Exhibit AA) further discusses visual impacts to visually sensitive resources and mitigation of such impacts. Facility sound levels along the Sandusky River will always be less than 46 dBA Leq, even under high winds and anomalous meteorological conditions (RSG, 2017). There are four small segments of the trail ranging from 167 feet to 280 feet that may experience more than 30 hours of shadow flicker per year. However, shadow flicker impacts are not anticipated along the Buckeye Trail as the trail crosses just into the 30 hours per year contour and shadow flicker impacts are conservative and do not take into account the screening effects associated with existing, site-specific conditions and obstacles such as trees (EDR, 2018b).

The VIA prepared for the proposed Facility includes photo-documentation and field review of the potential visibility of the Project from recreational resources within the visual study area (see Sensitive Sites Table, Appendix B of Exhibit AA).

(4) Visual Impact

EDR prepared a Visual Impact Analysis (VIA) for the proposed Facility (see Exhibit AA). The purpose of the VIA is to:

- Describe the appearance of the visible components of the proposed Facility.
- Define the visual character of the Project study area.
- Inventory and evaluate existing visual resources and viewer groups.
- Evaluate potential Project visibility within the study area.
- Identify key views for visual assessment.
- Assess the visual impacts associated with the proposed Facility.

The VIA was prepared by, and with oversight from, a professional with experience in developing visual impact assessments. It is also consistent with the policies, procedures, and guidelines contained in established visual impact assessment methodologies.

The visual study area for the Facility was defined as the area within a 10-mile radius of each of the proposed wind turbines. The 10-mile study area encompasses approximately 728 square miles, and includes portions of Erie, Huron, Sandusky, and Seneca Counties. Additional communities that occur within five miles of the proposed Facility include three cities (Bellevue, in Sandusky and Huron Counties, Clyde in Sandusky County, and Tiffin in Seneca County); two villages (Green Springs in Sandusky and Seneca Counties and Republic in Seneca County); and 16 townships (Groton in Erie County; Lyme, Norwich, and Sherman in Huron County; Ballville, Green Creek, and York in Sandusky County; and Adams, Bloom, Clinton, Liberty, Pleasant, Reed, Thompson, Scipio, and Venice in Seneca County). The location and extent of the visual study area is illustrated in Figure 4 in Exhibit AA.

(a) *Project Visibility and Viewshed Analysis*

An analysis of Facility visibility was undertaken to identify those locations within the visual study area where there is potential for the proposed wind turbines to be seen from ground-level vantage points. This analysis included identifying potentially visible areas on viewshed maps and verifying visibility in the field. The methodology employed for each of these assessment techniques is described in Exhibit AA. Results are summarized below, with additional detail to be found in Exhibit AA.

<u>Viewshed Analyses</u>

The topographic blade-tip viewshed analysis indicates that areas where there is no possibility of seeing the Facility are extremely limited, consisting of a few topographic depressions, such as quarries and portions of river/stream valleys. Based on the screening effect of topography alone, only two of the visually sensitive sites within the study area are indicated as being completely screened from views of the proposed wind turbines (the NRHP-listed Social Science House and the Village of Castalia).

Factoring vegetation and structures into the viewshed analysis provides a more accurate reflection of what the actual extent of Facility visibility is likely to be (see Figure 8 in Exhibit AA). The blade tip viewshed analysis indicates that approximately 60.7% of the study area will have potential views of some portion of a wind turbine. Visibility will be eliminated in small areas throughout the study area where blocks of forest vegetation occur, along forested stream corridors, and is drastically reduced or eliminated in cities and villages due to screening provided by trees and structures. In general, areas of screened views increase in size with distance from the Facility. Sizable areas of no or limited turbine visibility include the Cities of Tiffin, Fremont, Clyde, and Bellvue; the Sandusky River, Huron River, Wolf Creek, Honey Creek, and Silver Creek corridors; and the northeastern portion of the study area.

The results of the FAA warning light viewshed analysis are very similar to those of the blade tip analysis, except that it illustrates that the Facility's potential nighttime visibility covers a somewhat smaller geographic area. Considering the screening of topography, vegetation, and structures, potential nighttime turbine visibility is indicated within 50.7% of the visual study area.

Field Verification

The field review suggested that portions of the Facility will be visible throughout most of the study area due to the flat topography and the abundance of open agricultural land. The field review confirmed a general lack of open views toward the Facility from developed areas with an abundance of structures and street/yard trees, particularly in the Cities of Bellevue, Clyde, Fremont, and Tiffin; and the various villages within the study area (including Attica, Bettsville, Bloomville, Green Springs, Monroeville, and Republic). Consequently, views of the Facility from the majority of residences and historic sites within these residential areas are anticipated to be fully or partially screened. In general, only on the outskirts of these developed areas, where open fields adjoined residential areas, were open views available in the direction of the Facility. Views of Project turbines will be most available from the more rural/agricultural portions of the study area. Some screening will be provided by wood lots, hedgerows, farm buildings, rural residences and yard trees. Long distance views are likely to be unavailable where homes and roads are surrounded by vegetation, as the lack of topography allows the foreground and midground vegetation to screen the view. Field review also confirmed that the Facility will be visible from most of the transportation corridors in the study area. However, because of the distance, lack of topography, and intervening vegetation, the Interstate 80/90 corridor will have very limited visibility.

The largest concentration of sensitive sites is found within the cities and villages in the study area. Field review of these confirmed that visibility from the majority will be partially to fully screened, because of the surrounding built environment. More discussion of Facility visibility from sensitive sites is presented in Exhibit AA, which also includes, in Appendix B, a comprehensive summary of potential visibility from land and water recreation areas, recreational trails, scenic rivers, scenic routes or byways, and registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within 10 miles of a proposed turbine site.

(b) *Description of Scenic Quality of Existing Landscape*

As previously discussed, land use within the 10-mile radius visual study area is dominated by agricultural land, farms, and rural and suburban style residences. Rural residential development occurs at a very low density throughout the agricultural portions of the study area. Hamlets are relatively small pockets of development within a primarily rural/agricultural landscape. Higher density residential and commercial development is concentrated in the Cities of Bellevue, Clyde, and Tiffin, and the Villages of Green Springs and Republic. The city and villages are generally characterized by a main street business district, surrounded by traditional residential neighborhoods, with some commercial frontage development along the outskirts. Some suburban residential and commercial development occurs around the periphery of the city and villages in the study area. Commercial/industrial uses within the study area also occur on the outskirts of the city and villages, and along certain portions of state and county highways in the area.

Vegetation in the study area is dominated by active agricultural land (crop fields), followed by developed/open space (residences/yards), and some deciduous forest areas (woodlots). Many of the fields and roadsides have man-made or modified ditches that help maintain drainage for proper growing conditions. Forestland is limited to isolated woodlots between crop areas and along roads. The majority of the water features within the study area are small streams and ponds that occur on private land, and therefore receive very limited recreational use. These water bodies are also not major visual components of the landscape, and typically can only be seen at, or in proximity to, public road crossings.

The definition of landscape types found in the study area provides a useful framework for the analysis of available visual resources and viewer circumstances. These landscape types, referred to in the VIA as Landscape Similarity Zones (LSZs), are defined based on the similarity of landscape features such as landform, vegetation, water, and land use patterns, as well as characteristics that affect visual sensitivity, such as the availability of open views, scenic quality and user activity. Within the 10-mile radius visual study area, six major LSZs were defined:

- Rural Residential/Agricultural Zone,
- City/Village Zone,
- Suburban Residential Zone,
- Hamlet Zone,
- Water/Waterfront Zone, and
- Transportation Corridor Zone.

The Rural Residential/Agricultural LSZ is the dominant landscape type that occurs throughout the study area and is visually recognizable by its working landscape characteristics. The landscape in this zone is characterized by uniformly level topography with a mix of farms and associated crop fields, rural residences, hedgerows, small woodlots, and occasional water features. The dominant land use is crop farming (primarily soybeans and corn), along with small amounts of pasture. Due to the presence of open fields, views within this LSZ are more open and longer in distance than those available in other zones within the study area. These views typically include a level foreground field, with woodland vegetation in the background, and, in places, crossing or framing the view. Views in the Rural Residential/Agricultural LSZ include widely scattered homes, barns and silos, with working farm equipment occasionally seen in the fields. Scenic quality generally ranges from low to moderate depending on the variety and arrangement of landscape features in the view. Due to the abundance of open fields, and the proposed location of turbines exclusively within this zone, open foreground (0-0.5 mile), midground (0.5-3.5 miles), and background (>3.5 miles) views of the proposed Project will be available from many areas within the Rural Residential/Agricultural LSZ.

Additional information about the Rural Residential/Agricultural LSZ and descriptions of the other less common LSZs, including representative photos of each LSZ, can be found in Exhibit AA.

(c) *Landscape Alterations and Impact on Scenic Quality of the Landscape*

Construction and operation of the proposed Facility will result in an alteration to the existing landscape through the introduction of tall, lit, moving structures where currently there are none. However, the visibility and visual impact of the wind turbines will be highly variable, based on landscape setting, the extent of natural screening, the presence of other man-made features in the view, and distance of the viewer from the Facility. As described above, scenic quality in the study area generally ranges from low to moderate, depending on the variety and arrangement of landscape features in the view.

Based upon the nighttime photos/observations of existing wind power projects, the red flashing lights on the turbines could result in a potential nighttime visual impact (i.e., a landscape alteration). The actual significance of this impact from a given viewpoint will depend on how many lighted turbines are visible, what other sources of lighting are present in the view, the extent of screening provided by structures and trees, and nighttime viewer activity/sensitivity. It should be noted that nighttime visibility/visual impact will be limited in cities, villages, hamlets, and along highways where existing lights already compromise dark skies and compete for viewer attention. However, night lighting could be somewhat distracting and have an adverse effect on rural residents that currently experience dark nighttime skies.

The low to medium scenic quality within the working agricultural landscape that makes up the majority of the visual study area serves to limit the Facility's visual impact. There are no National Parks, National Forests, National Wildlife Refuges, National Natural Landmarks, federally designated scenic rivers or trails, State Nature Preserves, State Parks, or State Forests within the visual study area.

(d) *Visual Impacts to Landmarks of Cultural Significance*

The viewshed analysis indicates that views of the Facility will be fully screened from 192 of the inventoried visually sensitive resources. These include 47 NRHP-listed resources, 17 NRHP-eligible resources, nine state historic markers, the Village of Castalia, and 116 other locally significant resources (see Appendix B of Exhibit AA). Only 12 of the inventoried visually sensitive resources are indicated as having fully unobstructed views of the Facility, all of which are cemeteries, and the remaining 206 identified resources are indicated as having a combination of open and screened views, depending on the exact location of the viewer within the resources mapped boundary.

(e) *Photographic Simulations*

To illustrate anticipated visual changes associated with the proposed Facility, photographic simulations of the completed Facility from 10 selected viewpoints were used to evaluate Project visibility, appearance, and contrast with the existing landscape. The visual simulations are included as Appendix D of Exhibit AA. Review of these images, along with photos of the existing view, allowed for comparison of the aesthetic character of each view with and without the proposed Facility in place. Exhibit AA includes a detailed discussion of each simulation. Evaluation by an EDR aesthetics expert indicates that the Facility's overall contrast with the visual/aesthetic character of the area will range from insignificant to appreciable.

Insignificant to moderate contrast was noted for viewpoints located more than 1.5 miles from the Facility, particularly where existing vegetation provides at least partial screening, or where existing vertical elements (such as trees and utility poles) in the foreground or mid-ground reduces the turbines' perceived line and scale contrast with the landscape. Moderate to appreciable contrast was noted where foreground and near mid-ground views of turbines (i.e., under 1.3 miles) are available, especially from agricultural areas. Under these circumstances, the Facility's strong scale and line contrast with existing landscape features, and with viewer activity was noted. However, contrast was substantially reduced when views of the turbines were more distant or screened.

Based on experience with currently operating wind power projects elsewhere, public reaction to the Facility is likely to be generally positive, but highly variable based on proximity to the turbines, the affected landscape, and personal attitude of the viewer regarding wind power. As Stanton (1996) notes, although a wind power project is a man-made facility, what it represents "may be seen as a positive addition" to the landscape.

(f) *Impact Minimization Measures*

Mitigation options are limited, given the nature of the Facility and its siting criteria (i.e., tall structures typically located in open fields). The VIA evaluates various impact minimization measures, as summarized below:

Lighting

Turbine lighting will adhere to FAA regulations. Medium intensity red strobes will be used at night, rather than white strobes or steady burning red lights. Lighting at the proposed substation will be kept to a minimum and turned on only as needed by switch or motion detector.

Turbine Layout

Again, because of the extent of the Facility, the number of individual turbines, and the variety of viewpoints from which the Facility can be seen, turbine relocation will generally not significantly alter visual impact. Where visible from sensitive resources within the study area (e.g., local parks, historic locations, and heavily used roadways) numerous turbines are likely to be visible, and relocation of individual generators would have little effect on overall visual impact. Throughout the study area, available views of the Facility include different turbines at different distances from the viewer. Therefore, turbine relocation would generally not be effective in mitigating visual impacts.

Visual Screening

Views of the proposed turbines from cities and villages, where the majority of the residents and sensitive historic sites are located, are typically well screened by intervening structures and trees. Midground and background views in the more rural portions of the study area, including views from sensitive sites, are generally at least partially screened by hedgerows and woodlots. Due to the height of individual turbines and the geographic extent of the proposed Facility, screening of individual turbines with earthen berms, fences, or planted vegetation will generally not be effective in reducing Facility visibility or visual impact.

Facility Coloration

The white color of wind turbines (as mandated by the FAA to eliminate the need for day time lighting) minimizes contrast with the sky under most conditions, especially when viewed at distance against the horizon. The size and movement of the wind turbine blades prevents more extensive camouflage from being a viable mitigation alternative (i.e., they cannot be made to look like anything else).

Maintenance

The turbines and turbine sites will be maintained to ensure that they are operating efficiently. Research and anecdotal reports indicate that viewers find wind turbines more appealing when the rotors are turning (Stanton, 1996; Pasqualetti et al., 2002).

In addition to the mitigation measures described above, other measures that will reduce or mitigate visual impact have been incorporated into the Project design. These include the following:

- All turbines will have uniform design, speed, color, height and rotor diameter.
- The Project operations and maintenance building (although not yet designed) will reflect the vernacular architecture of the area (i.e., resemble an agricultural structure), or, preferably, will reuse an existing structure within the community that is currently vacant.
- New road construction will be minimized by utilizing existing farm lanes whenever possible.
- The placement of any advertising devices on the turbines will be prohibited.

(E) AGRICULTURAL DISTRICT IMPACTS

(1) Agricultural Land and Agricultural District Land Map

Agricultural land use is the dominant land use in the Project Area. Figure 08-9 depicts agricultural land, agricultural district land, and land eligible for Current Agricultural Use Value program within the Project Area.

(2) Potential Impacts and Proposed Mitigation

Significant impacts to agricultural land have been avoided through careful Facility design, which deliberatively sited Facility components along field edges/hedgerows to the extent practicable. Each wind turbine location, along with the locations for associated infrastructure, was individually inspected during field efforts by the Applicant and/or its consultants.

(a) *Acreage Impacted*

Table 08-17 quantifies impacts to agricultural land uses, based on the typical area of vegetation clearing column presented in Table 03-1.

Table 08-17. Impacts to Agricultural Land Uses

Agricultural Land Use[1]	Total Disturbance (acres)	Temporary Disturbance (acres)	Permanent Loss (acres)
Agricultural Vacant (100 or 110)	444.2	459.4	38.8
Wind Turbines and Workspaces	*233.8*	*232.7*	*1.1*
Access Roads	*62.3*	*34.6*	*27.7*
Buried Electrical Collection Cable	*124.1*	*124.1*	*0.0*
O&M Buildings	*5.0*	*0.0*	*5.0*
Laydown Yards	*12.0*	*12.0*	*0.0*
Substation	*5.0*	*0.0*	*5.0*
Meteorological Towers	*2.0*	*2.0*	*0.0*[2]
Cash Grain or General Farm (101 or 111)	*175.9*	*163.6*	*12.3*
Wind Turbines and Workspaces	*90.4*	*90.0*	*0.4*
Access Roads	*26.7*	*14.8*	*11.9*
Buried Electrical Collection Cable	*56.8*	*56.8*	*0.0*
O&M Buildings	*0.0*	*0.0*	*0.0*
Laydown Yards	*0.0*	*0.0*	*0.0*
Substation	*0.0*	*0.0*	*0.0*
Meteorological Towers	*2.0*	*2.0*	*0.0*[2]
Other Agricultural Use (199)	*68.1*	*64.1*	*4.0*
Wind Turbines and Workspaces	*39.1*	*38.9*	*0.2*
Access Roads	*8.6*	*4.8*	*3.8*
Buried Electrical Collection Cable	19.4	19.4	0.0
O&M Buildings	*0.0*	*0.0*	*0.0*
Laydown Yards	*0.0*	*0.0*	*0.0*
Substation	*0.0*	*0.0*	*0.0*
Meteorological Towers	*1.0*	*1.0*	*0.0*[2]
Total[3]	**688.2[3]**	**633.1[3]**	**55.1[3]**

[1] From land use codes in Seneca and Sandusky County parcel shapefiles.

[2] Permanent impacts from meteorological towers will be 10 square feet (0.0002 acre) per tower. For purposes of this table, that value rounds to 0.0 acre.

[3] This breakdown of impact acreages differs somewhat from those presented in Table 08-7 and Table 08-13. The ecological community impacts presented in Table 08-7 were derived from ODNR data, which are different in two significant ways: (1) they include non-agricultural communities, such as forestland and scrub-shrub, that are not included here; and (2) the data source contains polygons defined by community boundaries, not by parcel boundaries. The land use impacts in Table 08-13 and the agricultural land impacts presented here were both derived from parcel data, which assigns a single land use code to each parcel in entirety. However, although impacts to different types of agricultural land use are broken out separately here, all agricultural land uses were lumped together in Table 08-13. This results in a 3.0-acre discrepancy when comparing the total agricultural impacts in the two tables. This is because there are six possible meteorological sites, but only two will be utilized. All six potential meteorological tower sites are located within agricultural lands. As a result, Table 08-13 includes impacts for 2.0 acres of total and temporary impacts for the two meteorological towers; it doesn't matter which two sites are selected because impacts would be the same at all six possible sites. However, the six potential sites are located within three different types of agricultural land: three in agricultural vacant land, two in cash grain or general farm lands, and one in other agricultural use. Since the Applicant has not yet determined which two meteorological towers will be selected for construction, this table present worst-case impacts by accounting for impacts in all possible agricultural types. Although there are three potential tower sites in agricultural vacant land, the impacts included herein only account for two, since no more than two meteorological towers will ultimately be constructed. This desire to present conservative, worst-case impact numbers results in the over-reporting of agricultural impacts by 3.0 acres in this table. As reflected in Table 08-13, total impacts to agricultural lands will be 685.2 acres; temporary impacts to agricultural land will be 630.1 acres; and permanent impacts to agricultural land will be 55.1 acres.

Table 08-18 quantifies impacts to agricultural district land, based on the typical area of vegetation clearing column presented in Table 03-1.

Table 08-18. Impacts to Agricultural District Land

Agricultural District Land[1]	Total Disturbance (acres)	Temporary Disturbance (acres)	Permanent Loss (acres)
Seneca County			
Wind Turbines and Workspaces	91.2	90.8	0.4
Access Roads	28.1	15.6	12.5
Buried Electrical Collection Cable	75.9	75.9	0.0
O&M Buildings	0.0	0.0	0.0
Laydown Yards	0.0	0.0	0.0
Substation	5.0	0.0	5.0
Meteorological Towers	1.0	0.0	0.0[2]
Sandusky County[3]			
Wind Turbines and Workspaces	0.0	0.0	0.0
Access Roads	0.0	0.0	0.0
Buried Electrical Collection Cable	0.0	0.0	0.0
O&M Buildings	0.0	0.0	0.0
Laydown Yards	0.0	0.0	0.0
Substation	0.0	0.0	0.0
Meteorological Towers	0.0	0.0	0.0
Total[4]	**201.2[4]**	**183.3[4]**	**17.9[4]**

[1] Agricultural district data obtained from Seneca County and Sandusky County Auditors.

[2] Permanent impacts from meteorological towers will be 10 square feet (0.0002 acre) per tower. For purposes of this table, that value rounds to 0.0 acre.

[3] There are no Facility components located within designated Agricultural District lands in Sandusky County.

[4] This breakdown of impact acreages differs from those presented elsewhere in this Application, because this table only includes impacts from Facility components located within designated Agricultural Districts.

For property tax purposes, farmland devoted exclusively to commercial agriculture may be valued according to its current use rather than at its "highest and best" potential use. This provision of Ohio law is known as the Current Agricultural Use Value (CAUV) program. By permitting values to be set well below true market values, the CAUV normally results in a substantially lower tax bill for working farmers. To qualify for the CAUV, land must meet one of the following requirements during the three years preceding an application for the CAUV: ten or more acres must be devoted exclusively to commercial agricultural use; or if under ten acres are devoted exclusively to commercial agricultural use, the farm must produce an average yearly gross income of at least $2,500. Table 08-19 quantifies impacts to CAUV-eligible land, based on the typical area of vegetation clearing column presented in Table 03-1.

Table 08-19. Impacts to CAUV Land

Current Agricultural Use Value Lands[1]	Total Disturbance (acres)	Temporary Disturbance (acres)	Permanent Loss (acres)
Wind Turbines and Workspaces	362.4	360.7	1.7
Access Roads	97.7	54.3	43.4
Buried Electrical Collection Cable	190.6	190.6	0.0
O&M Buildings	5.0	0.0	5.0
Laydown Yards	12.0	12.0	0.0
Substation	5.0	0.0	5.0
Meteorological Towers	2.0	2.0	0.0[2]
Total[3]	**674.7[3]**	**619.6[3]**	**55.1[3]**

[1] From land use codes in Seneca and Sandusky County parcel shapefiles.

[2] Permanent impacts from meteorological towers will be 10 square feet (0.0002 acre) per tower. For purposes of this table, that value rounds to 0.0 acre.

[3] This breakdown of impact acreages differs from those presented elsewhere in this Application, because this table only includes impacts from Facility components located within designated CAUV lands.

(b) *Impacts on Agricultural Facilities and Practices*

(i) Field operations

As shown above in Table 08-17, construction of Facility access roads, buried interconnects, wind turbines, and other accessory structures will collectively disturb a total of 688.2 acres of agricultural lands. Although most of these impacts will be temporary, approximately 55.1 acres of agricultural lands will be converted to built facilities. Access road construction through agricultural fields will include stripping a 36-foot width of topsoil and placing it in windrows along the access road to prevent construction vehicles from driving over undisturbed soil and adjacent fields. Following turbine construction, access road widths will be reduced to 16 feet or less. In locations where buried cable crosses agricultural fields, construction equipment may disturb soil in a corridor up to an average of 20 feet wide. However, this will represent a temporary disturbance only, and as the cable will be buried at a minimum depth of 36 inches, will not have a long-term impact on farming practices (e.g., plowing). Topsoil within a 300-foot radius of each tower will first be stripped and stockpiled. A backhoe will then be used to excavate a foundation hole. Excavated subsoil and rock will be segregated from topsoil during this process. Following construction, the footprint of each turbine will be reduced to approximately 0.03 acre, which includes the turbine pedestal and a gravel crane pad. The remaining work area will be restored to agricultural use.

Along with these direct impacts to agricultural land, movement of equipment and material during Facility construction could result in damage to growing crops, damage to fences and gates, and/or temporary blockage of farmers' access to agricultural fields. However, as described in the following section, wind turbines and associated facilities have been located so as to minimize loss of active agricultural land and interference with agricultural operations. Such impacts are not anticipated during Facility operation and maintenance, but landowners will be compensated for any impacts that do occur.

(ii) Irrigation

Irrigation systems are not in widespread use in the Project Area. Potential interference to irrigation operations is very limited and coordination with affected landowners will alleviate potential for significant long-term disruption.

(iii) Field drainage systems

Facility construction could result in damage to subsurface drainage systems (tile lines). Avoidance of damage to drainage systems will be incorporated in Facility design, and mitigation measures will be implemented as outlined below.

(iv) Structures used for agricultural operations

The Facility will not physically impact any agriculturally related structures.

(v) Viability as agricultural district land

Aside from temporary disturbance during construction activities, the Facility is largely compatible with farming practices. Furthermore, the Facility will not result in a change in land use and will promote the long-term economic viability of the affected farms by supplementing the income of participating farmers. The presence of wind turbines will help preserve agricultural land and avoid conversion of that land to other developmental land uses, such as seasonal or permanent high-density residences.

(c) *Proposed Mitigation Procedures*

(i) Avoidance/minimization of damage to field tile drainage systems

Where Facility components are proposed to cross active agricultural fields, an attempt will be made to determine the location of any subsurface drainage tiles through consultation with the landowner and/or review of public records.

(ii) Timely repair of damaged field tile systems

Any drainage tiles damaged during construction will immediately be identified, documented, and repaired. It is anticipated that a local drain tile contractor or the farmer tending the land will be involved in repair activities.

(iii) Topsoil segregation, decompaction, and restoration

Mitigation measures to protect and restore agricultural soils have been incorporated into the siting of Facility components. For example, wind turbines and other structures have been located along field edges, so as to minimize adverse impacts on agricultural land and farming operations. Permanent access road width is limited to 16 feet or less. Where possible, access roads follow hedgerows and field edges to minimize loss of agricultural land. To the extent practicable, existing fields have been kept intact, rather than broken up into smaller, irregularly shaped fields that are more difficult to farm. Parking areas, the laydown yards, and other temporary and permanent support facilities have been located outside of active agricultural fields where possible. Known surface and subsurface drainage features (i.e., ditches, diversions, tile lines) have been avoided.

Additional measures to reduce impacts to agricultural land will be undertaken during Facility construction, operation, and maintenance. These mitigation measures include:

<u>Access Roads Specifications</u>

- Vehicular access to the tower sites will be minimized until permanent access roads have been constructed.
- Roads will be constructed only in locations shown on the construction drawings.
- The boundaries of all work areas will be identified with snow fence, stockpiled topsoil, or other temporary barrier. No vehicles or equipment will be allowed outside the work areas.
- All permanent access roads across agricultural fields will be the minimum width necessary to accommodate construction traffic (i.e., no wider than 16 feet).
- Project schedule permitting, roads across agricultural fields will not be constructed during saturated conditions when their development would damage agricultural soils.
- When constructing access roads on active agricultural land, all topsoil will be stripped from the entire work area and stockpiled in windrows along the road, or in designated temporary storage areas. Temporarily stockpiled topsoil shall be segregated from other excavated material (rock and/or subsoil).

- When stockpiling topsoil in windrows along roads, surface water drainage from the road or adjacent agricultural fields will not be blocked.
- When constructing access roads through active agricultural land, the final road surface will be leveled with the adjacent field surface. During restoration, topsoil will be used to create a smooth transition between the road surface and surrounding agricultural land, so as not to impede crossing by farm equipment.
- Where necessary, culverts or water bars will be installed to assure uninterrupted natural surface water drainage patterns. Such culverts or water bars will be installed in a manner that prevents concentration of water runoff and soil erosion.
- Access roads will be maintained throughout construction so as to allow continued use/crossing by farm machinery. Maintenance will be performed to repair rutting so as to avoid interrupting natural cross drainage of the area or preventing use or crossing of the road by the landowner.
- To prevent damage to adjacent agricultural land, all vehicle traffic and parking will be confined to the access roads, designated work areas at the tower sites, and/or designated parking and material laydown yards. Any necessary pull-offs and parking areas will be developed outside of active agricultural fields. If this is not possible, all topsoil shall be stripped from agricultural areas used for vehicle and equipment traffic and parking, and such areas will be restored at the end of construction.

Laydown Yard Specifications

- Temporary construction parking, laydown, and storage areas on active agricultural land will be developed by removing all topsoil from areas that will receive vehicular traffic. Topsoil will be stockpiled adjacent to the laydown yards in windrows or piles on the same property from which it was removed.
- Storage of construction materials on undisturbed ground will only be permitted if their placement and removal can be accomplished without driving over the undisturbed areas.
- Upon completion of construction, any gravel and/or geotextile mats will be removed, and the soils will be de-compacted and restored as described below in the restoration specifications.

Excavation/Backfill Specifications

- The boundaries of all rights-of-way and work areas will be identified with snow fence or other temporary barrier. No vehicles or equipment shall be allowed outside the work area.

- All agricultural areas to be disturbed by excavation shall first be stripped of topsoil. Topsoil stripping must be undertaken on the full area to be disturbed by excavation, grading, or piling of excavated subsoil/rock.
- Stripped topsoil will be segregated from subsoil and stockpiled in temporary storage areas on the property from which it was removed.
- All areas to be disturbed by excavation and backfilling will be enclosed within silt fencing or other temporary barrier to define the allowable limits of disturbance. No vehicular activity will be allowed outside the defined work area.
- Excavated subsoil and rock shall not be stockpiled or spoiled on active agricultural land outside the work area.
- Excess excavated subsoil and rock that is not suitable for backfill will be removed from the site. On-site disposal will only occur outside of active agricultural land with permission from the landowner.
- Open excavation areas in active pastureland will be temporarily fenced to protect livestock. All existing fences and gates will be maintained or relocated as necessary to prevent livestock access to the work area and/or escape from fenced enclosures. Following construction, any relocated fencing will be restored to "like new" condition in its original location (or as otherwise agreed upon with the landowner).
- Any water pumped from open excavations shall be directed into temporary sediment traps prior to discharge. Pumping will be done in a manner that minimizes adverse effects on agricultural crops and operations.
- Buried electric lines in active agricultural fields will be at least three feet deep, unless bedrock is encountered prior to reaching this depth. If bedrock is encountered, the buried lines will be placed completely below the bedrock surface.
- Backfill will utilize excavated subsoil and rock whenever possible. If this material is determined to be unsuitable as backfill, select granular fill (e.g., bank run gravel) will be utilized in its place. No rock backfill will be used in the top 24 inches in active agricultural fields.

<u>Foundation Specifications</u>

- Concrete trucks will be restricted to designated access roads and crane pads at all times.
- Excess concrete shall be disposed of off-site, unless otherwise approved by the landowner. Under no circumstances shall it be buried or left on the surface in active agricultural areas.
- Concrete trucks will be washed in foundation holes, or outside of active agricultural areas in locations approved by the landowner.

- In active pasture areas, foundations treated with concrete curing compound or sealer shall be temporarily fenced to prevent access by livestock.

Turbine Erection Specifications

- Any grading to accommodate crane pads and material laydown at the turbine sites will be confined to the designated work area around each foundation.
- Topsoil will be stripped from crane pad locations and work areas around foundations and stockpiled in areas designated on the construction drawings.
- Erection cranes will be restricted to designated access roads and work pads at the structure sites. Crane set-up and break-down activities will not occur outside these areas in active agricultural land.
- Crane paths across active agricultural land will be improved to the extent necessary to protect agricultural soils. If conditions allow (i.e., soils are hard and dry) the crane may drive across the ground without stripping of topsoil. If leveling of the ground is required, such leveling will be kept to a minimum, and topsoil will not be mixed with subsoil. If significant rutting or soil disturbance could occur, temporary roads will be developed to accommodate crane passage.
- Development of temporary roads, if necessary, across agricultural land will involve stripping and stockpiling of topsoil and may involve placement of gravel over a geotextile mat. Following use by the crane, any gravel and matting will be removed, and soils restored in accordance with the restoration specifications described below.
- The contractor will immediately pick up and dispose of any pieces of wire, bolts, staples, or other small metallic objects that fall to the ground in active pastureland.

Restoration Specifications

- Following completion of construction, excess gravel/fill will be removed from along access roads and crane paths, around towers, and the laydown yards.
- Exposed subsoils will be de-compacted with a deep ripper or heavy-duty chisel plow to a minimum depth of 18 inches. Soil de-compaction shall be paid for by the Applicant.
- Following de-compaction of the subsoil, the surface of the subsoil will be picked over to remove all rocks four inches in size or larger. Following rock picking, stockpiled topsoil will be returned to all disturbed agricultural areas. The topsoil will be re-graded to match original depth and contours to the extent possible.

- The surface of the re-graded topsoil will be disked, and any rocks over four inches in size will be removed from the soil surface. Restored topsoil will be stabilized with seeding and/or mulching, unless other arrangements have been made with the landowner.
- De-compaction of crane paths over otherwise undisturbed agricultural land will be accomplished using a deep ripper or heavy chisel plow as needed.
- All access roads will be re-graded as necessary to create a smooth travel surface, allow crossing by farm equipment, and prevent interruption of surface drainage. Temporary water bars and culverts shall be removed if they are no longer necessary.
- Restored agricultural areas will be stabilized with seed and/or mulch. In areas to remain in hay production, an appropriate seed mix will be selected in consultation with the landowner. If future crop type is undetermined at the time of restoration, the site shall be seeded with annual rye or similar cover crop, or as agreed to with the landowner. If restoration occurs outside of the growing season, restored areas will be stabilized by mulching with hay or straw.
- Any surface or subsurface drainage features, fences, or gates damaged during construction shall be repaired or replaced as necessary.
- All construction debris will be removed and disposed of off-site at the completion of restoration.
- The Applicant will review restored agricultural land with the landowner during the following growing season to identify and correct any Facility-related problems that may not have been apparent immediately following restoration.

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